ST. THOMAS COLLEGE
Ranni, Pathanamthitta, Kerala – 689673
ACCREDITED BY NAAC WITH ' B ' GRADE

7.1.3 : Environment and Energy Initiatives of the Institution

GREEN AUDIT/ ENVIRONMENTAL AUDIT REPORT

CRITERION : 7

INSTITUTIONAL VALUES AND BEST PRACTICES

ST. THOMAS COLLEGE, RANNI

Report-Green Audit

2018-2020

GREEN AUDIT REPORT

ST THOMAS COLLEGE

RANNI

OTTOTRACTIONS
Energy-Engineering-Environment

Green Audit Report
St. Thomas College, Ranni
Report No: EA 1004A/GA
2020

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.

Acknowledgment

We were privileged to work together with the administration and staff of St. Thomas College, Ranni 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

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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1 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 **St. Thomas College, Ranni** 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.

ST. THOMAS COLLEGE, RANNI

The history of the college is embedded in the history of Ranni. The college is situated on the top of a serene hill, in a sylvan surrounding, away from the din and bustle of the city, easily accessible and is at a walkable distance from the heart of Ranni town. The college was established in 1964, as a junior college by St Thomas Valiyapally Ranni, a pioneer parish of the Syrian Knanaya Arch Diocese of Malankara, with the whole hearted support of the then Bishop late lamented His Excellency Abraham Mor Clemis to meet the educational needs of the youth of the local community. The college was upgraded to a first grade college in 1968 and is the only institution for higher education in this part of the country. When the de-linking of Pre Degree sector was made possible by the government on administrative measures we were left with graduate and Post Graduate courses. The transmutation lead this institution to a

knowledge hub with divorcified courses. In addition to the conventional courses, we now offer UG & PG courses in Tourism also. During its 53 years of illustrious existence, the college gave birth to brilliant academicians, administrators, politicians and entrepreneurs.

The college aims at creating cultured and educated citizens who love God and their country. With its rural background and `Gurukula' atmosphere, the college fosters uninterrupted pursuit of knowledge. The first Principal, Late Prof. K. A. Mathew, served as minister and PSC member in the Kerala State. He played a vital role in upgrading the junior college to a first grade one in 1968. As the Golden Jubilee project St. Thomas College of Advanced Studies, Edamury, Ranni, a Self Financing College affiliated to M.G. University, Kottayam was established in June 2014. In March 2016, the College was assessed and re-accredited in the second cycle by the National Assessment and Accreditation Council (NAAC) of UGC and graded at B level.

Occupancy Details		
Particulars	2018-19	2019-20
Total Students	859	829
Staffs	64	64
Total Occupancy of the college	923	893

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	St. Thomas College, Ranni									
2	Address (include telephone, fax & e-mail)	St. Thomas College, Ranni, Pathanamthitta, 689641, stcranni@gmail.com,+91 8301057965									
2	Year of Establishment	1964									
3	Name of building and Total No. of Electrical Connections/building	St. Thomas college (8)									
4	Total Number of Students	Boys		Girls		Total	829				
5	Total Number of Staff	64									
6	Total Occupancy	893									
7	Total area of green cover	50%									
8	Type of Electrical Connection	HT	0	LT	8						
9	Total Connected Load (kW)	107									
10	Average Maximum Demand (KVA)	-									
11	Total built up area of the building (M^2)	8317									
12	Number of Buildings	5									
13	Average system Power Factor	0.96									
14	Details of capacitors connected	NA									
15	Transformer Details (Nos., kVA, Voltage ratio)	TR 1									
		NA									
15	DG Set Details (kVA,)	DG1	DG2	DG3	DG4	DG5	Remarks				
		10									
16	Details of motors	Rating		Nos.		Remarks					
		5 to 10		2							
		10 to 50									
		Above 50									
17	Brief write-up about the firm and the energy/environmental conservation activities already undertaken.	Installed LED Lights, Solar Street Lamps etc.									
18	Contact Person & Telephone number	Dr Lata Marina Varghese									
		9446978383									

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 1054 occupants of this campuses will reach same number of households. This message will spread to at least 4000 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).

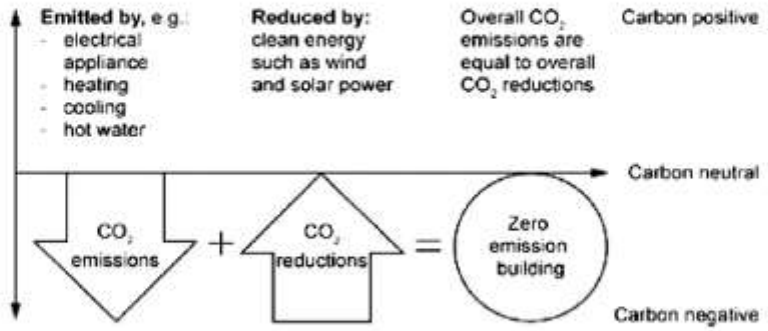
Global Warming Potentials (IPCC Second Assessment Report)					
Species	Chemical formula	Lifetime (years)	Global Warming		
			20 years	100 years	500 years
Carbon dioxide	CO2	variable §	1	1	1
Methane *	CH4	12±3	56	21	6.5
Nitrous oxide	N2O	120	280	310	170
HFC-23	CHF3	264	9100	11700	9800
HFC-32	CH2F2	5.6	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. $W_{\text{carbon-dioxide}} = 3.67 * W_{\text{carbon}}$

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3

RESULTS AND DISCUSSIONS

3.1 CARBON FOOTPRINT ESTIMATION

3.1.1 ENERGY

a. Electricity

Electricity is purchased from KSEB under 8 LT Connections, the details are given below.

Electricity Connection Details		
St. Thomas College, Ranni		
1	Name of the Consumer	St. Thomas College, Ranni
2	Tariff	LT-6A 3Ph
3	Consumer Numbers	1146072000540, 1146071019877, 1146079005428, 1146073013642, 1146070013641, 1146079016949, 1146076000773, 1146071019877
5	Connected Load Total (kW)	107
6	Annual Electricity Consumption (kWh)	28219

Electricity Bill Analysis

Annual Electricity Consumption (kWh)			
Consumer No	**2018-19**	**2019-20**	Connected Load (kW)
1146072000540	522	611	2
1146071019877	5432	513	6
1146079005428	1213	1834	4
1146073013642	2234	4675	16
1146070013641	13029	14234	16
1146079016949	3672	1876	35
1146076000773	9821	3241	22
1146071019877	2987	1235	6
Total	**35923**	**28219**	**107**

Diesel

Diesel Consumption Details				
	Transportation	Generator	Total	cost
	in L	in L	in L	in Rs
2018-19	0	344	344	30960
2019-20	0	289	289	26010

LPG

LPG Consumption Details		
	2018-19	2019-20
No Cylinders	4	5
Canteen/Lab LPG Consumption in kg	60	75
Total in kg	60	75

Base Line Energy Data			
St. Thomas College, Ranni			
		2018-19	2019-20
1	Electricity KSEB (kWh)	35923	28219
2	Electricity DG (kWh)	1032	867
3	Electricity Solar , Off grid (kWh)	0.00	0.00
4	Electricity (KSEB + DG + Off grid) kWh	36955	29086
5	Electricity Grid Tied (kWh)	1278	1278
6	Diesel (L)	0	0
7	LPG (kg)	60.00	75.00
8	Biogas (m3)	0.00	0.00

Energy Consumption Profile			
Sl No	Fuel	2018-19	2019-20
1	Electricity	31781300	25013960
2	Diesel	0	0
3	LPG	720000	900000
4	Biogas	0	0
Total		32501300	25913960

Thermal Fuel Consumption		
St. Thomas College, Ranni		
	2018-19	2019-20
Annual LPG consumption in kg	60	75
Annual Diesel consumption in L	344	289
Annual petrol consumption in L	0	0
Annual Biogas consumption in m3	0	0

Renewable Energy

biogas plant is installed in a facility and is not working, it is recommended to repair the plant to effectively manage bio degradable waste. Some common reasons why a biogas plant may not be working include clogging of the pipes, leaks in the system, and inadequate maintenance. Therefore, it is important to regularly maintain the plant to ensure that it is functioning properly.

Once the biogas plant is repaired and functioning, it can provide numerous benefits such as reducing waste management costs, reducing greenhouse gas emissions, and providing a renewable energy source.

Specific Energy Consumption

OTTOTRACTIONS- ENERGY AUDIT			
St. Thomas College, Ranni			
Energy Performance Index (EPI)			
Sl No	Particulars	2018-19	2019-20
1	Total building area (m²)	8317	8317
2	Annual Energy Consumption (kCal)	32501300	25913960
3	Annual Energy Consumption (kWh)	37792	30133
4	Total Energy in Toe	3.25	2.59
5	Specific Energy Consumption kWh/m²	4.54	3.62

The specific energy consumption in 2019-20 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		
St. Thomas College, Ranni		
Particulars	2018-19	2019-20
Total Occupancy	923	893
Waste generated in kg /day	18.46	17.86
Waste generated in kg /Yr	4061.2	3929.2

Non-Degradable waste

Solid non degradable Waste Generation		
St. Thomas College, Ranni		
Particulars	2018-19	2019-20
Total Occupancy	923	893
Waste paper generated in kg /day	0.1846	0.1786
Waste plastic generated in kg /day	0.2769	0.2679
Waste paper generated in kg /Yr	40.61	39.29
Waste plastic generated in kg /Yr	60.92	58.94

3.4. Transportation

The college does not have any vehicles for logistics

Carbon Emission Profile (2019-20)

Carbon emissions in the campus due to the day-to-day activities are calculated and is 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 2019-20

Carbon Foot Print					
Sl. No.	Particulars	2018-19	tCO2e	2019-20	tCO2e
1	Electricity (kWh)	36955	30.30	29086	23.85
2	Diesel (L)	0	0.00	0	0.00
3	LPG (kg)	60.00	0.09	75.00	0.11
4	Biogas (m3)	0.00	0.00	0.00	0.000
5	Degradable Waste in kg/yr.	4061.2	2.56	3929.2	2.48
6	Paper Waste in kg/yr	40.61	0.02	39.29	0.02
Total Carbon Foot Print tCO_2e/yr			32.97		26.46

3.5. 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		
Particular's	2018-19	2019-20
Total No of Trees	236	236
Carbon sequestrated by trees in the campus (tCO2e)	6.6	6.90

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

List of Trees and Plants		
Sl. No.	English Name	QTY
1	Jackfruit Tree	12
2	Mango	9
3	Ashoka Tree	1
4	Bulletwood	2
5	Teak	84
6	Coconut	21
7	Wild Jack	7
8	Royal Princiana	4
9	Mahagony	38
10	Soursop Tree	7
11	Golden Shower Tree	8
12	Guava Tree	10
13	Rambutan	3
14	Copper Pod	3
15	False Ashoka	6
16	Caturina	1
17	Ornamental Palm	10
18	All Spice	1
19	Pride of India	2
20	Papaya	2
21	Bay Leaf	1
22	Persian Silk Tree	1
23	Araucaria	1
24	Hyophorbe	1
25	Sand Paper Tree	1
Total		236

CARBON FOOTPRINT OF THE CAMPUS (2019-20)

Various carbon emitting activities such as consumption of energy, transportation and waste generation leads to the total emission of **26.46 tCO_2e** per year by the campus. The total carbon sequestration by trees in the campus compound is **6.90tCO_2e**. Thus, the current carbon footprint of the campus will be the difference of total carbon emission and total carbon sequestration/mitigation. The following table shows the carbon footprint level

Specific CO2 Footprint

Amount of Carbon to be mitigated for Low Carbon Campus			
Sl No	Particulars	2018-19	2019-20
1	Total carbon emission tCO_2e	32.97	26.46
2	Total carbon sequestration tCO_2e	6.56	6.90
3	Amount of carbon mitigated through renewable energy tCO_2e	1.05	1.05
4	To be mitigated tCO_2e	25.37	18.51
5	Total No of Students	923	893
6	Specific Carbon Footprint kg CO_2e/Student/Yr	27.49	20.73

The total specific carbon footprint is estimated as **20.73** kg of CO_2e per student for the year 2019-20.

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4

Carbon Mitigation Plans

The total emission of the carbon dioxide per student is **26.46** kg per year (2019-2020). 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 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'.

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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						
St. Thomas College, Ranni						
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 58 No's T12 (55W) Lamps to 18W LED Tube	3591	3.59	10	2.62	26.21
2	Energy Saving in Lighting by replacing existing 84 No's T8 (40W) Lamps to 18W LED Tube	3105	3.10	10	2.27	22.66
3	Energy Saving in Lighting by replacing existing 46 No's CFL(15W) Lamps to 9W LED Bulb	397	0.40	10	0.29	2.90
4	Energy Saving by replacing existing 156 No's in-efficent ceiling fans with Energy Efficient Five star fans	4770	4.77	10	3.48	34.82
Total		**11863**	**12**	**10**	**8.66**	**86.60**

St. Thomas College, Ranni						
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 through out life cycle
		(kWh)	MWh	Years		
1	Installation of 10kWp Solar Power Plant	13688	13.69	25	9.99	249.80
	Total	13688	14	25	9.99	250

OTTOTRACTIONS

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal Code 1	
Energy Saving in Lighting by replacing existing 84 No's T8 (40W) Lamps to 18W LED Tube	
Existing Scenario	
84 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	84
Total load (kW)	3.36
Annual Energy Consumption (kWh)	5645
Expected Annual Energy saving for replacing all fittings (kWh)	3105
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.25
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.25
Simple Pay Back (in Months)	12.18

OTTOTRACTIONS

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal Code	
Energy Saving in Lighting by replacing existing 58 No's T12 (55W) Lamps to 18W LED Tube	
Existing Scenario	
257 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 67% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2400
No of fittings	58
Total load (kW)	3.19
Annual Energy Consumption (kWh)	5359
Expected Annual Energy saving for replacing all fittings (kWh)	3591
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.29
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.17
Simple Pay Back (in Months)	7.27

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving by replacing existing 156 No's in-efficient ceiling fans with Energy Efficient Five star fans	
Existing Scenario	
There are 156 numbers of ceiling fans installed in the facility 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	156
Total load (kW)	10.92
Annual Energy Consumption (kWh)	17035
Expected Annual Energy saving, for total replacement(kWh)	4770
Cost of Power (Rs)	8.00
Annual saving in Lakhs Rs (1st year)	0.38
Investment required for a total replacement (Lakhs Rs)[@3000 Rs per Fan with 50W at full speed]	4.68
Simple Pay Back (in Months)	147.17

OTTOTRACTIONS

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving in Lighting by replacing existing 46 No's CFL(15W) Lamps to 9W LED Bulb	
Existing Scenario	
24 numbers of CFL (15W) 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 CFL may be replaced to LED Bulb of 9W in phased manner and the savings will be of 40% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2400
No of fittings	46
Total load (kW)	0.69
Annual Energy Consumption (kWh)	994
Expected Annual Energy saving for replacing all fittings (kWh)	397
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.03
Investment required for complete replacements [@Rs 90 per fittings](Lakhs Rs)	0.04
Simple Pay Back (in Months)	15.63

Energy Saving Proposal	
Installation of 10kWp 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 10kW 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)	10
Total average kWh per day expected (3.5kWh/day average)	37.50
Total annual Generating Capacity (kWh)	13688
Cost of energy generated annually Lakhs Rs	1.82
Investment required (INR lakh)(Approx)	5.50
Simple Pay Back (in Months)	36.26
Life cycle in Yrs	25
Total Saving in Life Cycle (Approx) RS lakh	45.51

Executive Summary					
Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects					
St. Thomas College, Ranni					
Sl No	Projects	Investment	Cost saving	SPB	Energy saved
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr
1	Energy Saving in Lighting by replacing existing 58 No's T12 (55W) Lamps to 18W LED Tube	0.17	0.29	7.27	3591
2	Energy Saving in Lighting by replacing existing 84 No's T8 (40W) Lamps to 18W LED Tube	0.25	0.248	12.18	3105
3	Energy Saving in Lighting by replacing existing 46 No's CFL(15W) Lamps to 9W LED Bulb	0.04	0.032	15.63	397
4	Energy Saving by replacing existing 156 No's in-efficent ceiling fans with Energy Efficient Five star fans	4.68	0.382	147.17	4770
5	Installation of 10kWp Solar Power Plant	5.50	1.820	36.26	13688
	Total	**10.47**	**2.48**	**43.70**	**21959**
(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

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 tCO_2e/yr	26.46
2	Carbon Sequestrated tCO_2e/yr	6.90
3	Carbon mitigated by Renewable Energy tCO_2e/yr (Installed)	1.05
4	Carbon mitigated by Renewable Energy tCO_2e/yr (Proposed)	9.99
5	Carbon mitigated by Energy Efficiency (Proposed) tCO_2e/yr	8.66
6	Effective Carbon footprint tCO_2e/yr	-0.14
7	Total No of Students	829
8	Specific Carbon Footprint kg CO_2e/Student/Yr	-0.17

From this study it was found that carbon footprint of the campus to be **-0.17** $kgCO_2e$/ Student/ Year in place of current footprint i.e., **31.92** $kgCO_2e$/ student/ Year. To achieve this an investment of **10.47 lakhs Rs** is required through energy efficiency and renewable energy projects proposed. It will be around **1263 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	4.97
2	Cost of implementation in Renewable Energy Lakhs Rs	5.50
3	Total Lakhs Rs	10.47
4	Total number of students	829
5	Cost per student to make the campus carbon negative Rs/ Student	1263

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Reports and Books

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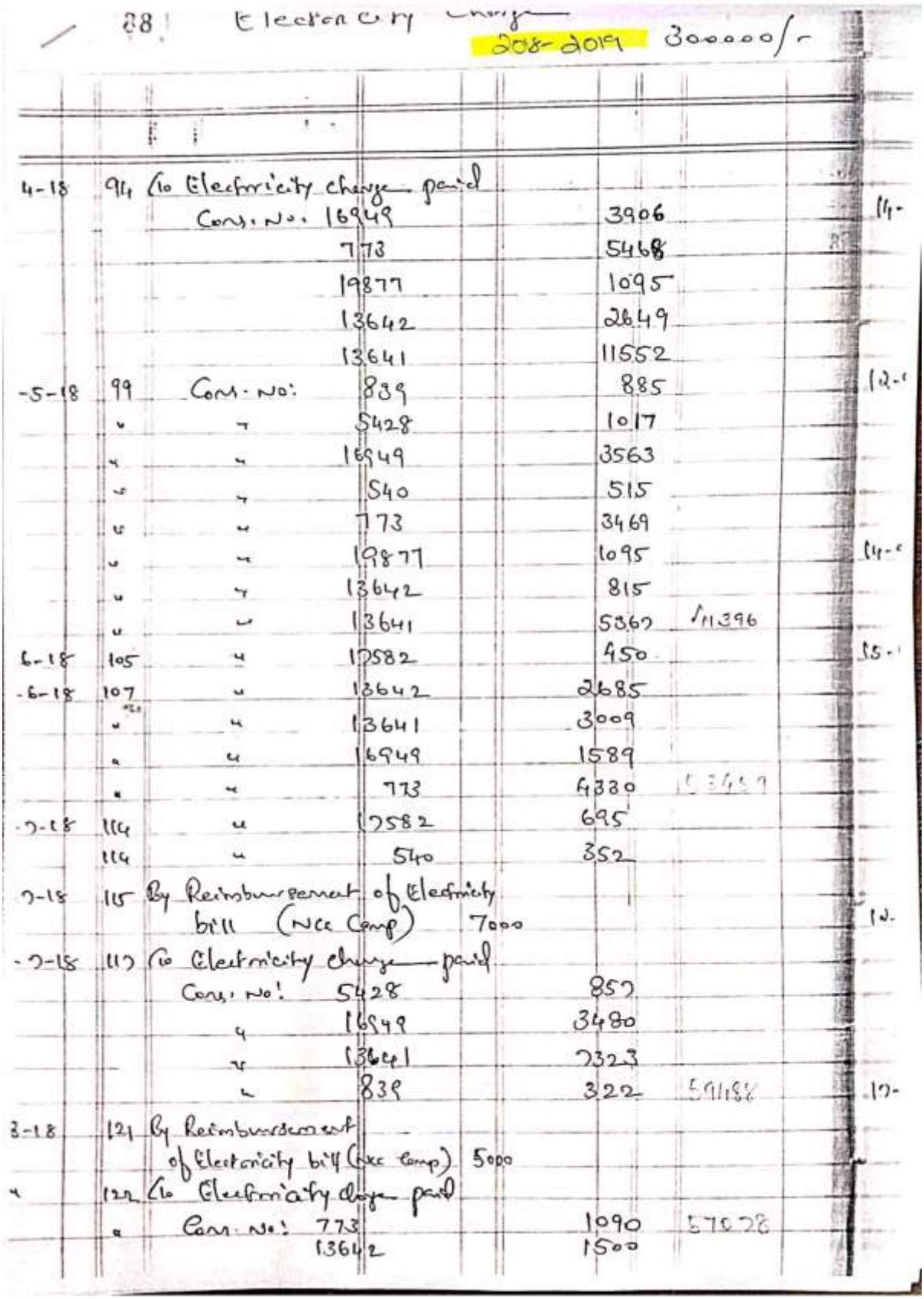
OTTOTRACTIONS

6

TECHNICAL SUPPLEMENT

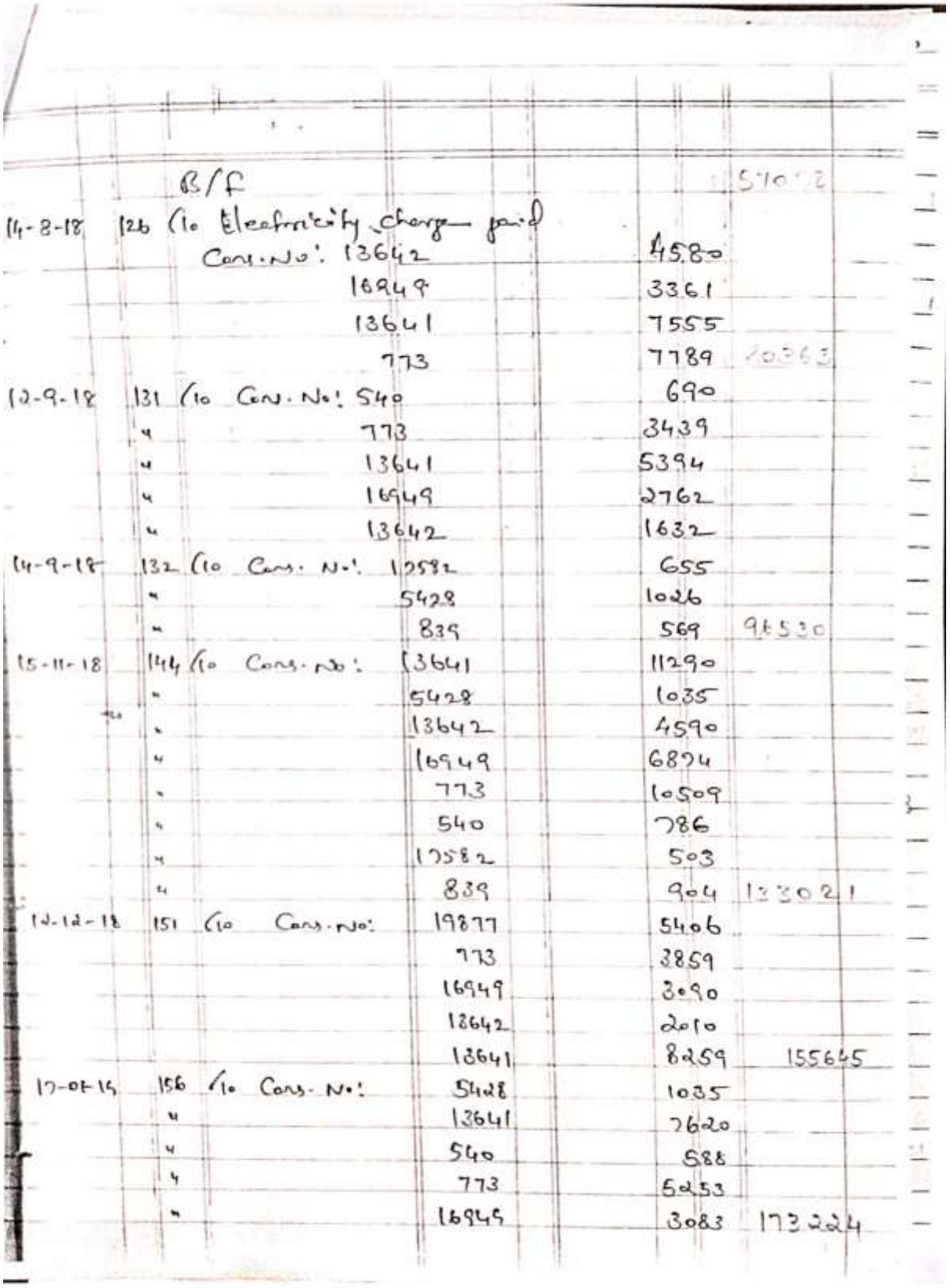
St. Thomas College, Ranni																
Sl.No	Location	Lights							Fans		IT			Others		
		LED-T	LED-B	LED-SQ	T8	T12	ICL	CFL	CF	EF	Printer	Projector	PC	TV	AC (1TR)	Fridge
1	Principal	1		9		1			2		1		1	1		
2	Conf Hall				2	2			1				1		1	
3	Office	1			3	4			6		2		2			
4	Admn Room	1			4				3		3		1			
5	Manager					1			2		1		1			
6	Malayalam Dpmt	1							1							
7	3 Rooms	3							3							
8	4 Rooms					4			4							
9	9 Rooms					27			13							
10	Seminar Hall	3							6	1		1				
11	4 Rooms				4				4							
12	Botany department					1			2		1		1			1
13	Museum	1							2				1			
14	5 Classrooms	1				5			5							
15	Physics Department	1	1		2	1		2	5			1	1			
16	Computer lab				3				2				5			
17	3 Rooms							12	9							
18	3 Rooms				3				3							
19	3 Rooms				3				3							
20	English department					2			1				1			
21	6 Rooms				6				6							
22	Conf Hall		2					22	6							
23	3 Rooms						3		3							

24	Lab				2	1		3	4		1		24			
25	3 Departments				6	6			14							
26	6 Rooms				6			2	6							
27	9 Rooms	1			5	1		1	9							
28	4 Rooms							4	4							
29	3 Rooms				3				4							
30	2 Rooms				2				2							
31	3 Rooms	1			1	2			3							
32	5 Rooms				7				5							
33	Auditorium	4			22				13							
	Total	**19**	**3**	**9**	**84**	**58**	**3**	**46**	**156**	**1**	**9**	**2**	**39**	**1**	**1**	**1**

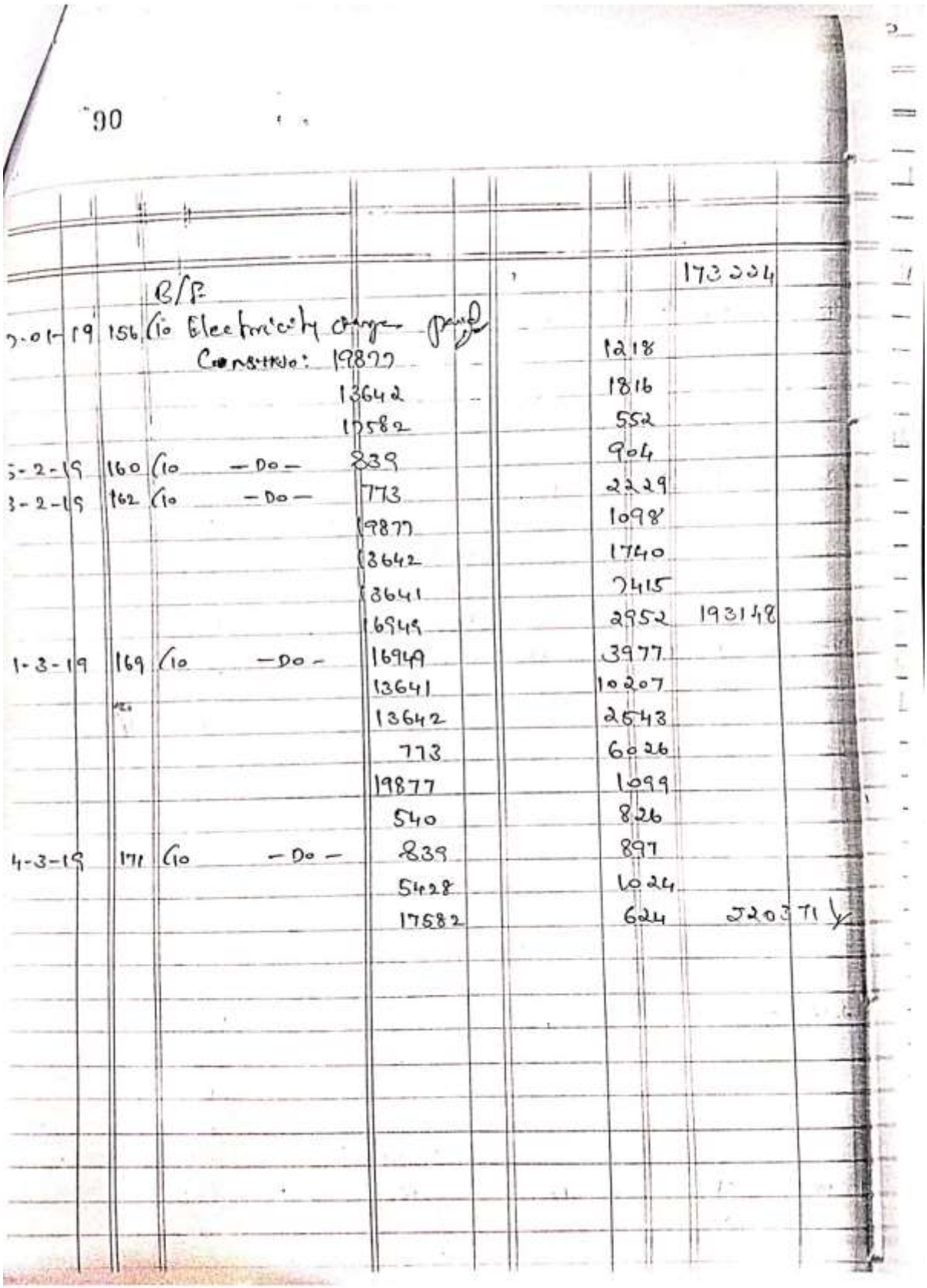


28 Electricity charge — 2018-2019 3000000/-

4-18	94	To Electricity charge paid Cons. No:	16949	3906	14-
			773	5468	
			19877	1095	
			13642	2649	
			13641	11552	
-5-18	99	Cons. No:	839	885	12-1
	"	"	5428	1017	
	"	"	16949	3563	
	"	"	540	515	
	"	"	773	3469	
	"	"	19877	1095	14-1
	"	"	13642	815	
	"	"	13641	5367	11396
6-18	105	"	12582	450	15-1
-6-18	107	"	13642	2685	
	"	"	13641	3009	
	"	"	16949	1589	
	"	"	773	4330	13419
-7-18	114	"	12582	695	
	114	"	540	352	
7-18	115	By Reimbursement of Electricity bill (NCC Camp)	7000		12-
-7-18	117	To Electricity charge paid Cons. No:	5428	857	
		"	16949	3480	
		"	13641	7323	
		"	839	322	59188
8-18	121	By Reimbursement of Electricity bill (NCC Camp)	5000		17-
"	122	To Electricity charge paid			
	"	Cons. No: 773		1090	57928
		13642		1500	



		B/f			5702
14-8-18	126	C/o Electricity charge paid Cons.No:	13642	4580	
			16949	3361	
			13641	7555	
			773	7789	20285
12-9-18	131	C/o Con. No:	540	690	
	"		773	3439	
	"		13641	5394	
	"		16949	2762	
	"		13642	1632	
14-9-18	132	C/o Cons. No:	12582	655	
	"		5428	1026	
	"		839	569	96530
15-11-18	144	C/o Cons. No:	13641	11290	
	"		5428	1035	
	"		13642	4590	
	"		16949	6894	
	"		773	10509	
	"		540	786	
	"		12582	503	
	"		839	904	130021
12-12-18	151	C/o Cons. No:	19877	5406	
			773	3859	
			16949	3090	
			13642	2010	
			13641	8259	155645
17-04-19	156	C/o Cons. No:	5428	1035	
	"		13641	7620	
	"		540	588	
	"		773	5253	
	"		16949	3083	173224



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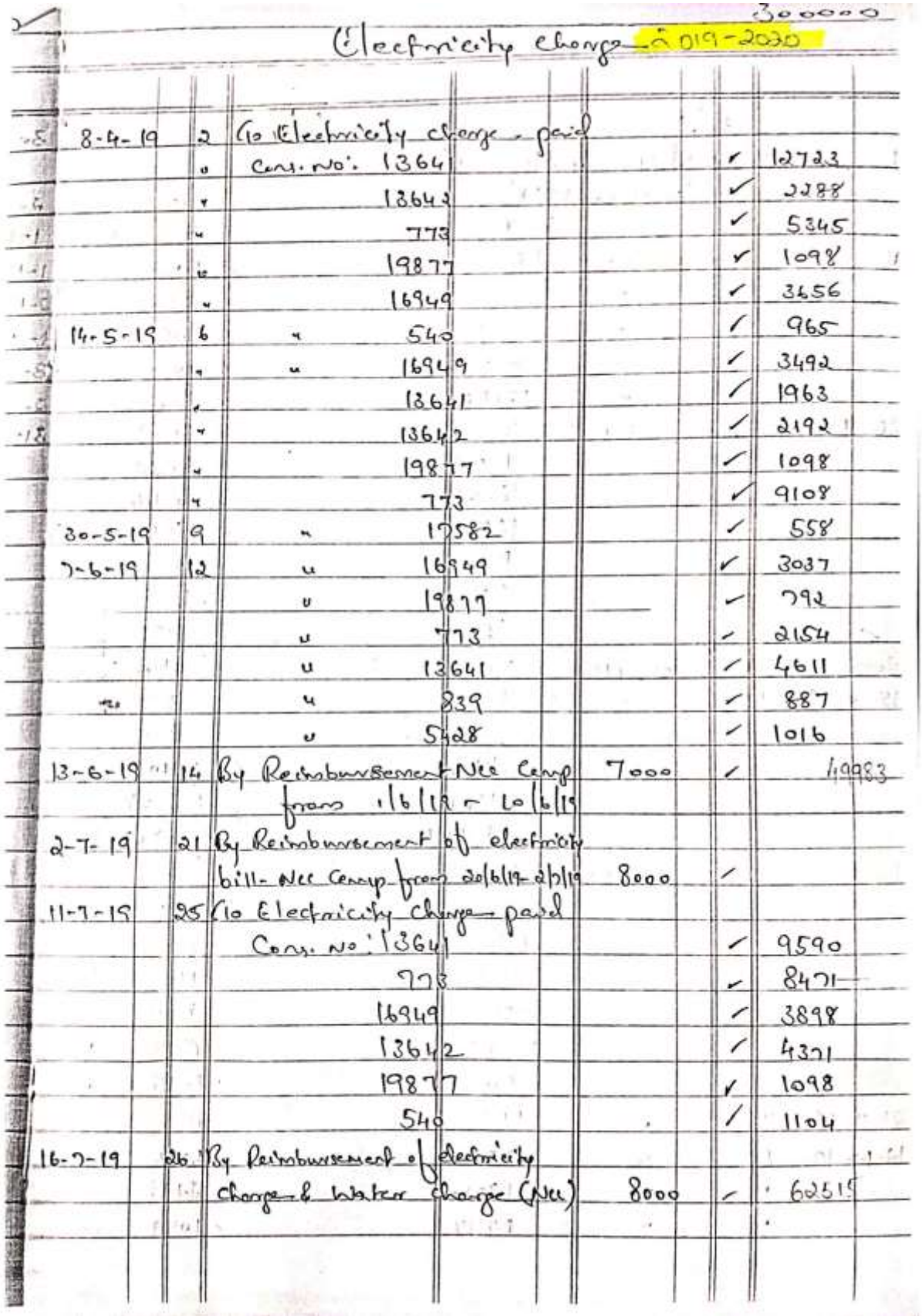
		B/F				173224
2-01-19	156	C/o	Electricity charges paid			
			Constructo:	19877	1218	
				13642	1816	
				17582	552	
2-2-19	160	C/o	-Do-	839	904	
3-2-19	162	C/o	-Do-	773	2229	
				19877	1098	
				13642	1740	
				13641	7415	
				16949	2952	193148
1-3-19	169	C/o	-Do-	16949	3977	
				13641	10207	
				13642	2543	
				773	6026	
				19877	1099	
				540	826	
4-3-19	171	C/o	-Do-	839	897	
				5428	1024	
				17582	624	32037



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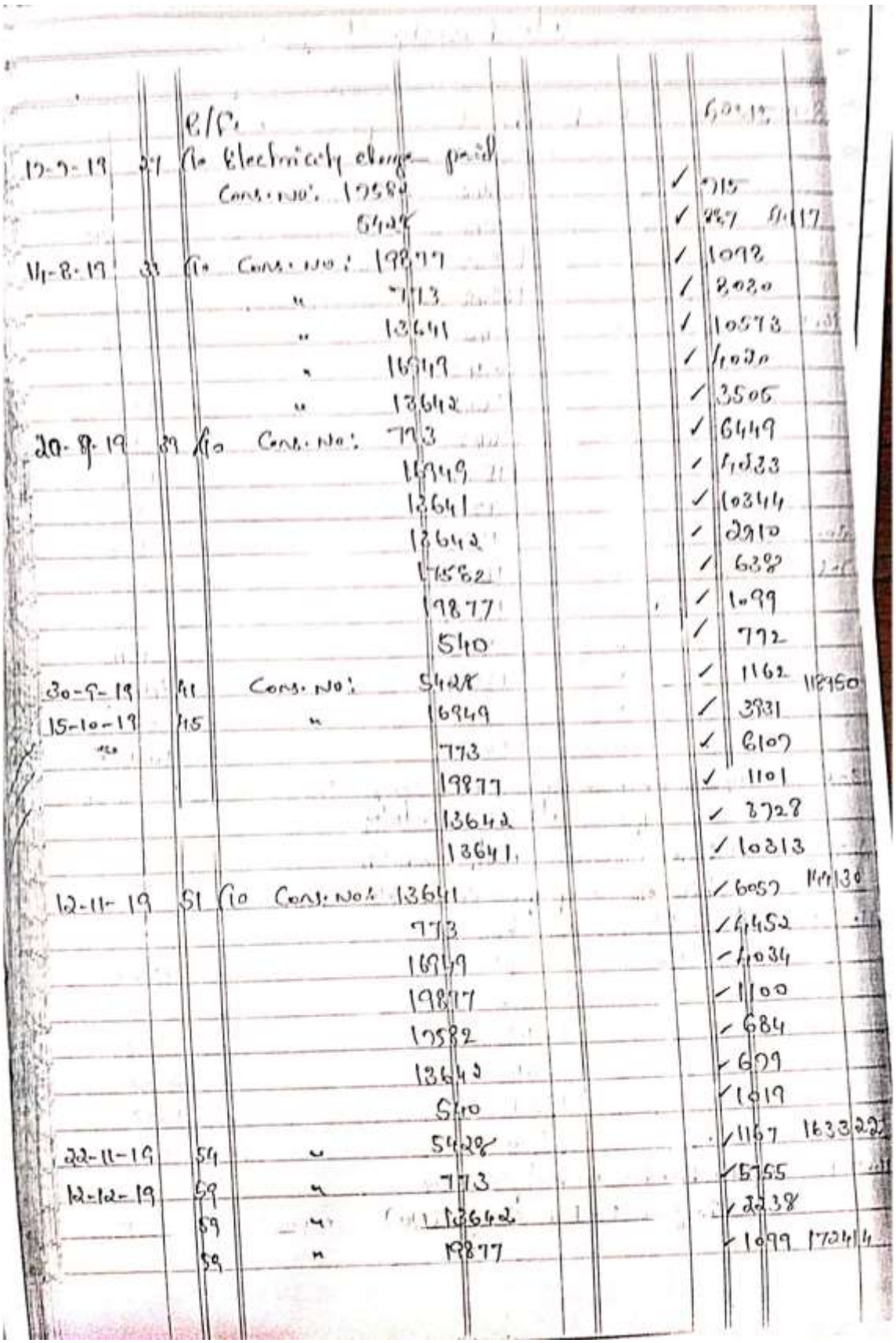
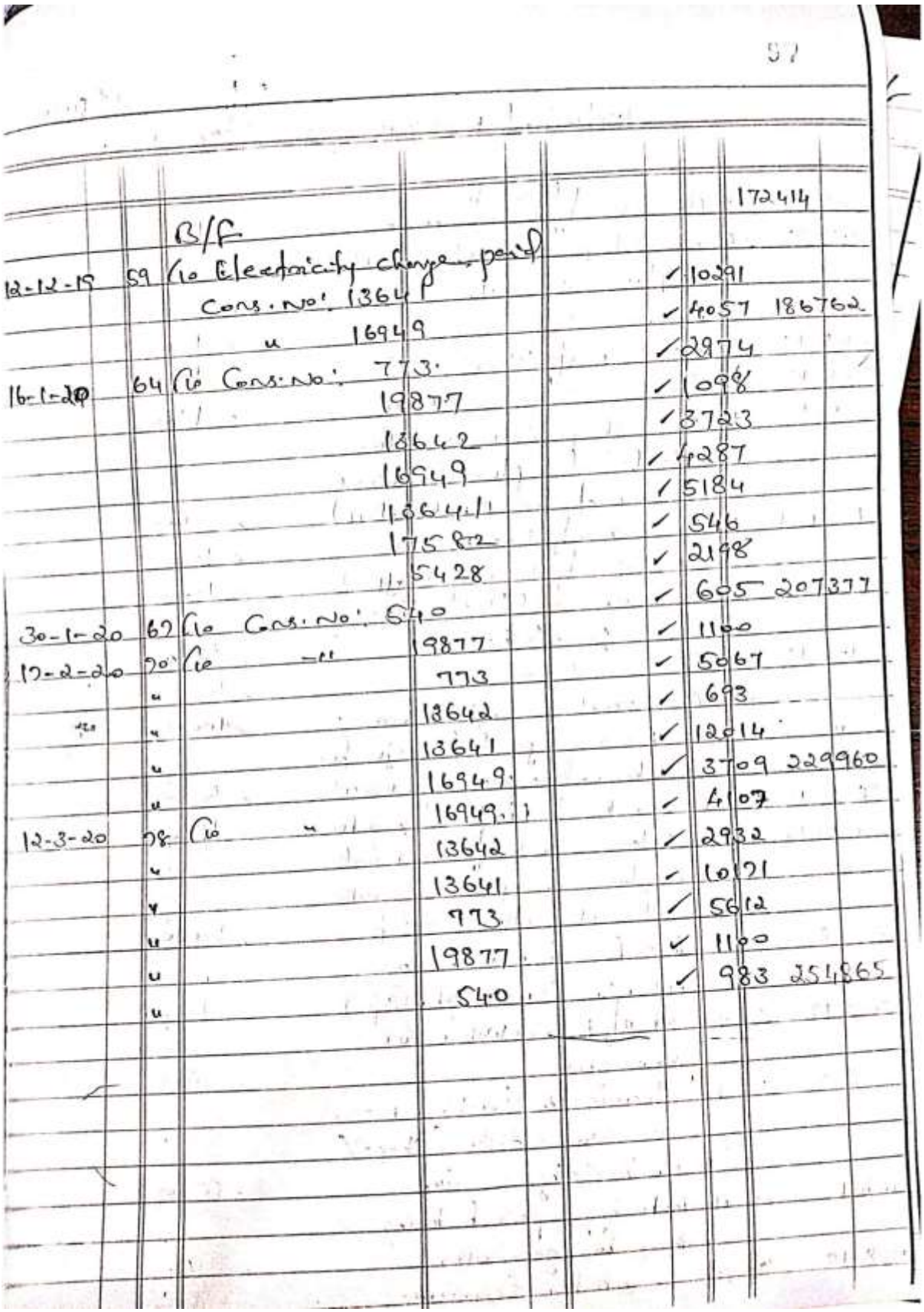
Electricity charge - 2019-2020

8-4-19	2	C/o Electricity charge - paid			✓	12723
	"	Cons. No: 13641			✓	2288
	"	13642			✓	5345
	"	773			✓	1098
	"	19877			✓	3656
	"	16949			✓	965
14-5-19	6	" 540			✓	3492
	"	" 16949			✓	1963
	"	13641			✓	2192
	"	13642			✓	1098
	"	19877			✓	9108
	"	773			✓	558
30-5-19	9	" 17582			✓	3037
7-6-19	12	" 16949			✓	792
		" 19877			✓	2154
		" 773			✓	4611
		" 13641			✓	887
		" 839			✓	1016
		" 5428				119983
13-6-19	14	By Reimbursement Nec Comp from 1/6/19 - 10/6/19	7000		✓	
2-7-19	21	By Reimbursement of electricity bill- Nec Comp from 20/6/19-2/7/19	8000		✓	
11-7-19	25	C/o Electricity charge - paid				
		Cons. No: 13641			✓	9590
		773			✓	8471
		16949			✓	3898
		13642			✓	4321
		19877			✓	1098
		540			✓	1104
16-7-19	26	By Reimbursement of electricity charge & water charge (Nec)	8000		✓	62519



R/C

12-9-19	27	To Electricity charge paid			
		Cons. No:	17582	✓	715
			5428	✓	887
11-8-19	33	To Cons. No:	19877	✓	1092
		"	773	✓	8020
		"	13641	✓	10573
		"	16949	✓	10020
		"	13642	✓	3506
20-8-19	39	To Cons. No:	773	✓	6449
			16949	✓	10033
			13641	✓	10344
			13642	✓	2910
			17582	✓	6382
			19877	✓	1099
			5410	✓	772
30-9-19	41	Cons. No:	5428	✓	1162
15-10-19	45	"	16949	✓	3831
"			773	✓	6107
			19877	✓	1101
			13642	✓	3728
			13641	✓	10313
12-11-19	51	To Cons. No:	13641	✓	6052
			773	✓	4452
			16949	✓	10034
			19877	✓	1100
			17582	✓	684
			13642	✓	609
			5410	✓	1019
22-11-19	54	"	5428	✓	1167
12-12-19	59	"	773	✓	5755
	59	"	13642	✓	2238
	59	"	19877	✓	1099



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				172414
		B/F.		
12-12-19	59	C/o Electricity charges paid		
		Cons. No: 13641	✓	10291
		" 16949	✓	4057 186762
			✓	2974
16-1-20	64	C/o Cons. No: 773	✓	1098
		19877	✓	3723
		13642	✓	4287
		16949	✓	5184
		13641	✓	546
		17582	✓	2198
		5428	✓	605 207377
30-1-20	62	C/o Cons. No: 540	✓	1100
12-2-20	90	C/o " 19877	✓	5067
	"	773	✓	693
	"	13642	✓	12014
	"	13641	✓	3709 229960
	"	16949	✓	4107
12-3-20	98	C/o " 16949	✓	2932
	"	13642	✓	10121
	"	13641	✓	5612
	"	773	✓	1100
	"	19877	✓	983 254965
	"	540		

Report- Energy Audit

2018-2020

ENERGY AUDIT REPORT

ST. THOMAS COLLEGE

RANNI

OTTOTRACTIONS

Energy Audit Report
St. Thomas College, Ranni
Report No: EA 1004B
2020

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. Thomas College, Ranni 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. Thomas College, Ranni					
Sl No	Projects	Investment	Cost saving	SPB	Energy saved
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr
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2	Energy Saving in Lighting by replacing existing 84 No's T8 (40W) Lamps to 18W LED Tube	0.25	0.248	12.18	3105
3	Energy Saving in Lighting by replacing existing 46 No's CFL(15W) Lamps to 9W LED Bulb	0.04	0.032	15.63	397
4	Energy Saving by replacing existing 156 No's in-efficient ceiling fans with Energy Efficient Five star fans	4.68	0.382	147.17	4770
5	Installation of 10kWp Solar Power Plant	5.50	1.820	36.26	13688
	Total	**10.47**	**2.48**	**43.70**	**21959**
(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-Engineering-Environment

1

Introduction

A detailed energy audit has been carried out at St. Thomas College Ranni by OTTOTRACTIONS in April 2020. 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

The history of the college is embedded in the history of Ranni. The college is situated on the top of a serene hill, in a sylvan surrounding, away from the din and bustle of the city, easily accessible and is at a walkable distance from the heart of Ranni town. The college was established in 1964, as a junior college by St Thomas Valiyapally Ranni, a pioneer parish of the Syrian Knanaya Arch Diocese of Malankara, with the whole hearted support of the then Bishop late lamented His Excellency Abraham Mor Clemis to meet the educational needs of the youth of the local community. The college was upgraded to a first grade college in 1968 and is the only institution for higher education in this part of the country. When the de-linking of Pre Degree sector was

made possible by the government on administrative measures we were left with graduate and Post Graduate courses. During its 53 years of illustrious existence, the college gave birth to brilliant academicians, administrators, politicians and entrepreneurs.

The college aims at creating cultured and educated citizens who love God and their country. With its rural background and `Gurukula' atmosphere, the college fosters uninterrupted pursuit of knowledge. The first Principal, Late Prof. K. A. Mathew, served as minister and PSC member in the Kerala State. He played a vital role in upgrading the junior college to a first grade one in 1968. As the Golden Jubilee project St. Thomas College of Advanced Studies, Edamury, Ranni, a Self-Financing College affiliated to M.G. University, Kottayam was established in June 2014. In March 2016, the College was assessed and re-accredited in the second cycle by the National Assessment and Accreditation Council (NAAC) of UGC and graded at B level.

Occupancy Details		
Particulars	2018-19	2019-20
Total Students	859	829
Staffs	64	64
Total Occupancy of the college	923	893

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. Jomon J S, Project Engineer
5. Amrutha A M, Data Analyst
6. Anjana B S, Project Assistant

2

Process description

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

BASELINE DATA SHEET FOR GREEN AUDIT											
1	Name of the Organisation	St. Thomas College, Ranni									
2	Address (include telephone, fax & e-mail)	St. Thomas College, Ranni, Pathanamthitta, 689641, stcranni@gmail.com,+91 8301057965									
2	Year of Establishment	1964									
3	Name of building and Total No. of Electrical Connections/building	St. Thomas college (8)									
4	Total Number of Students	Boys		Girls		Total	829				
5	Total Number of Staff	64									
6	Total Occupancy	893									
7	Total area of green cover	50%									
8	Type of Electrical Connection	HT	0	LT	8						
9	Total Connected Load (kW)	107									
10	Average Maximum Demand (KVA)	-									
11	Total built up area of the building (M^2)	8317									
12	Number of Buildings	5									
13	Average system Power Factor	0.96									
14	Details of capacitors connected	NA									
15	Transformer Details (Nos., kVA, Voltage ratio)	TR 1									
		NA									
15	DG Set Details (kVA,)	DG1	DG2	DG3	DG4	DG5	Remarks				
		10									
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 8 LT Connections, the details are given below. A 10 kVA Diesel Generator are in operation at this campus

Electricity Connection Details		
St. Thomas College, Ranni		
1	Name of the Consumer	St. Thomas College, Ranni
2	Tariff	LT-6A 3Ph
3	Consumer Numbers	1146072000540, 1146071019877, 1146079005428, 1146073013642, 1146070013641, 1146079016949, 1146076000773, 1146071019877
5	Connected Load Total (kW)	107
6	Annual Electricity Consumption (kWh)	28219

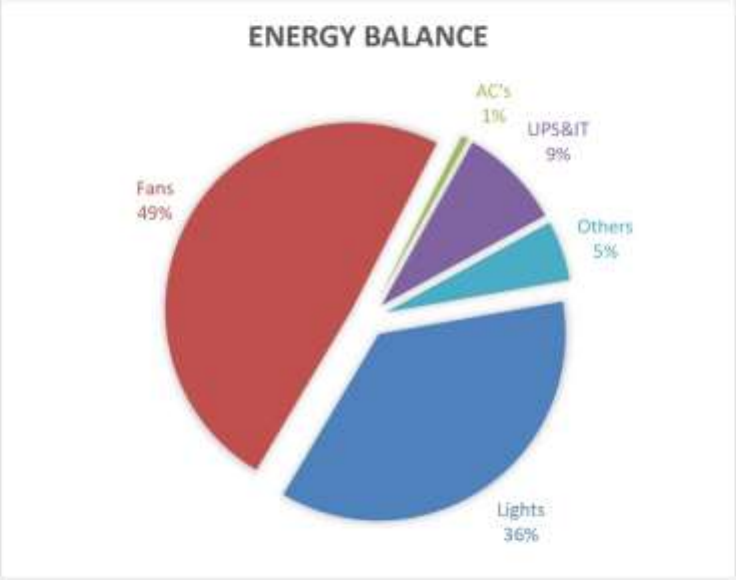
3.2. Thermal Energy / Transportation

There are no vehicles operated from college for transportation. LPG is used for cooking in the canteen and diesel is used to operate Diesel Generators.

OTTOTRACTIONS

4

Energy Balance



49 % of the total energy consumed in this facility is used to operate Fans. Lighting uses 36% UPS and IT Uses AC uses 9%. Air-conditioners uses 1% and Others uses 5%.

OTTOTRACTIONS

5

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 **8.00 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

Annual Electricity Consumption (kWh)			
Consumer No	**2018-19**	**2019-20**	Connected Load (kW)
1146072000540	522	611	2
1146071019877	5432	513	6
1146079005428	1213	1834	4
1146073013642	2234	4675	16
1146070013641	13029	14234	16
1146079016949	3672	1876	35
1146076000773	9821	3241	22
1146071019877	2987	1235	6
Total	**35923**	**28219**	**107**

Diesel

The campus has a Diesel Generator. The details of Diesel consumption is given below.

Diesel Consumption Details				
	Transportation	Generator	Total	cost
	in L	in L	in L	in Rs
2018-19	0	344	344	30960
2019-20	0	289	289	26010

Base Line Energy Data St. Thomas College, Ranni			
		2018-19	2019-20
1	Electricity KSEB (kWh)	35923	28219
2	Electricity DG (kWh)	1032	867
3	Electricity Solar , Off grid (kWh)	0.00	0.00
4	Electricity (KSEB + DG + Off grid) kWh	36955	29086
5	Electricity Grid Tied (kWh)	1278	1278
6	Diesel (L)	0	0
7	LPG (kg)	60.00	75.00
8	Biogas (m3)	0.00	0.00

Energy Consumption Profile			
Sl No	Fuel	2018-19	2019-20
1	Electricity	31781300	25013960
2	Diesel	0	0
3	LPG	720000	900000
4	Biogas	0	0
Total		32501300	25913960

Solar Power Plant

Solar Power Plant		
Capacity (kWp)	2018-19	2019-20
1	1278	1278

Lighting

St. Thomas College, Ranni										
Sl.No	Location	Lights							Fans	
		LED-T	LED-B	LED-SQ	T8	T12	ICL	CFL	CF	EF
1	Principal	1		9		1			2	
2	Conf Hall				2	2			1	
3	Office	1			3	4			6	
4	Admn Room	1			4				3	
5	Manager					1			2	
6	Malayalam Dpmt	1							1	
7	3 Rooms	3							3	
8	4 Rooms					4			4	
9	9 Rooms					27			13	
10	Seminar Hall	3							6	1
11	4 Rooms				4				4	
12	Botany department					1			2	
13	Museum	1							2	
14	5 Classrooms	1				5			5	
15	Physics Department	1	1		2	1		2	5	
16	Computer lab				3				2	
17	3 Rooms							12	9	
18	3 Rooms				3				3	
19	3 Rooms				3				3	
20	English department					2			1	
21	6 Rooms				6				6	

22	Conf Hall		2					22	6	
23	3 Rooms						3		3	
24	Lab				2	1		3	4	
25	3 Departments				6	6			14	
26	6 Rooms				6			2	6	
27	9 Rooms	1			5	1		1	9	
28	4 Rooms							4	4	
29	3 Rooms				3				4	
30	2 Rooms				2				2	
31	3 Rooms	1			1	2			3	
32	5 Rooms				7				5	
33	Auditorium	4			22				13	
	Total	**19**	**3**	**9**	**84**	**58**	**3**	**46**	**156**	**1**

Lux Measurement

Sl. No:	Location	Lux Avg
1	Manager	64
2	Seminar Hall	74
3	Botany department	80
4	Museum	84
5	Physics Department	93
6	Computer lab	75
7	Lab	76
8	Auditorium	88

OTTOTRACTIONS

6

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. Thomas College, Ranni			
Energy Performance Index (EPI)			
Sl No	Particulars	2018-19	2019-20
1	Total building area (m²)	8317	8317
2	Annual Energy Consumption (kCal)	32501300	25913960
3	Annual Energy Consumption (kWh)	37792	30133
4	Total Energy in Toe	3.25	2.59
5	Specific Energy Consumption kWh/m²	4.54	3.62

The Energy Performance Index (EPI) is

3.62 kWh/m²

The EPI of 2019-20 may be taken as benchmark.

OTTOTRACTIONS

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. THOMAS COLLEGE RANNI,
RANNI

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
- Started to installing LED Lights
- Conducted Energy Conservation Training Programs
- Installed Solar street lights

OTTOTRACTIONS

8

Energy Conservation Measures and Recommendations

Executive Summary					
Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects					
St. Thomas College, Ranni					
Sl No	Projects	Investment	Cost saving	SPB	Energy saved
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr
1	Energy Saving in Lighting by replacing existing 58 No's T12 (55W) Lamps to 18W LED Tube	0.17	0.29	7.27	3591
2	Energy Saving in Lighting by replacing existing 84 No's T8 (40W) Lamps to 18W LED Tube	0.25	0.248	12.18	3105
3	Energy Saving in Lighting by replacing existing 46 No's CFL(15W) Lamps to 9W LED Bulb	0.04	0.032	15.63	397
4	Energy Saving by replacing existing 156 No's in-efficent ceiling fans with Energy Efficient Five star fans	4.68	0.382	147.17	4770
5	Installation of 10kWp Solar Power Plant	5.50	1.820	36.26	13688
	Total	**10.47**	**2.48**	**43.70**	**21959**
(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

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal Code 1	
Energy Saving in Lighting by replacing existing 84 No's T8 (40W) Lamps to 18W LED Tube	
Existing Scenario	
84 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	84
Total load (kW)	3.36
Annual Energy Consumption (kWh)	5645
Expected Annual Energy saving for replacing all fittings (kWh)	3105
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.25
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.25
Simple Pay Back (in Months)	12.18

OTTOTRACTIONS

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal Code	
Energy Saving in Lighting by replacing existing 58 No's T12 (55W) Lamps to 18W LED Tube	
Existing Scenario	
257 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 67% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2400
No of fittings	58
Total load (kW)	3.19
Annual Energy Consumption (kWh)	5359
Expected Annual Energy saving for replacing all fittings (kWh)	3591
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.29
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.17
Simple Pay Back (in Months)	7.27

OTTOTRACTIONS

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving by replacing existing 156 No's in-efficient ceiling fans with Energy Efficient Five star fans	
Existing Scenario	
There are 156 numbers of ceiling fans installed in the facility 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	156
Total load (kW)	10.92
Annual Energy Consumption (kWh)	17035
Expected Annual Energy saving, for total replacement(kWh)	4770
Cost of Power (Rs)	8.00
Annual saving in Lakhs Rs (1st year)	0.38
Investment required for a total replacement (Lakhs Rs)[@3000 Rs per Fan with 50W at full speed]	4.68
Simple Pay Back (in Months)	147.17

OTTOTRACTIONS

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving in Lighting by replacing existing 46 No's CFL(15W) Lamps to 9W LED Bulb	
Existing Scenario	
24 numbers of CFL (15W) 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 CFL may be replaced to LED Bulb of 9W in phased manner and the savings will be of 40% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2400
No of fittings	46
Total load (kW)	0.69
Annual Energy Consumption (kWh)	994
Expected Annual Energy saving for replacing all fittings (kWh)	397
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.03
Investment required for complete replacements [@Rs 90 per fittings](Lakhs Rs)	0.04
Simple Pay Back (in Months)	15.63

Energy Saving Proposal	
Installation of 10kWp 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 10kW 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)	10
Total average kWh per day expected (3.5kWh/day average)	37.50
Total annual Generating Capacity (kWh)	13688
Cost of energy generated annually Lakhs Rs	1.82
Investment required (INR lakh)(Approx)	5.50
Simple Pay Back (in Months)	36.26
Life cycle in Yrs	25
Total Saving in Life Cycle (Approx) RS lakh	45.51

OTTOTRACTIONS

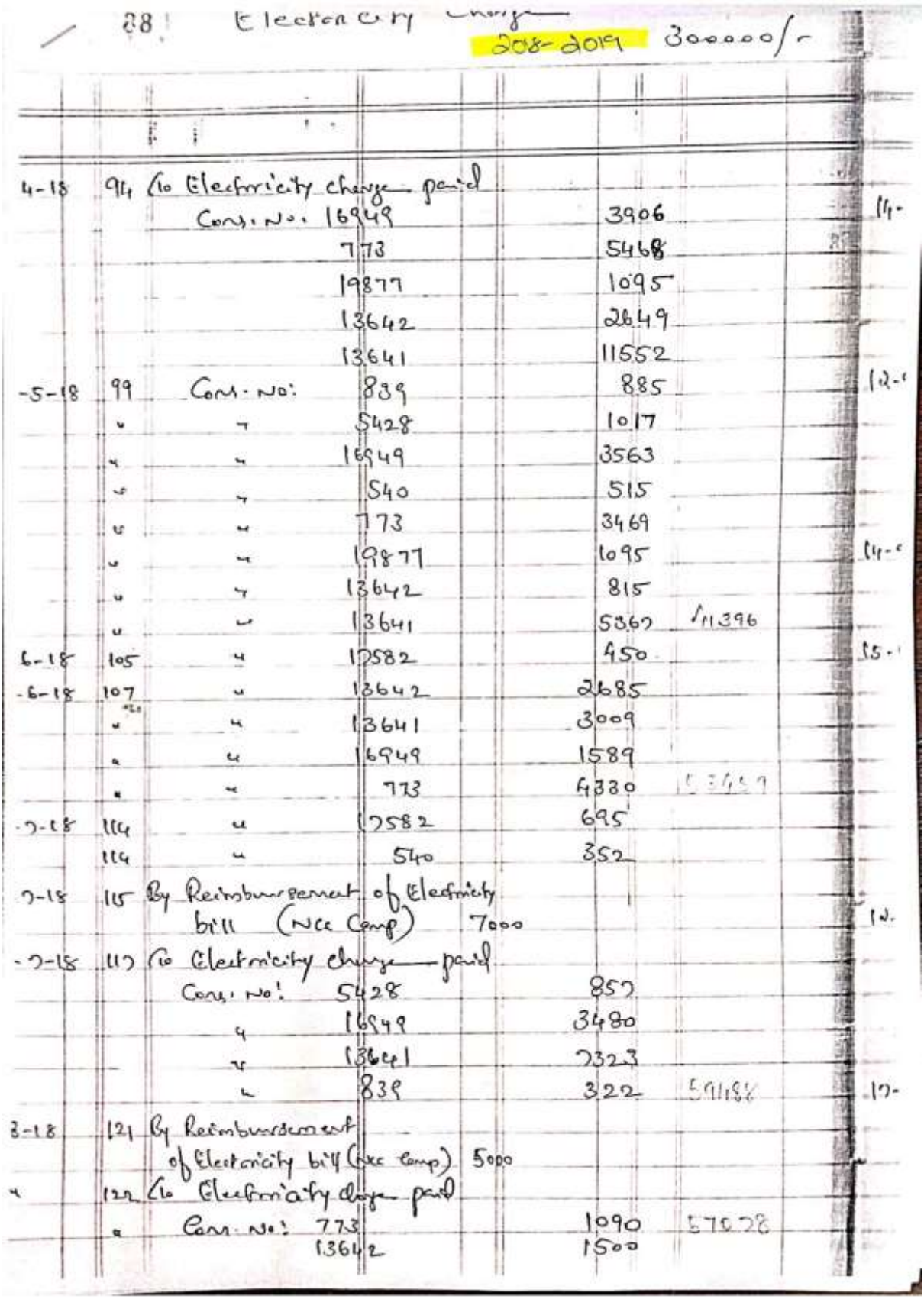
OTTOTRACTIONS- ENERGY AUDIT						
St. Thomas College, Ranni						
Greenhouse Gas Mitigation through Major Energy Efficiency Projects						
Sl No	Projects	Energy saved(Yearly)		Sustainability (Years)	First year ton of CO2 mitigated	Expected Tons of CO2 mitigated through out life cycle
		(kWh)	MWh	Years		
1	Energy Saving in Lighting by replacing existing 58 No's T12 (55W) Lamps to 18W LED Tube	3591	3.59	10	2.62	26.21
2	Energy Saving in Lighting by replacing existing 84 No's T8 (40W) Lamps to 18W LED Tube	3105	3.10	10	2.27	22.66
3	Energy Saving in Lighting by replacing existing 46 No's CFL(15W) Lamps to 9W LED Bulb	397	0.40	10	0.29	2.90
4	Energy Saving by replacing existing 156 No's in-efficent ceiling fans with Energy Efficient Five star fans	4770	4.77	10	3.48	34.82
Total		**11863**	**12**	**10**	**8.66**	**86.60**

St. Thomas College, Ranni						
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 through out life cycle
		(kWh)	MWh	Years		
1	Installation of 10kWp Solar Power Plant	13688	13.69	25	9.99	249.80
	Total	13688	14	25	9.99	250

Technical Supplements

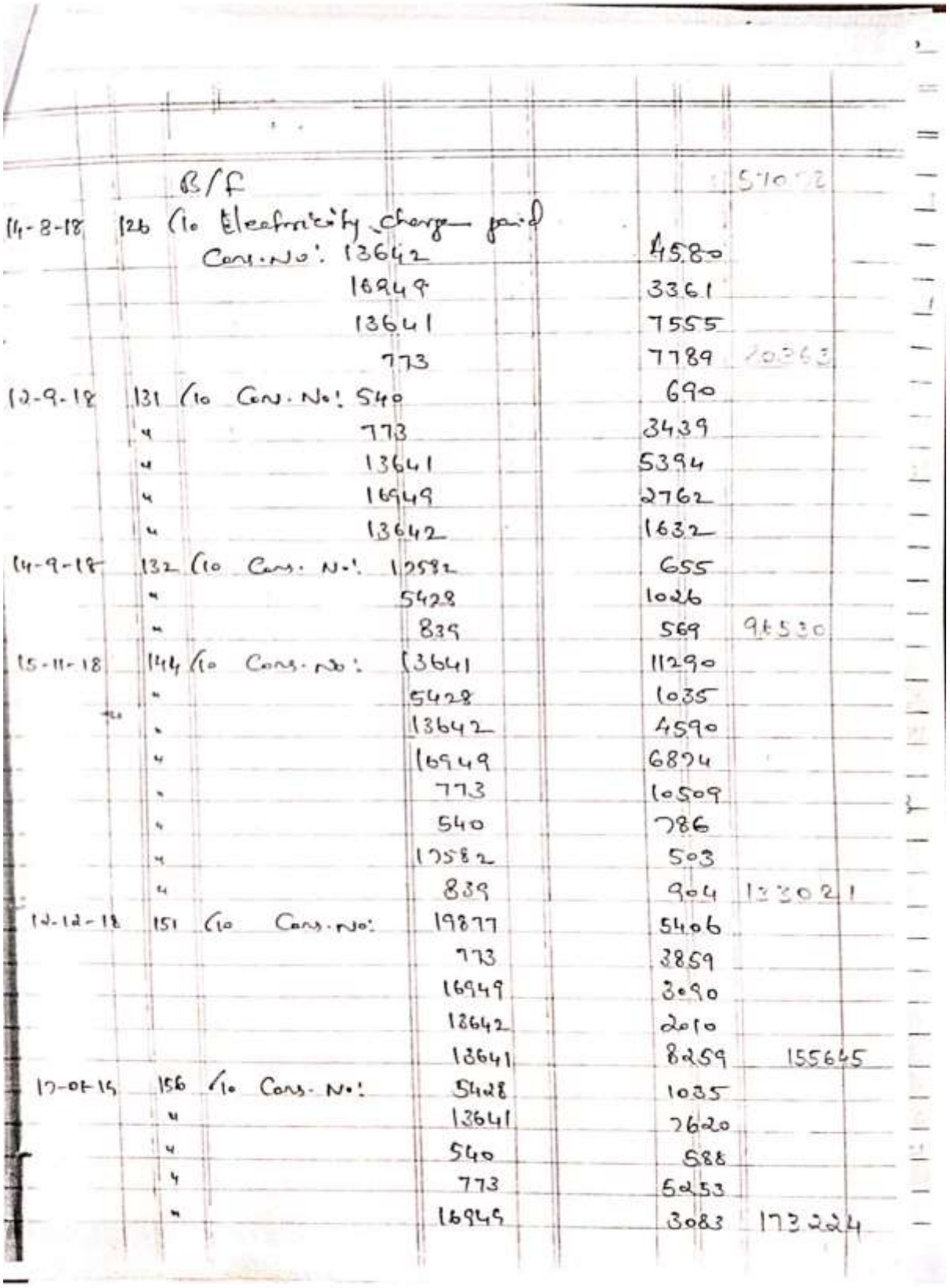
St. Thomas College, Ranni																
Sl.No	Location	Lights							Fans		IT			Others		
		LED-T	LED-B	LED-SQ	T8	T12	ICL	CFL	CF	EF	Printer	Projector	PC	TV	AC (1TR)	Fridge
1	Principal	1		9		1			2		1		1	1		
2	Conf Hall				2	2			1				1		1	
3	Office	1			3	4			6		2		2			
4	Admn Room	1			4				3		3		1			
5	Manager					1			2		1		1			
6	Malayalam Dpmt	1							1							
7	3 Rooms	3							3							
8	4 Rooms					4			4							
9	9 Rooms					27			13							
10	Seminar Hall	3							6	1		1				
11	4 Rooms				4				4							
12	Botany department					1			2		1		1			1
13	Museum	1							2				1			
14	5 Classrooms	1				5			5							
15	Physics Department	1	1		2	1		2	5			1	1			
16	Computer lab				3				2				5			
17	3 Rooms							12	9							
18	3 Rooms				3				3							
19	3 Rooms				3				3							
20	English department					2			1				1			
21	6 Rooms				6				6							

22	Conf Hall		2					22	6							
23	3 Rooms						3		3							
24	Lab				2	1		3	4		1		24			
25	3 Departments				6	6			14							
26	6 Rooms				6			2	6							
27	9 Rooms	1			5	1		1	9							
28	4 Rooms							4	4							
29	3 Rooms				3				4							
30	2 Rooms				2				2							
31	3 Rooms	1			1	2			3							
32	5 Rooms				7				5							
33	Auditorium	4			22				13							
	Total	**19**	**3**	**9**	**84**	**58**	**3**	**46**	**156**	**1**	**9**	**2**	**39**	**1**	**1**	**1**

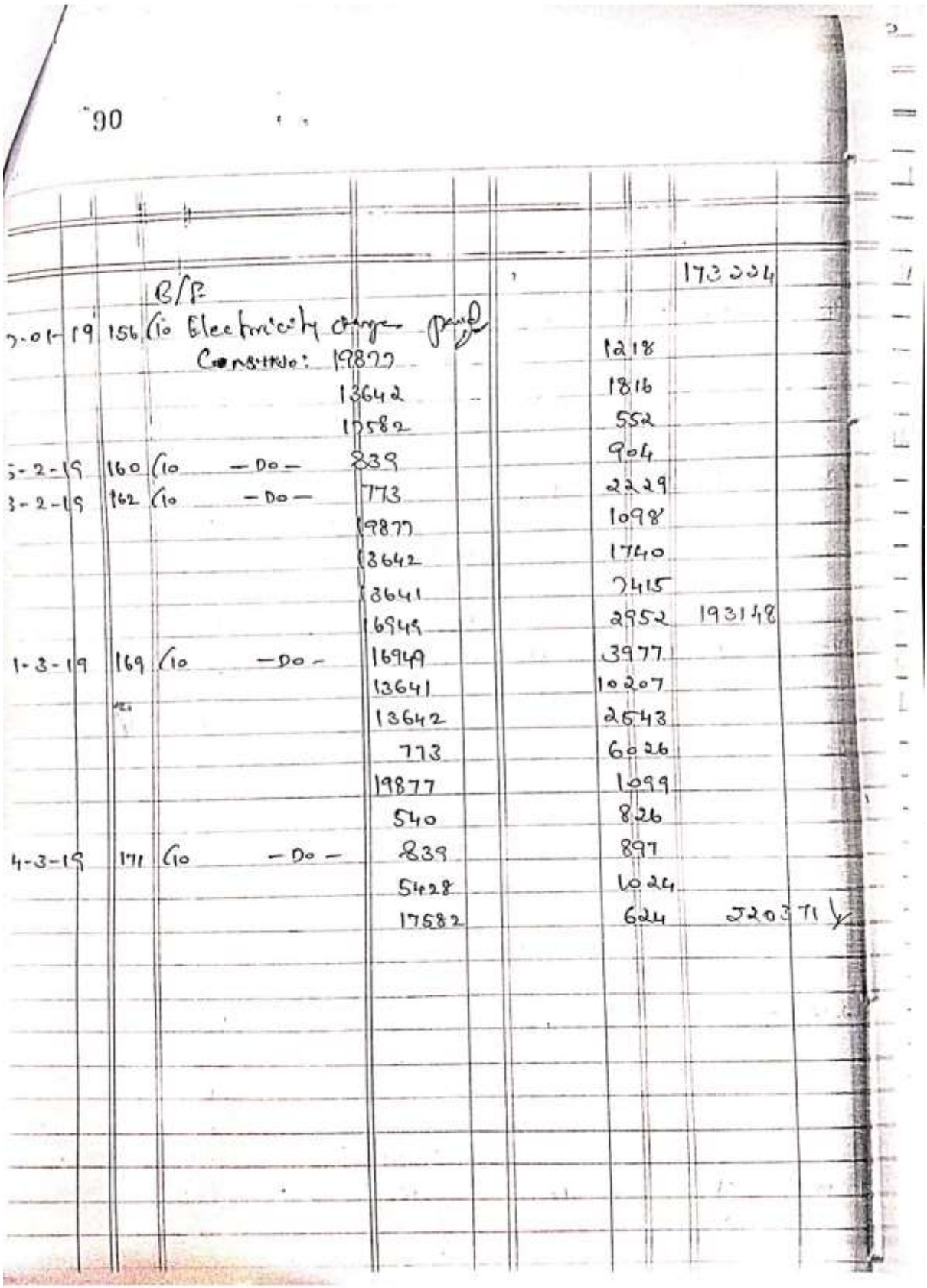


28 Electricity charge — 2018-2019 3000000/-

4-18	94	To Electricity charge paid			
		Cons. No.	16949	3906	
			773	5468	
			19877	1095	
			13642	2649	
			13641	11552	
-5-18	99	Cons. No.	839	885	
	"	"	5428	1017	
	"	"	16949	3563	
	"	"	540	515	
	"	"	773	3469	
	"	"	19877	1095	
	"	"	13642	815	
	"	"	13641	5367	11396
6-18	105	"	12582	450	
-6-18	107	"	13642	2685	
	"	"	13641	3009	
	"	"	16949	1589	
	"	"	773	4330	
-7-18	114	"	12582	695	
	114	"	540	352	
7-18	115	By Reimbursement of Electricity bill (NCC Camp)	7000		
-7-18	117	To Electricity charge paid			
		Cons. No.	5428	857	
		"	16949	3480	
		"	13641	7323	
		"	839	322	59188
8-18	121	By Reimbursement of Electricity bill (NCC Camp)	5000		
"	122	To Electricity charge paid			
	"	Cons. No.	773	1090	57528
			13642	1500	



		B/f			5702
14-8-18	126	C/o Electricity charge paid Cons.No:	13642	4580	
			16949	3361	
			13641	7555	
			773	7789	20285
12-9-18	131	C/o Con. No:	540	690	
	"		773	3439	
	"		13641	5394	
	"		16949	2762	
	"		13642	1632	
14-9-18	132	C/o Cons. No:	12582	655	
	"		5428	1026	
	"		839	569	96530
15-11-18	144	C/o Cons. No:	13641	11290	
	"		5428	1035	
	"		13642	4590	
	"		16949	6894	
	"		773	10509	
	"		540	786	
	"		12582	503	
	"		839	904	130021
12-12-18	151	C/o Cons. No:	19877	5406	
			773	3859	
			16949	3090	
			13642	2010	
			13641	8259	155645
17-04-19	156	C/o Cons. No:	5428	1035	
	"		13641	7620	
	"		540	588	
	"		773	5253	
	"		16949	3083	173224



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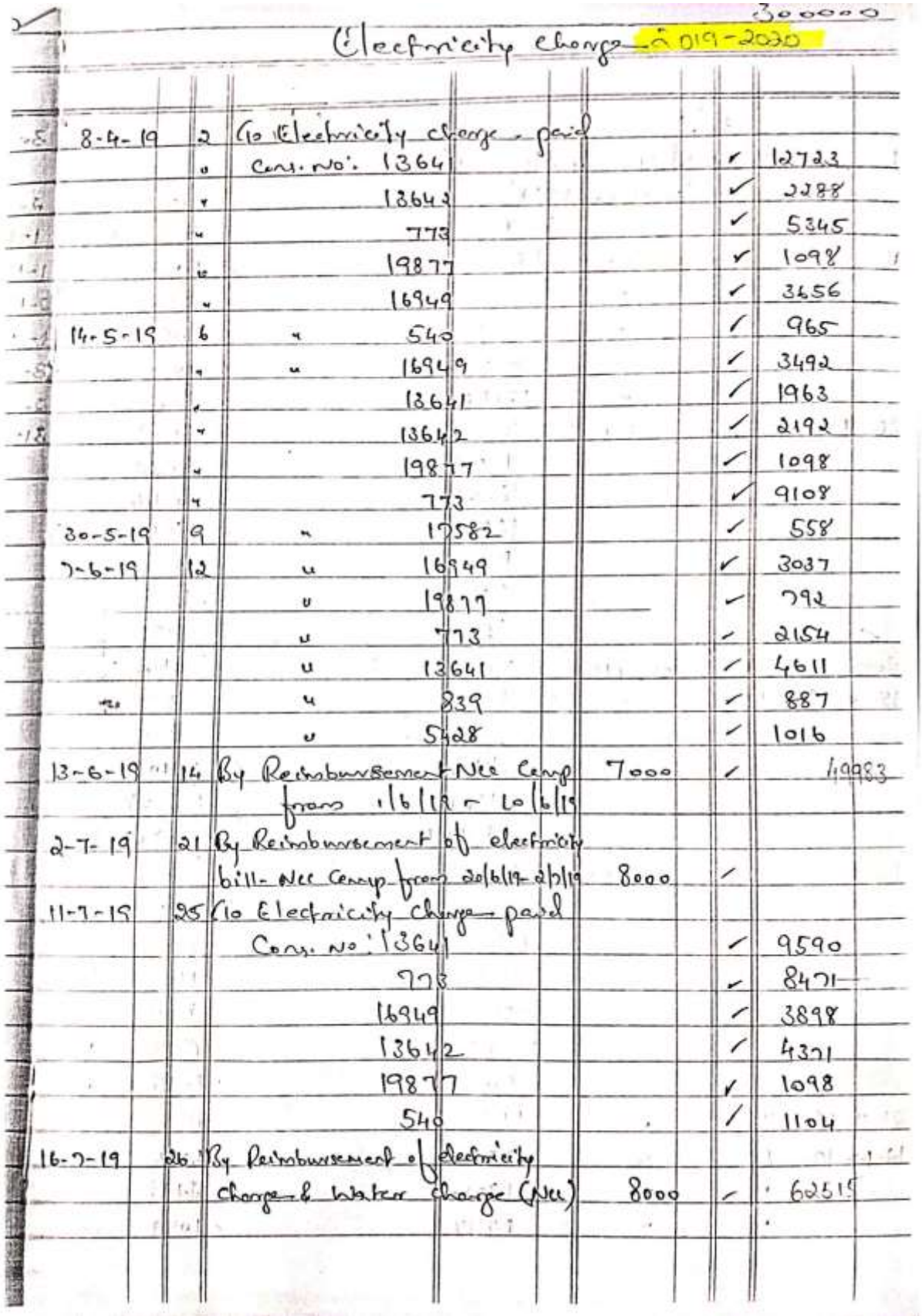
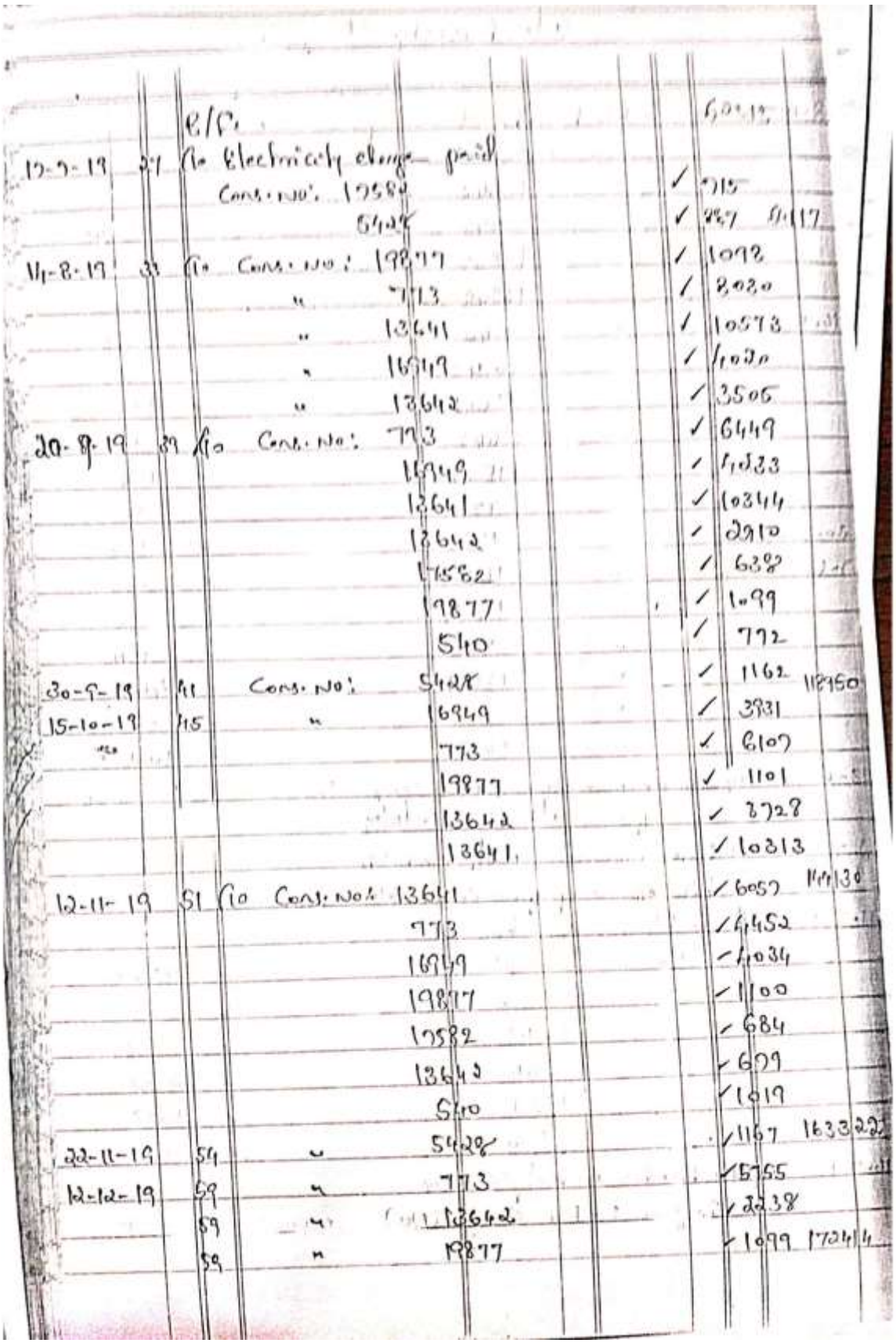
			B/F			173204
2-01-19	156	C/o	Electricity charges paid			
			Constitute:	19877	1218	
				13642	1816	
				17582	552	
2-2-19	160	C/o	-Do-	839	904	
3-2-19	162	C/o	-Do-	773	2229	
				19877	1098	
				13642	1740	
				13641	7415	
				16949	2952	193148
1-3-19	169	C/o	-Do-	16949	3977	
				13641	10207	
				13642	2543	
				773	6026	
				19877	1099	
				540	826	
4-3-19	171	C/o	-Do-	839	897	
				5428	1024	
				17582	624	32037



3000000

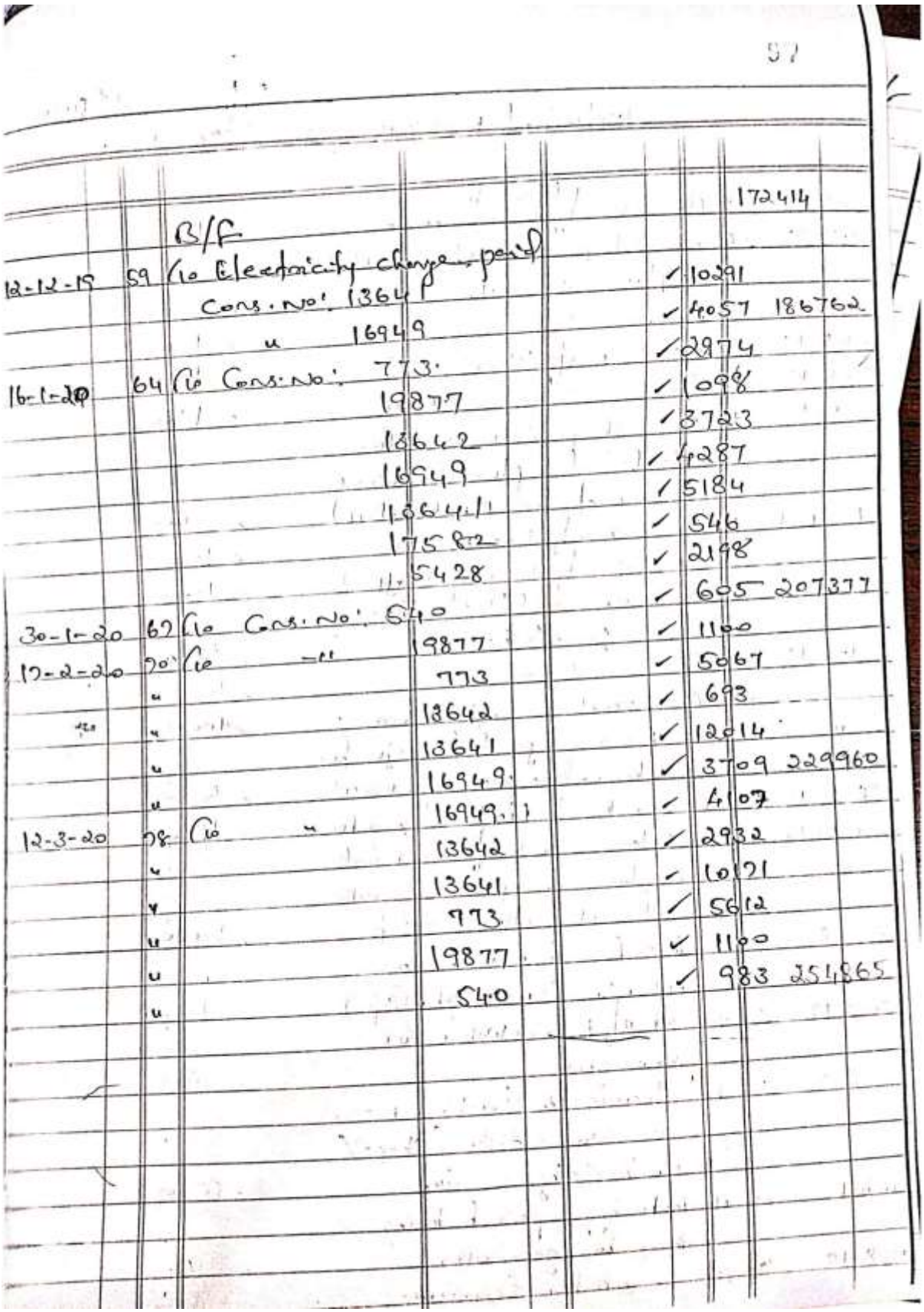
Electricity charge - 2019-2020

8-4-19	2	C/o Electricity charge - paid			✓	12723
	"	Cons. No: 13641			✓	2288
	"	13642			✓	5345
	"	773			✓	1098
	"	19877			✓	3656
	"	16949			✓	965
14-5-19	6	"	540		✓	3492
	"	"	16949		✓	1963
	"		13641		✓	2192
	"		13642		✓	1098
	"		19877		✓	9108
	"		773		✓	558
30-5-19	9	"	17582		✓	3037
7-6-19	12	"	16949		✓	792
		"	19877		✓	2154
		"	773		✓	4611
		"	13641		✓	887
		"	839		✓	1016
		"	5428			
13-6-19	14	By Reimbursement NEC Camp from 1/6/19 - 10/6/19		7000	✓	19983
2-7-19	21	By Reimbursement of electricity bill- NEC Camp from 20/6/19-2/7/19		8000	✓	
11-7-19	25	C/o Electricity charge - paid				
		Cons. No: 13641			✓	9590
		773			✓	8471
		16949			✓	3898
		13642			✓	4321
		19877			✓	1098
		540			✓	1104
16-7-19	26	By Reimbursement of electricity charge & water charge (NEC)		8000	✓	62515



B/F

12-9-19	27	To Electricity charge paid	Cons. No: 17582		715
				5428	887
11-8-19	33	To	Cons. No:	19877	1092
			"	773	8020
			"	13641	10573
			"	16949	10020
			"	13642	3506
20-8-19	39	To	Cons. No:	773	6449
				16949	10233
				13641	10344
				13642	2910
				17582	6382
				19877	1099
				540	772
30-9-19	41		Cons. No:	5428	1162
15-10-19	45		"	16949	3831
"				773	6107
				19877	1101
				13642	3728
				13641	10313
12-11-19	51	To	Cons. No:	13641	6052
				773	4452
				16949	10034
				19877	1100
				17582	684
				13642	609
				540	1019
22-11-19	54		"	5428	1167
12-12-19	59		"	773	5755
	59		"	13642	2238
	59		"	19877	1099



57

				172414
		B/F.		
12-12-19	59	C/o Electricity charges paid		
		Cons. No: 13641	✓	10291
		" 16949	✓	4057 186762
			✓	2974
16-1-20	64	C/o Cons. No: 773.	✓	1098
		19877	✓	3723
		13642	✓	4287
		16949	✓	5184
		13641	✓	546
		17582	✓	2198
		5428	✓	605 207377
30-1-20	62	C/o Cons. No: 540	✓	1100
12-2-20	90	C/o " 19877	✓	5067
	"	773	✓	693
	"	13642	✓	1214
	"	13641	✓	3709 229960
	"	16949	✓	4107
12-3-20	98	C/o " 16949	✓	2932
	"	13642	✓	1021
	"	13641	✓	5612
	"	773	✓	1100
	"	19877	✓	983 254965
	"	540		

Report- Environment Audit

2018-2020

ENVIRONMENT AUDIT REPORT

ST. THOMAS COLLEGE

RANNI

OTTOTRACTIONS

Environment Audit Report
ST. THOMAS COLLEGE, RANNI
EA 1004C, 2020

Audit Team

Ottotractions

1	Er. Suresh Babu B V,	Accredited Energy Auditor, AEA 33
2	Er. B. Zachariah,	Director, Ottotractions
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4	Er. Joemon J S	Project Engineer,
5	Ms.Amrutha	Data Analyst
6	Ms.Anjana	Project Assistant

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 and ISO 14001-2015 Certified organization, which ensures the quality of its services.

Acknowledgment

We were privileged to work together with the administration and staff of St. Thomas College, Ranni 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 team OTTOTRACTIONS 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
Government of India

Contents

OTTOTRACTIONS

INTRODUCTION

St. Thomas College, Ranni has entrusted Ottotractions to carry out an environment audit of their campus building.

Each section contains recommendations for improvements relating to environmental issues, which are consolidated in the action plan in section 4.

OTTOTRACTIONS

BACKGROUND

The history of the college is embedded in the history of Ranni. The college is situated on the top of a serene hill, in a sylvan surrounding, away from the din and bustle of the city, easily accessible and is at a walkable distance from the heart of Ranni town. The college was established in 1964, as a junior college by St Thomas Valiyapally Ranni, a pioneer parish of the Syrian Knanaya Arch Diocese of Malankara, with the whole hearted support of the then Bishop late lamented His Excellency Abraham Mor Clemis to meet the educational needs of the youth of the local community. The college was upgraded to a first grade college in 1968 and is

the only institution for higher education in this part of the country. When the de-linking of Pre Degree sector was made possible by the government on administrative measures we were left with graduate and Post Graduate courses. During its 53 years of illustrious existence, the college gave birth to brilliant academicians, administrators, politicians and entrepreneurs.

The college aims at creating cultured and educated citizens who love God and their country. With its rural background and 'Gurukula' atmosphere, the college fosters uninterrupted pursuit of knowledge. The first Principal, Late Prof. K. A. Mathew, served as minister and PSC member in the Kerala State. He played a vital role in upgrading the junior college to a first grade one in 1968. As the Golden Jubilee project St. Thomas College of Advanced Studies, Edamury, Ranni, a Self Financing College affiliated to M.G. University, Kottayam was established in June 2014. In March 2016, the College was assessed and re-accredited in the second cycle by the National Assessment and Accreditation Council (NAAC) of UGC and graded at B level.

Occupancy Details		
Particulars	2018-19	2019-20
Total Students	859	829
Staffs	64	64
Total Occupancy of the college	923	893

Total student strength of the campus is 829. For calculating per capita carbon emission estimation, the student strength is taken into account.

OTTOTRACTIONS

ENVIRONMENTAL ISSUES

This section is broken down into the following different areas: waste, water, energy, resource and materials use and procurement. A final 'other' section is also included for any additional issues.

1.1. Waste

The way communities generate and manage their waste plays an absolutely key role in their ability to use resources efficiently. All buildings contain bins for both general

waste and mixed recyclables (plastic bottles, card, cans and paper). On average each floor in the buildings areas has its own general waste bin and one recycling bin. When the bins are emptied by the cleaning staff. Bins are marked and kept in different colors for identification, however in some locations throughout the building it was unclear which bins were for which waste streams.

There are four basic ways in which campus can do **plastic** recycling **collection** services for **plastic** bottles and containers – curbside, drop-off, buy-back or deposit/refund programs. The first, and most widely accessible, **collection** method is curbside **collection** of recyclables. The campus is installed bins to collect plastic bottles and single use plastics. The college has given a proper awareness on plastic waste problems and they are discouraging the students or teachers to carry plastics to the campus. The Bhoomitra Sena Club is very active in the campus and do a verity of programs to build awareness on waste management. The reports on different activities of the club are attached as technical supplement of this report.

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. The degradable waste is treated in the biogas plant, the biogas generated is used in the kitchen. A state of art sewage treatment plant is installed in the campus

Degradable Waste Generation		
St. Thomas College, Ranni		
Particulars	2018-19	2019-20
Total Occupancy	923	893
Waste generated in kg /day	18.46	17.86
Waste generated in kg /Yr	4061.2	3929.2

Burning plastics shall be strictly restricted inside the campus. **Burning plastic** and other wastes releases dangerous substances such as heavy metals, Persistent Organic Pollutants, and other toxics into the air and ash waste residues. Such

pollutants contribute to the development of asthma, cancer, endocrine disruption, and the global burden of disease.

Solid non degradable Waste Generation		
St. Thomas College, Ranni		
Particulars	2018-19	2019-20
Total Occupancy	923	893
Waste paper generated in kg /day	0.1846	0.1786
Waste plastic generated in kg /day	0.2769	0.2679
Waste paper generated in kg /Yr	40.61	39.29
Waste plastic generated in kg /Yr	60.92	58.94

WASTE MINIMIZATION AND RECYCLING		
1	Does your institute generate any waste?	Yes, Solid waste, Canteen waste, paper, plastic, Horticulture Waste etc.
	If so, what are they?	
2	What is the approximate amount of waste generated per day? (in Kilograms/) (approx.)	18
3	How is the waste generated in the institute managed? By	Reuse of one side printed Paper for internal communication. Kitchen waste is used to generate manures and biogas. Two types of Waste bins are provided at campus for biodegradable and non-biodegradable waste.
	1 Composting	In-house
	2 Recycling	In-house
	3 Reusing	In-house
	4 Others (specify)	
4	Do you use recycled paper in institute?	Yes
5	Do you use reused paper in institute?	Yes
6	How would you spread the message of recycling to others in the community? Have you taken any initiatives? If yes,	Number of awareness programs through Nature Club, Biodiversity Club and NSS Camp
	please specify.	
7	Can you achieve zero garbage in your institute? If yes, how?	Not yet achieved. Possible through waste management plan.

OTTOTRACTIONS

Green Cover Audit			
1	**Is there a garden in your institute?**	**Yes**	
2	Do students spend time in the garden?	Yes	
3	Total number of Plants in Campus	Plant type	Approx. number
		Trees	236
		Ornamental	Not estimated
4	Number of Tree Plantation Drives organized by School per annum. (If Any)	Yes, through Nature Club and Biodiversity club plantation drives are organized.	
5	Number of Trees Planted in Last FY.	60	
	Survival Rate	90%	

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.

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. Detailed table is included in the technical supplement.

Carbon Sequestration		
Particulars	2018-19	2019-20
Total No of Trees	236	236
Carbon sequestrated by trees in the campus (tCO_2e)	6.6	6.90

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

Carbon sequestrated by each species of trees in the campus compound is given in the Table. Detailed calculation results are listed out in the tables provided in the technical supplements of 'Carbon sequestration'.

List of Trees and Plants		
Sl. No.	English Name	QTY
1	Jackfruit Tree	12
2	Mango	9
3	Ashoka Tree	1
4	BulletWood	2
5	Teak	84
6	Coconut	21
7	Wild Jack	7
8	Royal Princiana	4
9	Mahagony	38
10	Soursop Tree	7
11	Golden Shower Tree	8
12	Guava Tree	10
13	Rambutan	3
14	Copper Pod	3
15	False Ashoka	6
16	Caturina	1
17	Ornamental Palm	10
18	All Spice	1
19	Pride of India	2
20	Papaya	2
21	Bay Leaf	1
22	Persian Silk Tree	1
23	Araucaria	1
24	Hyophorbe	1
25	Sand Paper Tree	1
Total		236

OTTOTRACTIONS

3.1.1 ENERGY

a. Electricity

The total emission of the carbon dioxide per student is 20.73 kg per year. 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. All energy efficiency projects shall be implemented, So, the effective specific carbon emission per student is -0.17kg of CO_2 per year only

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 optimization
- Energy efficiency
- Renewable energy

Electricity Consumption

Electricity Connection Details		
St. Thomas College, Ranni		
1	Name of the Consumer	St. Thomas College, Ranni
2	Tariff	LT-6A 3Ph
3	Consumer Numbers	1146072000540, 1146071019877, 1146079005428, 1146073013642, 1146070013641, 1146079016949, 1146076000773, 1146071019877
5	Connected Load Total (kW)	107
6	Annual Electricity Consumption (kWh)	28219

OTTOTRACTIONS

Annual Electricity Consumption (kWh)			
Consumer No	**2018-19**	**2019-20**	Connected Load (kW)
1146072000540	522	611	2
1146071019877	5432	513	6
1146079005428	1213	1834	4
1146073013642	2234	4675	16
1146070013641	13029	14234	16
1146079016949	3672	1876	35
1146076000773	9821	3241	22
1146071019877	2987	1235	6
Total	**35923**	**28219**	**107**

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 utilization 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 optimize its usage.

Currently, College 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 optimization 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.

OTTOTRACTIONS

FUELS FOR COOKING

The campus can install 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. 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'

Renewable Energy

1kWp Solar power plant is installed in the campus which helps offsetting the carbon foot print. The details of these projects are given in the concerned chapters.

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

OTTOTRACTIONS- ENERGY AUDIT						
St. Thomas College, Ranni						
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 58 No's T12 (55W) Lamps to 18W LED Tube	3591	3.59	10	2.62	26.21
2	Energy Saving in Lighting by replacing existing 84 No's T8 (40W) Lamps to 18W LED Tube	3105	3.10	10	2.27	22.66
3	Energy Saving in Lighting by replacing existing 46 No's CFL(15W) Lamps to 9W LED Bulb	397	0.40	10	0.29	2.90
4	Energy Saving by replacing existing 156 No's in-efficient ceiling fans with Energy Efficient Five star fans	4770	4.77	10	3.48	34.82
Total		**11863**	**12**	**10**	**8.66**	**86.60**

St. Thomas College, Ranni						
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 10kWp Solar Power Plant	13688	13.69	25	9.99	249.80
	Total	13688	14	25	9.99	250

General Environmental Awareness Questionnaire	
Are you aware of any environmental Laws pertaining to different aspects of environmental management?	Yes
Does your institute have any rules to protect the environment? List possible rules you could include.	Yes
Dose Environmental Ambient Air Quality Monitoring conducted by the Institute?	No
Dose Environmental Water and Wastewater Quality monitoring conducted by the Institute?	Yes
Dose stack monitoring of DG sets conducted by the Institute?	No
Is any warning notice, letter issued by state government bodies?	No
Dose any Hazardous waste generated by the Institute? If yes explain its category and disposal method	No
Are you aware of any environmental Laws pertaining to different aspects of environmental management?	Yes
Does your institute have any rules to protect the environment? List possible rules you could include.	Yes
Does housekeeping schedule in your campus?	Yes
Are students and faculties aware of environmental cleanliness ways? If Yes Explain	Yes
Does Important Days Like World Environment Day, Earth Day, and Ozone Day etc. eminent in Campus?	Yes
Does Institute participate in National and Local Environmental Protection Movement?	Yes
Does the institute have any Recognition/certification for environment friendliness?	No
Does the institute use renewable energy?	Yes
Does the Institution conduct a green/environmental audit of its campus?	Yes
Has the institution been audited / accredited by any other agency such as NABL, NABET, TQPM, NAAC etc.?	Yes (NAAC)

OTTOTRACTIONS

Best Practices and Initiatives	
Renewable Energy	Yes
Solar Power Plant	Yes
Energy Audit and Green Audit Conducted	Yes
Biogas Plant installed	No
Biodiversity Conservation	Yes
Green Cover	Yes
Tree Plantation Drives	Yes
ECO clubs	Yes
Groundwater Recharge	Yes
Rain Water Harvesting System.	Yes
Pollution Reduction Public Transportation	Yes
E Waste Management	Yes
Connected to authorized recycler	Yes
Solid Waste Management	Yes
Lifting of garbage from the campus on alternate days by the Municipal Corporation.	No
Adoption of Village	Yes
CSR	Yes
Water Conservation	Yes
Energy Conservation	Yes

OTTOTRACTIONS

RECOMMENDATIONS

1. Implement a utility monitoring program.
   - Allocate staff to carry out meter readings for electricity, waste and water on regular basis
   - Add monitoring data to spreadsheet so results can be viewed graphically
   - Compare with the utility bills meter readings in order to ensure accuracy;
2. Consider adopting and implementing a sustainable procurement policy which takes into account the whole life cycle of a product, and make sure environmental issues are written into tenders when contracting out.
3. Consider trialing recycled paper again – many recycled brands today, such as

Evolve, are just as good as virgin paper.

4. Trial the use of re-manufactured (i.e., refilled) ink and toner cartridges rather than purchasing new ones.
5. Consider producing some designated 'environmental' pages on the intranet to make it easier for staff to find environmental information. If possible, a discussion forum could be set up to allow easy internal communications and staff to make suggestions for environmental improvements.
6. Environmental training could be formalized and carried out for all staff. It does not have to be too long or onerous, providing it covers key points, particularly in relation to waste so all staff are aware of the legal requirements. At the very least, environmental information should be included in the induction pack.
7. It is strongly recommended that environmental information is also given to students and staff during induction. It is particularly important for them to be aware of what waste they can dispose of on site and where they can dispose of it, and what waste streams they must take away with them.
8. Consider implementing an environmental management system to incorporate all improvements and monitoring requirements. It does not need to be a complex system certified to any particular standard, merely a way of ensuring that baselines are set and progress is measured. Formation of Environment Policy and communicated to all faculties and other staff.
9. Plan for Zero Waste Campus Project
10. E-waste monthly inventory be maintained at campus as per E waste rules 2016.
11. A Water Meter should be installed at the institute for monitoring of water consumption per capita.
12. Increase in Environmental promotional activities for spreading awareness at campus.
13. Environment/Green committee formation for regulating eco-friendly initiatives at campus premises and periphery.

OTTOTRACTIONS

CONCLUSION

This audit involved extensive consultation with all the campus team, interactions with key personnel on a wide range of issues related to Environmental aspects. The audit has identified several observations for making the campus premise more environmentally friendly. The recommendations are also mentioned with observations for St. Thomas college, Ranni team to initiate actions.

OTTOTRACTIONS

Carbon Foot Print					
Sl. No.	Particulars	2018-19	tCO2e	2019-20	tCO2e
1	Electricity (kWh)	36955	30.30	29086	23.85
2	Diesel (L)	0	0.00	0	0.00
3	LPG (kg)	60.00	0.09	75.00	0.11
4	Biogas (m3)	0.00	0.00	0.00	0.000
5	Degradable Waste in kg/yr.	4061.2	2.56	3929.2	2.48
6	Paper Waste in kg/yr	40.61	0.02	39.29	0.02
Total Carbon Foot Print tCO2e/yr			32.97		26.46

Net Carbon Emission after implementing Energy Efficiency projects and Renewable Energy Projects Proposed		
1	Total Carbon Foot Print tCO_2e/yr	26.46
2	Carbon Sequestrated tCO_2e/yr	6.90
3	Carbon mitigated by Renewable Energy tCO_2e/yr (Installed)	1.05
4	Carbon mitigated by Renewable Energy tCO_2e/yr (Proposed)	9.99
5	Carbon mitigated by Energy Efficiency (Proposed) tCO_2e/yr	8.66
6	Effective Carbon footprint tCO_2e/yr	-0.14
7	Total No of Students	829
8	Specific Carbon Footprint kg CO_2e/Student/Yr	-0.17

However, there is scope for further improvement, particularly in relation to waste minimization and energy monitoring. By implementing a basic environmental management system, current good practice can be formalized and a framework can be set up for monitoring, implementation of action plans and continual improvement.

The audit team observed that the overall site is maintained well from an environmental perspective. There are no major observations but few things are important to initiate urgently are waste management records by monthly inventory of hazardous waste, rainwater harvesting recharge; water balance cycle and periodic inspection of buildings; environment policy and initiation of composting at campus.

OTTOTRACTIONS

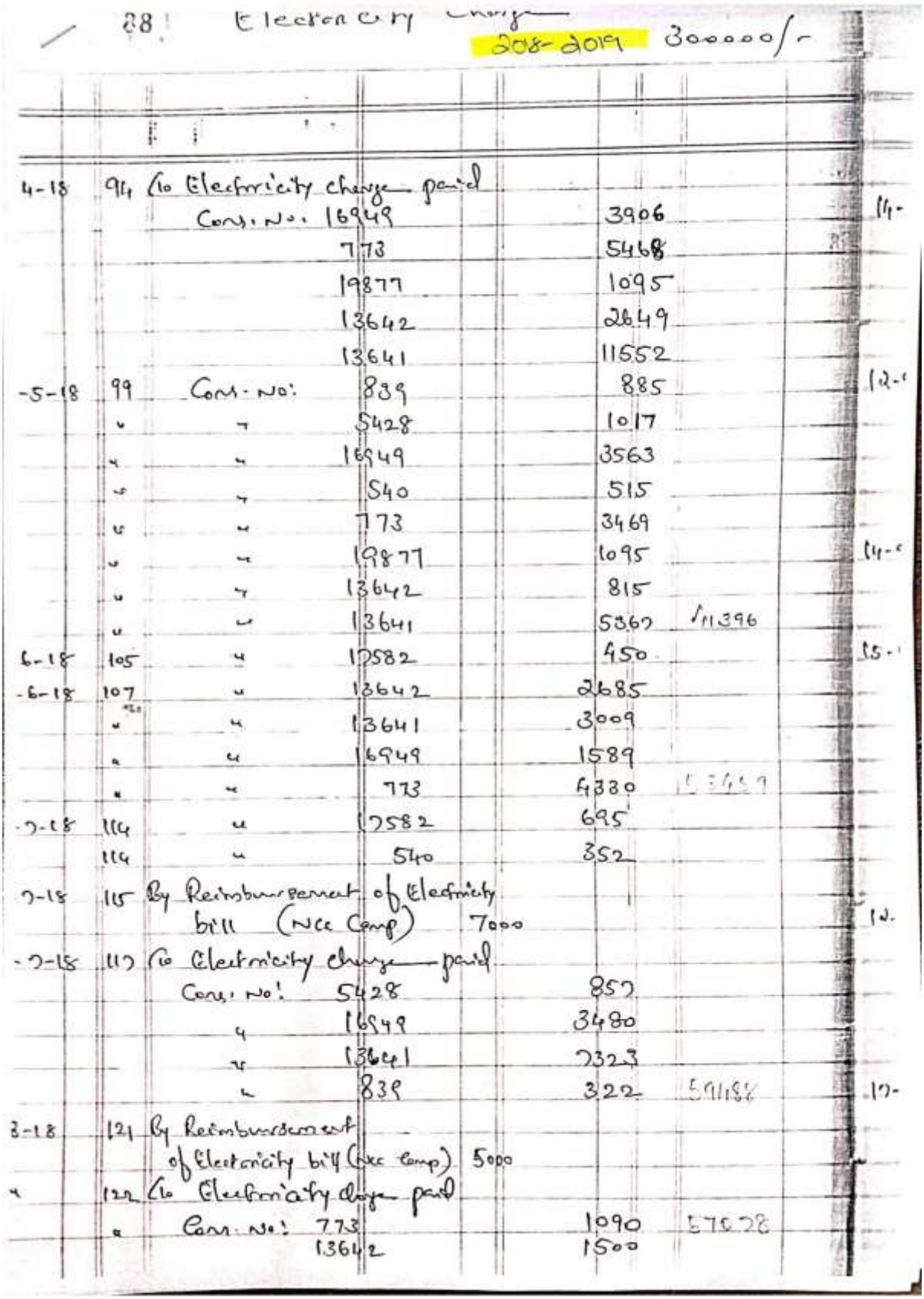
References

- The Environment [Protection] Act – 1986 (Amended 1991) & Rules-1986 (Amended 2010)
- The Petroleum Act: 1934 – The Petroleum Rules: 2002
- The Central Motor Vehicle Act: 1988 (Amended 2011) and The Central Motor Vehicle
- Rules:1989 (Amended in 2005)
- Energy Conservation Act 2010.
- The Water [Prevention & Control Of Pollution] Act – 1974 (Amended 1988) & the Water (Prevention & Control of Pollution) Rules – 1975
- The Water [Prevention & Control Of Pollution] Cess Act-1977 (Amended 2003) and Rules- 1978
- The Air [Prevention & Control Of Pollution] Act – 1981 (Amended 1987) The Air (Prevention & Control of Pollution) Rules – 1982
- The Gas Cylinders Rules – 2016 (Replaces the Gas Cylinder Rules – 1981
- E-waste management rules 2016
- Electrical Act 2003 (Amended 2001) / Rules 1956 (Amended 2006)
- The Hazardous Waste (Management and Handling and Trans-boundary Movement) Rules, 2008 (Amended 2016)
- The Noise Pollution Regulation & Control rules, 2000 (Amended 2010)
- The Batteries (Management and Handling) rules, 2001 (Amended 2010)
- Relevant Indian Standard Code practices

OTTOTRACTIONS

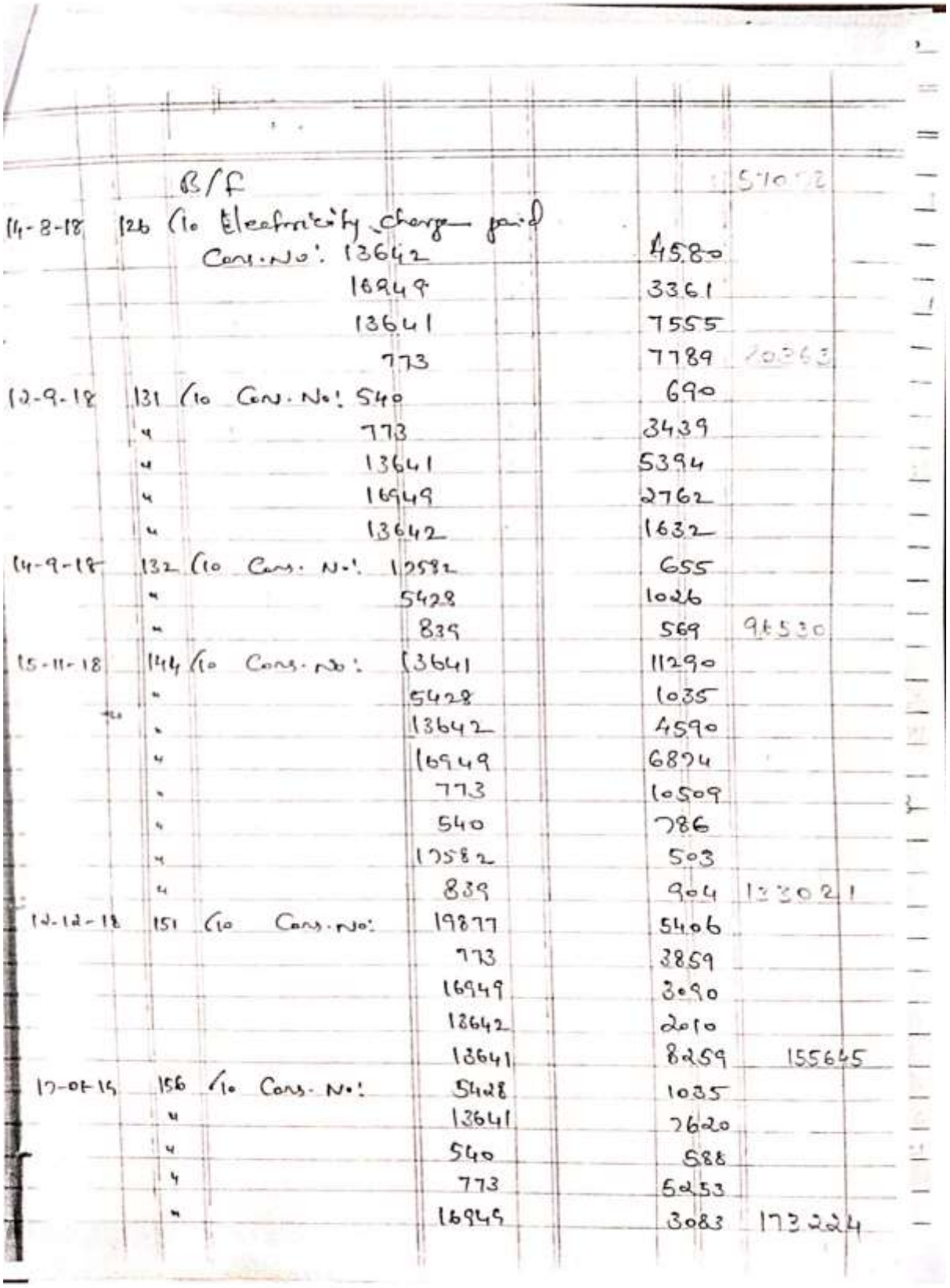
TECHNICAL SUPPLEMENTS

Sl. No.	Scientific name	Malayalam name	English Name	No.
1.	*Artocarpus heterophyllus*	പ്ലാവ്	JACKFRUIT TREE	12
2.	*Mangifera indica*	മാവ്	MANGO	9
3.	*Saracaasoca*	അശോകം	ASHOKA TREE	1
4.	*Mimusposelengi*	ഇലഞ്ഞി	BULLET WOOD	2
5.	*Tectona grandis*	തേക്ക്	TEAK	84
6.	*Cocos nucifera*	തെങ്ങ്	COCONUT TREE	21
7.	*Artocarpus hirsutus*	ആഞ്ഞിലി	WILD JACK	7
8.	*Delonix regia*	ഗുൽമോഹർ	ROYAL PRINCIANA	4
9.	*Swietenia macrophylla*	മഹാഗണി	MAHAGONY	38
10.	*Annona muricata*	മുള്ളാത്ത	SOURSOP TREE	7
11.	*Cassia fistula*	കണിക്കൊന്ന	GOLDEN SHOWER TREE	8
12.	*Psidium guajava*	പേര	GUAVA TREE	10
13.	*Nephelium lappaceum*	റംബൂട്ടാൻ	RAMBUTAN	3
14.	*Peltophorum pterocarpum*	മഞ്ഞവാക	COPPER POD	3
15.	*Polyathia longifolia*	അരണമരം	FALSE ASHOKA	6
16.	*Casuarina equisetifolia*	പൂള	CATURINA	1
17.	*Palmacaea*	അലങ്കാര പന	ORNAMENTAL PALM	10
18.	*Pimenta dioica*	സർവ്വസുഗന്ധി	ALL SPICE	1
19.	*Lagerstroemia speciosa*	മണിമരുത്	PRIDE OF INDIA	2
20.	*Caruca papaya*	പപ്പായ	PAPAYA	2
21.	*Cinnamumum verum*	വഴന	BAY LEAF	1
22.	*Albizia julibrissin*	പൂവാക	PERSIAN SILK TREE	1
23.	*Araucaria heterophylla*	ഒരകേറിയ	ARAUCARIA	1
24.	*Palmacaea*	അലങ്കാര പന	HYOPHORBE	1
25.	*Ficus exasperata*	തേരകം	SAND PAPER TREE	1

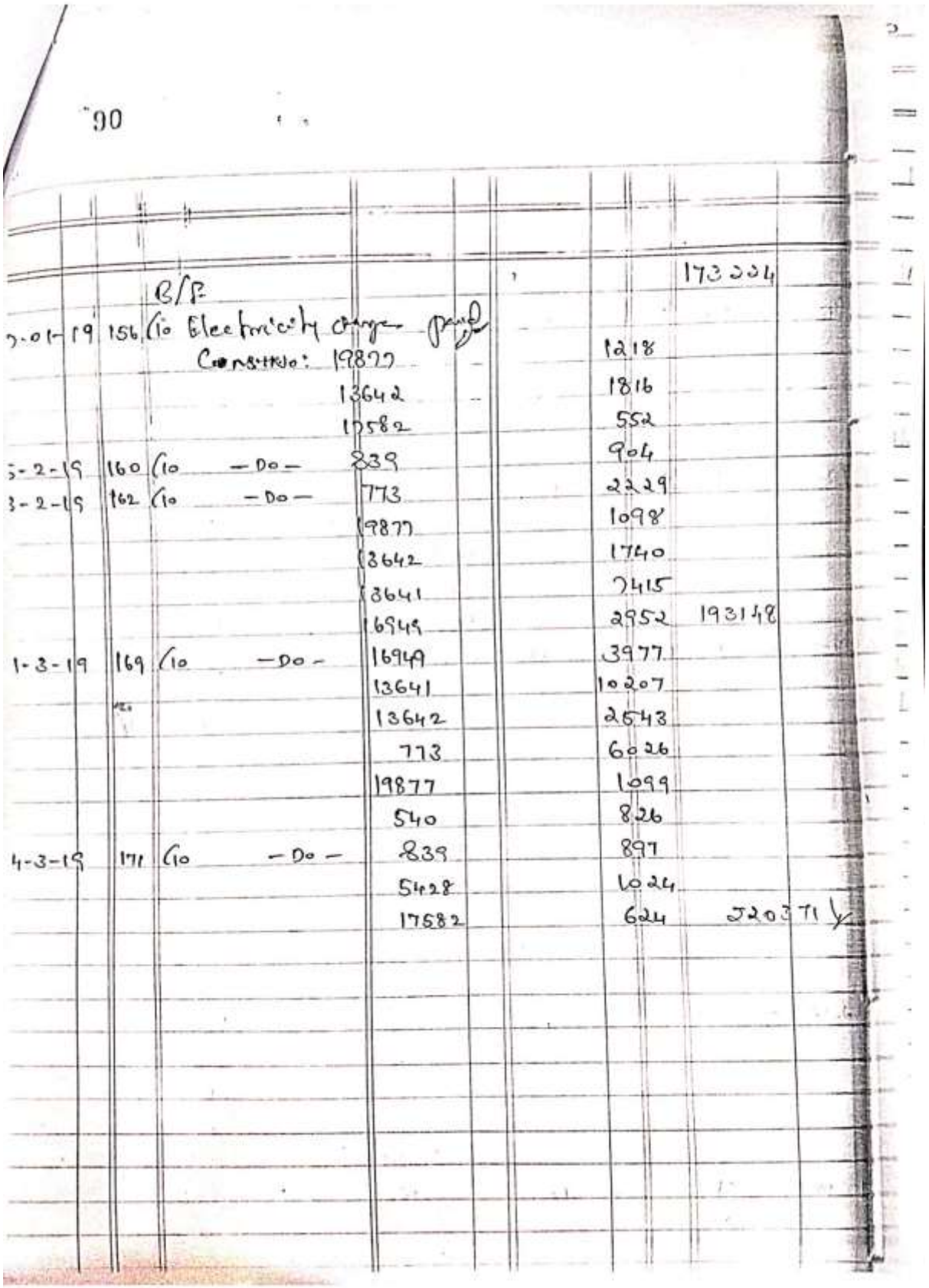


28 Electricity charge — 2018-2019 3000000/-

4-18	94	To Electricity charge paid			
		Cons. No.	16949	3906	
			773	5468	
			19877	1095	
			13642	2649	
			13641	11552	
-5-18	99	Cons. No.	839	885	
	"	"	5428	1017	
	"	"	16949	3563	
	"	"	540	515	
	"	"	773	3469	
	"	"	19877	1095	
	"	"	13642	815	
	"	"	13641	5367	11396
6-18	105	"	12582	450	
-6-18	107	"	13642	2685	
	"	"	13641	3009	
	"	"	16949	1589	
	"	"	773	4330	
-7-18	114	"	12582	695	
	114	"	540	352	
7-18	115	By Reimbursement of Electricity bill (NCC Camp)	7000		
-7-18	117	To Electricity charge paid			
		Cons. No.	5428	857	
		"	16949	3480	
		"	13641	7323	
		"	839	322	59188
8-18	121	By Reimbursement of Electricity bill (NCC Camp)	5000		
"	122	To Electricity charge paid			
	"	Cons. No.	773	1090	57928
			13642	1500	



		B/f			5702
14-8-18	126	C/o Electricity charge paid Cons. No:	13642	4580	
			16949	3361	
			13641	7555	
			773	7789	23285
12-9-18	131	C/o Con. No:	540	690	
	"		773	3439	
	"		13641	5394	
	"		16949	2762	
	"		13642	1632	
14-9-18	132	C/o Cons. No:	12582	655	
	"		5428	1026	
	"		839	569	96530
15-11-18	144	C/o Cons. No:	13641	11290	
	"		5428	1035	
	"		13642	4590	
	"		16949	6894	
	"		773	10509	
	"		540	786	
	"		12582	503	
	"		839	904	136021
12-12-18	151	C/o Cons. No:	19877	5406	
			773	3859	
			16949	3090	
			13642	2010	
			13641	8259	155645
17-04-19	156	C/o Cons. No:	5428	1035	
	"		13641	7620	
	"		540	588	
	"		773	5253	
	"		16949	3083	173224



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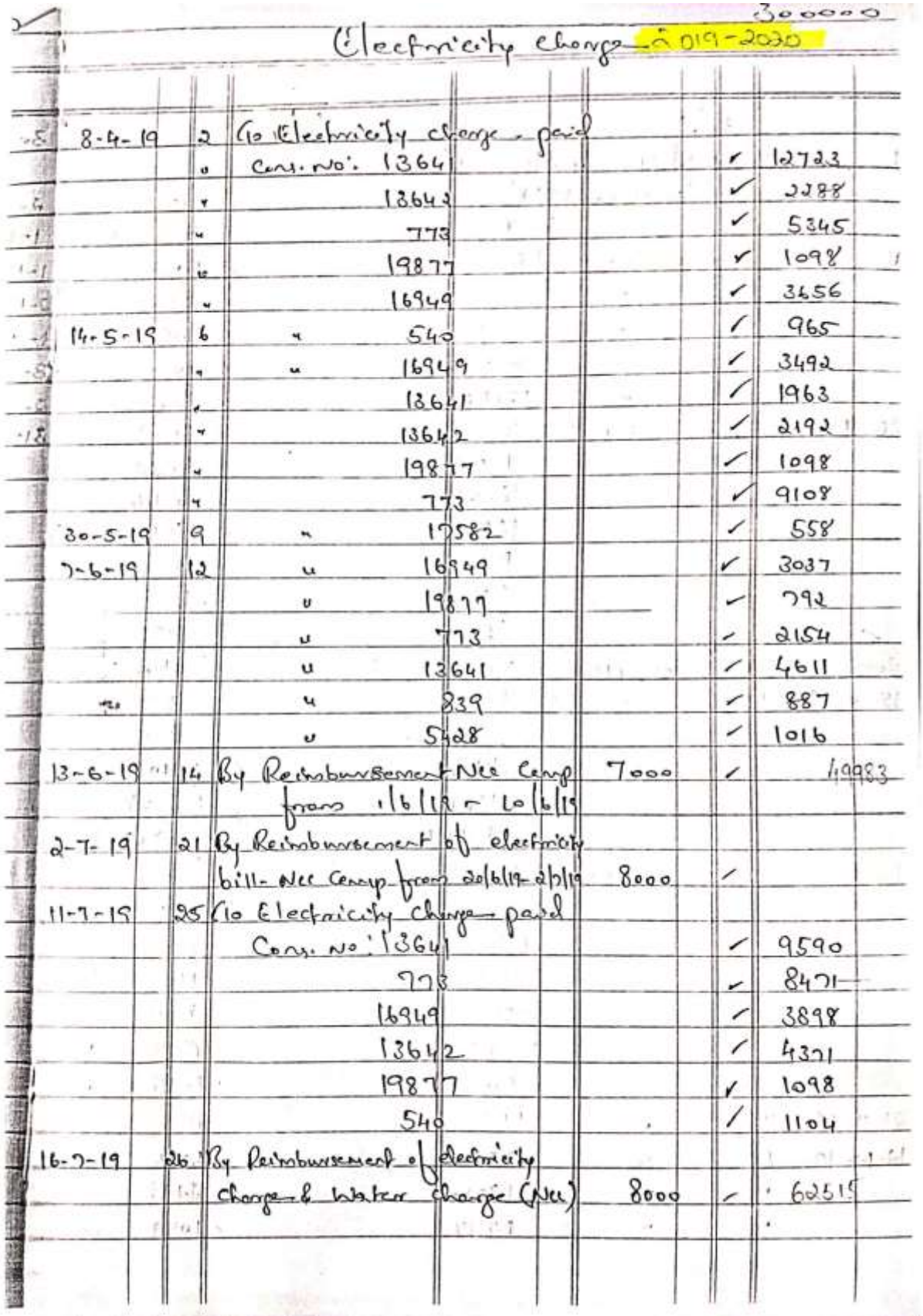
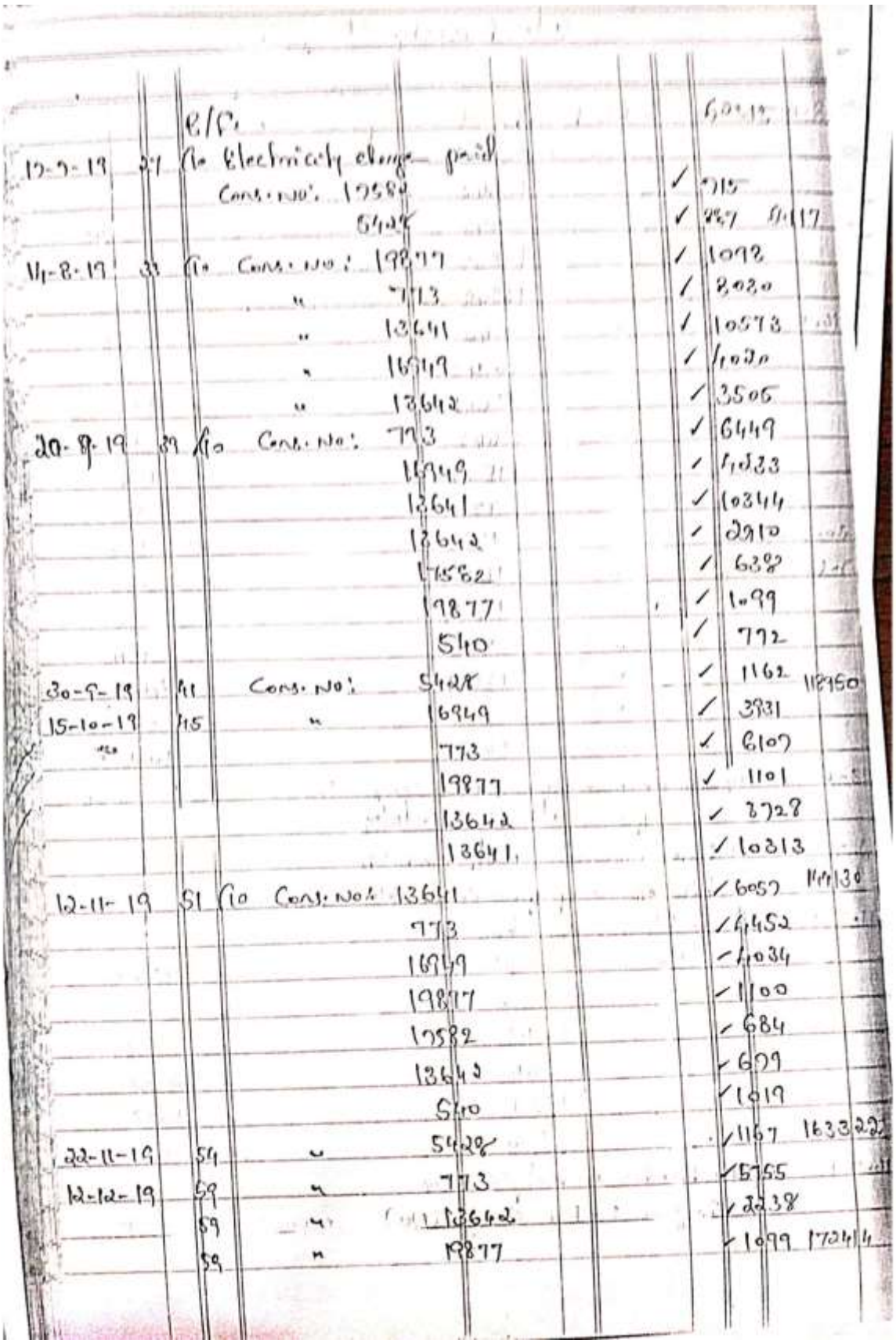
		B/F				173204
2-01-19	156	C/o	Electricity charges paid			
			Constitute:	19877	1218	
				13642	1816	
				17582	552	
3-2-19	160	C/o	-Do-	839	904	
3-2-19	162	C/o	-Do-	773	2229	
				19877	1098	
				13642	1740	
				13641	7415	
				16949	2952	193148
1-3-19	169	C/o	-Do-	16949	3977	
				13641	10207	
				13642	2543	
				773	6026	
				19877	1099	
				540	826	
4-3-19	171	C/o	-Do-	839	897	
				5428	1024	
				17582	624	32037



3000000

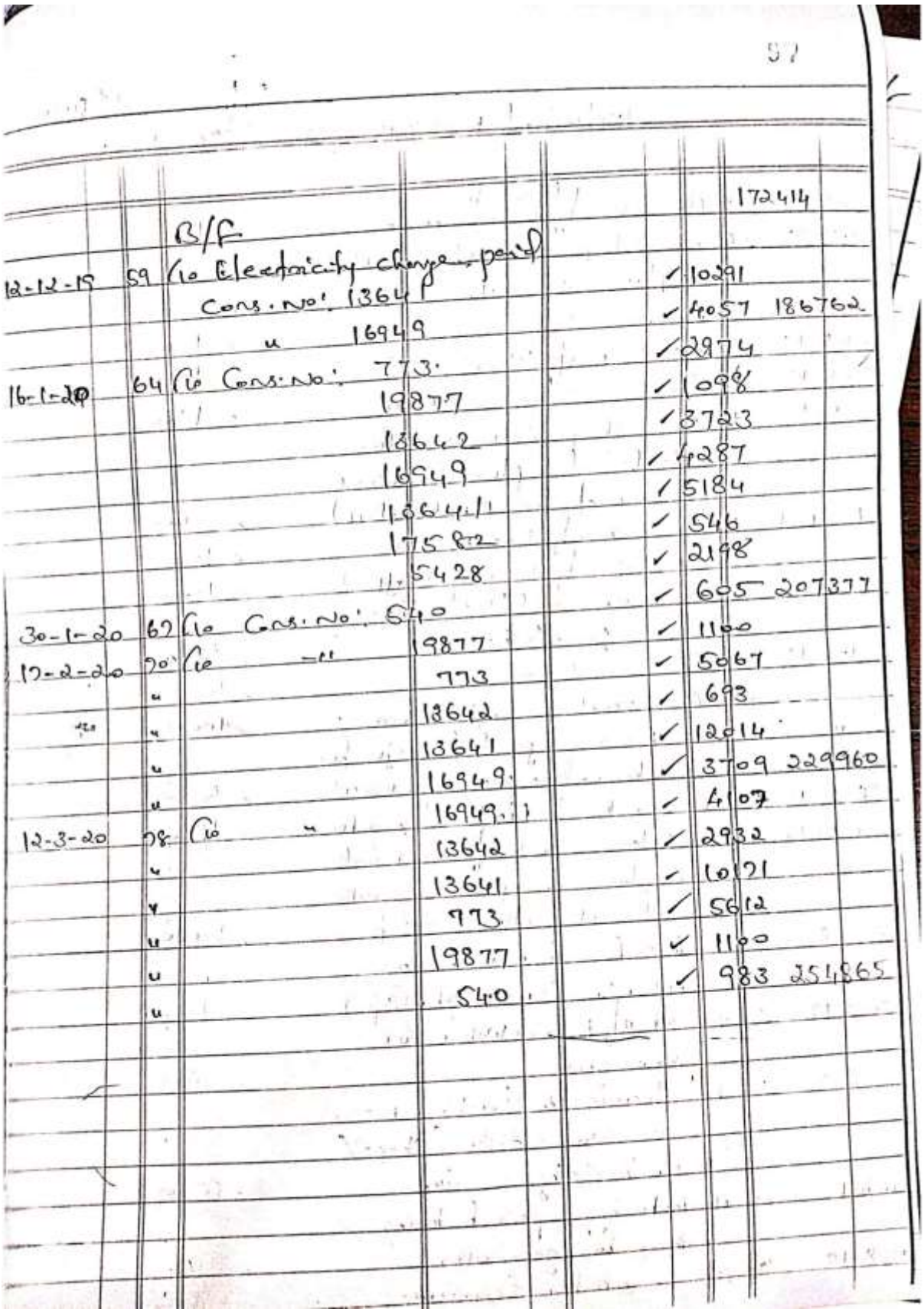
Electricity charge - 2019-2020

8-4-19	2	C/o Electricity charge - paid			✓	12723
	〃	Cons. No: 13641			✓	2288
	〃	13642			✓	5345
	〃	773			✓	1098
	〃	19877			✓	3656
	〃	16949			✓	965
14-5-19	6	〃	540		✓	3492
	〃	〃	16949		✓	1963
	〃		13641		✓	2192
	〃		13642		✓	1098
	〃		19877		✓	9108
	〃		773		✓	558
30-5-19	9	〃	17582		✓	3037
7-6-19	12	〃	16949		✓	792
		〃	19877		✓	2154
		〃	773		✓	4611
		〃	13641		✓	887
		〃	839		✓	1016
		〃	5428			
13-6-19	14	By Reimbursement Nec Comp from 1/6/19 - 10/6/19		7000	✓	19983
2-7-19	21	By Reimbursement of electricity bill- Nec Comp from 20/6/19-2/7/19		8000	✓	
11-7-19	25	C/o Electricity charge - paid				
		Cons. No: 13641			✓	9590
		773			✓	8471
		16949			✓	3898
		13642			✓	4321
		19877			✓	1098
		540			✓	1104
16-7-19	26	By Reimbursement of electricity charge & water charge (Nec)		8000	✓	62515



R/P

12-9-19	27	To Electricity charge paid			6.9.19
		Cons. No:	17582	✓	715
			5428	✓	987 6.9.19
11-8-19	33	To Cons. No:	19877	✓	1092
		"	773	✓	8020
		"	13641	✓	10573
		"	16949	✓	10020
		"	13642	✓	3506
20-8-19	39	To Cons. No:	773	✓	6449
			16949	✓	10033
			13641	✓	10344
			13642	✓	2910
			17582	✓	6382
			19877	✓	1099
			540	✓	772
30-9-19	41	Cons. No:	5428	✓	1162 118950
15-10-19	715	"	16949	✓	3831
"			773	✓	6107
			19877	✓	1101
			13642	✓	3728
			13641	✓	10313
12-11-19	51	To Cons. No:	13641	✓	6052 119130
			773	✓	4452
			16949	✓	10034
			19877	✓	1100
			17582	✓	684
			13642	✓	609
			540	✓	1019
22-11-19	54	"	5428	✓	1167 1633222
12-12-19	59	"	773	✓	5755
	59	"	13642	✓	2238
	59	"	19877	✓	1099 1724114



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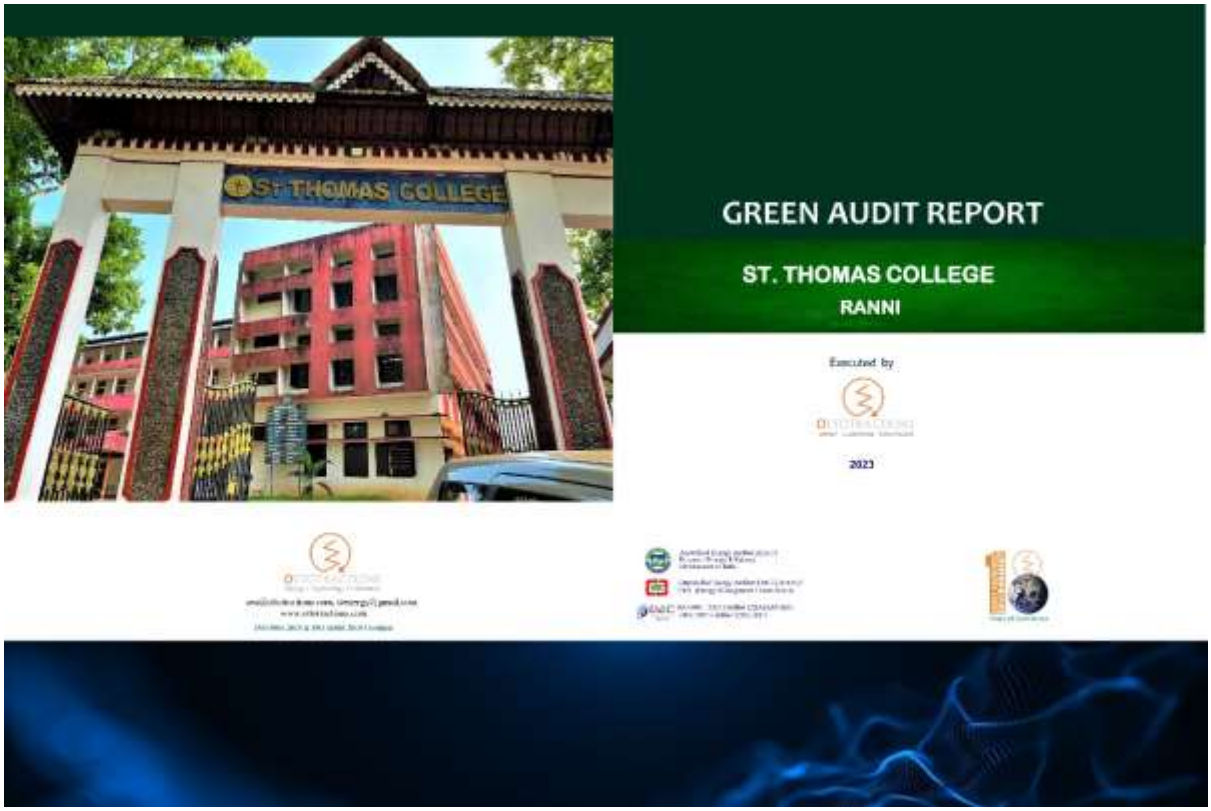
				172414
		B/F.		
12-12-19	59	C/o Electricity charges paid		
		Cons. No: 13641	✓	10291
		" 16949	✓	4057 186762
			✓	2974
16-1-20	64	C/o Cons. No: 773	✓	1098
		19877	✓	3723
		13642	✓	4287
		16949	✓	5184
		13641	✓	546
		17582	✓	2198
		5428	✓	605 207377
30-1-20	62	C/o Cons. No: 540	✓	1100
12-2-20	90	C/o " 19877	✓	5067
	"	773	✓	693
	"	13642	✓	1214
	"	13641	✓	3709 229960
	"	16949	✓	4107
12-3-20	98	C/o " 16949	✓	2932
	"	13642	✓	1021
	"	13641	✓	5612
	"	773	✓	1100
	"	19877	✓	983 254965
	"	540		

Report-Green Audit

2020-2023



GREEN AUDIT REPORT

ST THOMAS COLLEGE

RANNI

OTTOTRACTIONS
Energy-Engineering-Environment

Green Audit Report
St. Thomas College, Ranni
Report No: EA 1004/GA
2023-March

About OTTOTRACTIONS

Established in 2005, OTTOTRACTIONS is a reputable organization with extensive expertise in the fields of energy, engineering, and environmental services. They hold the distinction of being the first Accredited Energy Auditor from Kerala, entrusted with conducting Mandatory Energy Audits in Designated Consumers as per the Energy Conservation Act-2001. The Government of Kerala has recognized and commended OTTOTRACTIONS, honoring them with the prestigious "The Kerala State Energy Conservation Award 2009" for their outstanding performance as an Energy Auditor. OTTOTRACTIONS is an ISO 9001-2015, ISO 17020-2012, and ISO 14001-2015 certified organization, demonstrating their commitment to delivering high-quality services.

Acknowledgment

We extend our sincere appreciation to the administration and staff of St. Thomas College, Ranni for their invaluable assistance in ensuring the timely completion of the audit and the production of this green audit report. We are grateful for their support and collaboration throughout the process.

Furthermore, we would like to express our gratitude to the diligent efforts and unwavering commitment of all individuals who contributed to the development of this report. Their dedicated contributions have been instrumental in its successful completion.

We would also like to acknowledge the exceptional support provided by our audit team, whose bona-fide efforts have greatly contributed to the successful execution of this audit.

Additionally, we extend our thanks to our consultants, engineers, and backup staff for their unwavering dedication and hard work in bringing this report to fruition.

Thank you for your continued support

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

Preface

Throughout history, educational institutions have played a crucial leadership role in society, showcasing the necessary changes concerning key issues of their time. Today, educational institutions worldwide are embracing the global trend of sustainability by striving to become carbon-neutral schools. An example of this is Victoria University School of Architecture and Design, which made history in 2007 by declaring itself the world's first carbon-neutral campus through the purchase of carbon credits. However, this approach is not a sustainable model as it does not guarantee the permanent capture of carbon and can also be financially burdensome.

Academic institutions, regardless of their location, whether it be a school in a remote village or a university in an urban setting, possess immense potential to become catalysts for change. They can take on a leadership role within their communities, using their influence and platform to promote and encourage carbon-neutral living.

The primary contributors to carbon emissions are energy consumption, transportation, and waste. To effectively reduce carbon emissions in these sectors, two approaches can be taken: behavioral changes, which are low-cost but require mindset shifts, and technological investments, which are more expensive but offer long-term solutions. In order to facilitate these changes, it is essential to educate students about the concept of carbon-neutral campuses and provide them with the necessary knowledge and methods to actively participate in emission reduction efforts.

The idea of carbon-neutral campuses is rapidly gaining traction in India. Green audits conducted on campuses involve assessing the quantity of greenhouse gas (GHG) emissions generated as a result of campus operations. This assessment is carried out through an inventory-like process that takes into account all sources of GHG emissions and carbon sequestration within the school campus. Using this information, the total carbon footprint of the campus is calculated. Recommendations are then provided to reduce the carbon footprint and achieve carbon neutrality for the campus.

BENCY ZACHARIAH
Director, OTTOTRACTIONS

Contents

OTTOTRACTIONS
Energy-Engineering-Environment

1

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 **St. Thomas College, Ranni** 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.

ST. THOMAS COLLEGE, RANNI

The history of the college is embedded in the history of Ranni. The college is situated on the top of a serene hill, in a sylvan surrounding, away from the din and bustle of the city, easily accessible and is at a walkable distance from the heart of Ranni town. The college was established in 1964, as a junior college by St Thomas Valiyapally Ranni, a pioneer parish of the Syrian Knanaya Arch Diocese of Malankara, with the whole hearted support of the then Bishop late lamented His Excellency Abraham Mor Clemis to meet the educational needs of the youth of the local community. The college was upgraded to a first grade college in 1968 and is the only institution for higher education in this part of the country. When the de-linking of Pre Degree sector was made possible by the government on administrative measures we were left with graduate and Post Graduate courses. The transmutation

lead this institution to a knowledge hub with divorcified courses. In addition to the conventional courses, we now offer UG & PG courses in Tourism also. During its 53 years of illustrious existence, the college gave birth to brilliant academicians, administrators, politicians and entrepreneurs.

The college aims at creating cultured and educated citizens who love God and their country. With its rural background and `Gurukula' atmosphere, the college fosters uninterrupted pursuit of knowledge. The first Principal, Late Prof. K. A. Mathew, served as minister and PSC member in the Kerala State. He played a vital role in upgrading the junior college to a first grade one in 1968. As the Golden Jubilee project St. Thomas College of Advanced Studies, Edamury, Ranni, a Self Financing College affiliated to M.G. University, Kottayam was established in June 2014. In March 2016, the College was assessed and re-accredited in the second cycle by the National Assessment and Accreditation Council (NAAC) of UGC and graded at B level.

Occupancy Details			
Particulars	2020-21	2021-22	2022-23
Total Students	900	881	805
Staffs	64	64	64
Total Occupancy of the college	964	945	869

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	St. Thomas College, Ranni									
2	Address (include telephone, fax & e-mail)	St. Thomas College, Ranni, Pathanamthitta, 689641, stcranni@gmail.com, +91 8301057965									
2	Year of Establishment	1964									
3	Name of building and Total No. of Electrical Connections/building	St. Thomas college (8)									
4	Total Number of Students	Boys		Girls		Total	805				
5	Total Number of Staff	64									
6	Total Occupancy	869									
7	Total area of green cover	50%									
8	Type of Electrical Connection	HT	0	LT	8						
9	Total Connected Load (kW)	107									
10	Average Maximum Demand (KVA)	-									
11	Total built up area of the building (M^2)	8317									
12	Number of Buildings	5									
13	Average system Power Factor	0.96									
14	Details of capacitors connected	NA									
15	Transformer Details (Nos., kVA, Voltage ratio)	TR 1									
		NA									
15	DG Set Details (kVA)	DG1	DG2	DG3	DG4	DG5	Remarks				
		10									
16	Details of motors	Rating		Nos.		Remarks					
		5 to 10		2							
		10 to 50									
		Above 50									
17	Brief write-up about the firm and the energy/environmental conservation activities already undertaken.	Installed LED Lights, Solar Street Lamps etc.									
18	Contact Person & Telephone number	Dr. Sneha Elcy Jacob									
		9847888783									

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 1054 occupants of this campuses will reach same number of households. This message will spread to at least 4000 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.

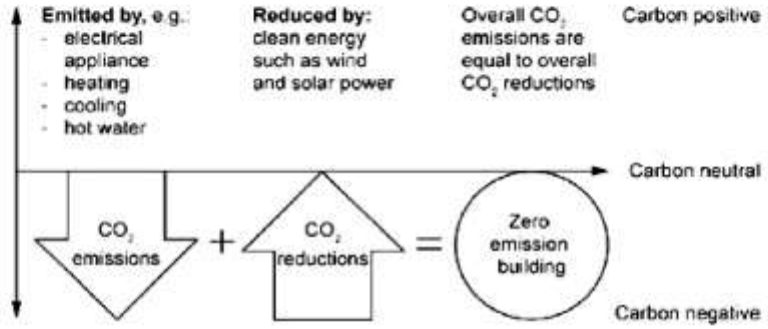
Global Warming Potential (GWP) is a measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide. The Global Warming Potential (GWP) was developed to allow comparisons of the global warming impacts of different gases. Specifically, it is 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%.

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

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. $W_{carbon\text{-}dioxide} = 3.67 * W_{carbon}$

OTTOTRACTIONS

3

RESULTS AND DISCUSSIONS

3.1 CARBON FOOTPRINT ESTIMATION

3.1.1 ENERGY

a. Electricity

Electricity is purchased from KSEB under 8 LT Connections, the details are given below.

Electricity Connection Details		
St. Thomas College, Ranni		
1	Name of the Consumer	St. Thomas College, Ranni
2	Tariff	LT-6A 3Ph
3	Consumer Numbers	1146072000540, 1146071019877, 1146079005428, 1146073013642, 1146070013641, 1146079016949, 1146076000773, 1146071019877
5	Connected Load Total (kW)	107
6	Annual Electricity Consumption (kWh)	29879

Electricity Bill Analysis

2022-2023			
Name of the Consumer		**St. Thomas College, Ranni**	
Connected load	**2**	Consumer no	**1146072000540**
Tariff	LT-6A 3Ph	Section	**Ranny North**
Month	**kWh**	**Rs (Total)**	**Rs/kwh**
May-22	208	1294	**6.22**
Jul-22	221	1483	**6.72**
Sep-22	127	941	**7.39**
Nov-22	141	1041	**7.39**
Jan-23	121	1012	**8.39**
Mar-23	176	1473	**8.39**

2022-2023			
Name of the Consumer		St. Thomas College, Ranni	
Connected load	6	Consumer no	1146071019877
Tariff	LT-6A 3Ph	Section	Ranny North
Month	**kWh**	**Rs (Total)**	**Rs/kwh**
May-22	258	1098	**4.26**
Jul-22	0	1098	**0.00**
Sep-22	0	1098	**0.00**
Nov-22	0	1098	**0.00**
Jan-23	0	1098	**0.00**
Mar-23	0	1098	**0.00**

2022-2023

Name of the Consumer		St. Thomas College, Ranni	
Connected load	4	Consumer no	1146079005428
Tariff	LT-6A 3Ph	Section	Ranny North
Month	**kWh**	**Rs (Total)**	**Rs/kwh**
May-22	325	3325	**10.23**
Jul-22			
Sep-22			
Nov-22			
Jan-23	332	2618	**7.89**
Mar-23			

2022-2023

Name of the Consumer		St. Thomas College, Ranni	
Connected load	16	Consumer no	1146073013642
Tariff	LT-6A 3Ph	Section	Ranny North
Month	**kWh**	**Rs (Total)**	**Rs/kwh**
Apr-22	166	2099	**12.64**
May-22	180	1799	**9.99**
Jun-22	457	4566	**9.99**
Jul-22			
Aug-22	349	3074	**8.81**
Sep-22			
Oct-22	697	6137	**8.81**
Nov-22	475	4185	**8.81**
Jan-23			
Mar-23	436	2548	**5.84**

2022-2023

Name of the Consumer		St. Thomas College, Ranni	
Connected load	**16**	Consumer no	**1146070013641**
Tariff	LT-6A 3Ph	Section	**Ranny North**
Month	**kWh**	**Rs (Total)**	**Rs/kwh**
May-22	1272	10161	**7.99**
Jul-22	1393	16508	**11.85**
Sep-22	934	12235	**13.10**
Nov-22	865	11522	**13.32**
Jan-23			
Mar-23	1106	14123	**12.77**

2022-2023

Name of the Consumer		St. Thomas College, Ranni	
Connected load	**35**	Consumer no	**1146079016949**
Tariff	LT-6A 3Ph	Section	**Ranny North**
Month	**kWh**	**Rs (Total)**	**Rs/kwh**
Apr-22	315	4124	**13.09**
May-22	242	3812	**15.75**
Jul-22	0	0	
Sep-22	271	4197	**15.49**
Oct-22	286	4066	**14.22**
Nov-22	320	4554	**14.22**
Jan-23	294	4178	**14.22**
Mar-23	271	4483	**16.54**

2022-2023

Name of the Consumer		St. Thomas College, Ranni	
Connected load	**22**	Consumer no	**1146076000773**
Tariff	LT-6A 3Ph	Section	**Ranny North**
Month	**kWh**	**Rs (Total)**	**Rs/kwh**
May-22	627	5931	**9.46**
Jun-22	392	3507	**8.95**
Jul-22	449	4022	**8.95**
Aug-22	475	4249	**8.95**
Sep-22	0		**8.95**
Nov-22	0		**8.95**
Jan-23	0		**8.95**
Mar-23	613	6102	**9.95**

2022-2023

Name of the Consumer		St. Thomas College, Ranni	
Connected load	6	Consumer no	1146071019877
Tariff	LT-6A 3Ph	Section	Ranny North
Month	**kWh**	**Rs (Total)**	**Rs/kwh**
May-22	123	1098	**8.93**
Jun-22	124	1098	**8.85**
Jul-22	125	1098	**8.78**
Aug-22	123	1098	**8.93**
Sep-22	123	1098	**8.93**
Oct-22	123	1098	**8.96**
Nov-22	122	1098	**9.00**
Dec-22	122	1098	**9.04**
Jan-23	121	1098	**9.07**
Feb-23	121	1098	**9.11**
Mar-23	120	1098	**9.15**

Annual Electricity Consumption (kWh)				
Consumer No	**2020-21**	**2021-22**	**2022-23**	Connected Load (kW)
1146072000540	210	672	993	2
1146071019877	5387	4487	516	6
1146079005428	2090	1164	1971	4
1146073013642	2446	2108	4731	16
1146070013641	3102	12628	13368	16
1146079016949	3476	3513	2999	35
1146076000773	4068	8099	3834	22
1146071019877	1445	1656	1468	6
Total	**20778**	**32671**	**29879**	**107**

Diesel

Diesel Consumption Details				
	Transportation	Generator	Total	cost
	in L	in L	in L	in Rs
20-21	0	310	310	28800
21-22	0	323	323	30060
22-23	0	328	328	31200

LPG

LPG Consumption Details			
	2020-21	2021-22	2022-23
No Cylinders	4	5	5
Canteen/Lab LPG Consumption in kg	60	75	75
Total in kg	60	75	75

Base Line Energy Data				
St. Thomas College, Ranni				
		2020-21	2021-22	2022-23
1	Electricity KSEB (kWh)	20778	32671	29879
2	Electricity DG (kWh)	929	970	985
3	Electricity Solar, Off grid (kWh)	0.00	0.00	0.00
4	Electricity (KSEB + DG + Off grid) kWh	21707	33641	30864
5	Electricity Grid Tied (kWh)	1214	1214	1278
6	Diesel (L)	0	0	0
7	LPG (kg)	60.00	75.00	75.00
8	Biogas (m3)	0.00	0.00	0.00

Energy Consumption Profile				
Sl No	Fuel	2020-21	2021-22	2022-23
			(kCal)	
1	Electricity	18667740	28931009	26543354
2	Diesel	0	0	0
3	LPG	720000	900000	900000
4	Biogas	0	0	0
Total		19387740	29831009	27443354

Thermal Fuel Consumption St. Thomas College, Ranni			
	2020-21	2021-22	2022-23
Annual LPG consumption in kg	60	75	75
Annual Diesel consumption in L	310	323	328
Annual petrol consumption in L	0	0	0
Annual Biogas consumption in m3	0	0	0

Renewable Energy

biogas plant is installed in a facility and is not working, it is recommended to repair the plant to effectively manage bio degradable waste. Some common reasons why a biogas plant may not be working include clogging of the pipes, leaks in the system, and inadequate maintenance. Therefore, it is important to regularly maintain the plant to ensure that it is functioning properly.

Once the biogas plant is repaired and functioning, it can provide numerous benefits such as reducing waste management costs, reducing greenhouse gas emissions, and providing a renewable energy source.

Specific Energy Consumption

OTTOTRACTIONS- ENERGY AUDIT				
St. Thomas College, Ranni				
Energy Performance Index (EPI)				
Sl No	Particulars	2020-21	2021-22	2022-23
1	Total building area (m^2)	8317	8317	8317
2	Annual Energy Consumption (kCal)	19387740	29831009	27443354
3	Annual Energy Consumption (kWh)	22544	34687	31911
4	Total Energy in Toe	1.94	2.98	2.74
5	Specific Energy Consumption kWh/m^2	2.71	4.17	3.84

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			
St. Thomas College, Ranni			
Particulars	2020-21	2021-22	2022-23
Total Occupancy	964	945	869
Waste generated in kg /day	19.28	18.9	17.38
Waste generated in kg /Yr	4241.6	4158	3823.6

Non-Degradable waste

Solid non degradable Waste Generation			
St. Thomas College, Ranni			
Particulars	2020-21	2021-22	2022-23
Total Occupancy	964	945	869
Waste paper generated in kg /day	0.1928	0.189	0.1738
Waste plastic generated in kg /day	0.2892	0.2835	0.2607
Waste paper generated in kg /Yr	42.42	41.58	38.24
Waste plastic generated in kg /Yr	63.62	62.37	57.35

3.4. Transportation

The college does not have any vehicles for logistics

Carbon Emission Profile (2022-23)

Carbon emissions in the campus due to the day-to-day activities are calculated and is 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	2020-21	tCO_2e	2021-22	tCO_2e	2022-23	tCO_2e
1	Electricity (kWh)	21707	17.80	33641	27.59	30864	25.31
2	Diesel (L)	0	0	0	0.00	0	0.00
3	LPG (kg)	60.00	0	75.00	0.11	75.00	0.11
4	Biogas (m3)	0.00	0	0.00	0.00	0.00	0.000
5	Degradable Waste in kg/yr.	4241.6	3	4158	2.62	3823.6	2.41
6	Paper Waste in kg/yr	42.42	0	41.58	0.02	38.24	0.02
Total Carbon Foot Print tCO_2e/yr			20.59		30.34		27.85

3.5. 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	2020-21	2021-22	2022-23
Total No of Trees	236	236	236
Carbon sequestrated by trees in the campus (tCO2e)	6.4	7.1	7.50

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

List of Trees and Plants		
Sl. No.	English Name	QTY
1	Jackfruit Tree	12
2	Mango	9
3	Ashoka Tree	1
4	Bulletwood	2
5	Teak	84
6	Coconut	21
7	Wild Jack	7
8	Royal Princiana	4
9	Mahagony	38
10	Soursop Tree	7
11	Golden Shower Tree	8
12	Guava Tree	10
13	Rambutan	3
14	Copper Pod	3
15	False Ashoka	6
16	Caturina	1

17	Ornamental Palm	10
18	All Spice	1
19	Pride of India	2
20	Papaya	2
21	Bay Leaf	1
22	Persian Silk Tree	1
23	Araucaria	1
24	Hyophorbe	1
25	Sand Paper Tree	1
Total		236

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 **27.85 tCO_2e** per year by the campus. The total carbon sequestration by trees in the campus compound is **7.50tCO_2e**. Thus, the current carbon footprint of the campus will be the difference of total carbon emission and total carbon sequestration/mitigation. The following table shows the carbon footprint level

Specific CO2 Footprint

Amount of Carbon to be mitigated for Low Carbon Campus				
Sl No	Particulars	2020-21	2021-22	2022-23
1	Total carbon emission tCO2e	20.59	30.34	27.85
2	Total carbon sequestration tCO2e	6.41	7.13	7.50
3	Amount of carbon mitigated through renewable energy tCO2e	1.00	1.00	1.05
4	To be mitigated tCO2e	13.18	22.22	19.30
5	Total No of Students	964	945	869
6	Specific Carbon Footprint kg CO2e/Student/Yr	13.67	23.51	22.21

The total specific carbon footprint is estimated as **22.41** kg of CO_2e per student for the year 2022-23.

OTTOTRACTIONS

4

Carbon Mitigation Plans

The total emission of the carbon dioxide per student is **27.85** 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 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'.

OTTOTRACTIONS

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 St. Thomas College, Ranni 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 34 No's T12 (55W) Lamps to 18W LED Tube	902	0.90	10	0.66	6.59
2	Energy Saving in Lighting by replacing existing 64 No's T8 (40W) Lamps to 18W LED Tube	1014	1.01	10	0.74	7.40
3	Energy Saving in Lighting by replacing existing 16 No's CFL(15W) Lamps to 9W LED Bulb	69	0.07	10	0.05	0.50
4	Energy Saving by replacing existing 178 No's in-efficent ceiling fans with Energy Efficient Five star fans	4187	4.19	10	3.06	30.56
Total		**6172**	**6**	**10**	**4.51**	**45.05**

OTTOTRACTIONS- ENERGY AUDIT St. Thomas College, Ranni 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 20kWp Solar Power Plant	27375	27.38	25	19.98	499.59
	Total	27375	27	25	19.98	500

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal Code 1	
Energy Saving in Lighting by replacing existing 64 No's T8 (40W) Lamps to 18W LED Tube	
Existing Scenario	
64 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	64
Total load (kW)	2.56
Annual Energy Consumption (kWh)	1843
Expected Annual Energy saving for replacing all fittings (kWh)	1014
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.08
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.19
Simple Pay Back (in Months)	28.41

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal Code	
Energy Saving in Lighting by replacing existing 34 No's T12 (55W) Lamps to 18W LED Tube	
Existing Scenario	
257 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 67% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2400
No of fittings	34
Total load (kW)	1.87
Annual Energy Consumption (kWh)	1346
Expected Annual Energy saving for replacing all fittings (kWh)	902
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.07
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.10
Simple Pay Back (in Months)	16.96

OTTOTRACTIONS

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving by replacing existing 178 No's in-efficient ceiling fans with Energy Efficient Five star fans	
Existing Scenario	
There are 178 numbers of ceiling fans installed in the facility 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	178
Total load (kW)	12.46
Annual Energy Consumption (kWh)	14952
Expected Annual Energy saving, for total replacement(kWh)	4187
Cost of Power (Rs)	8.00
Annual saving in Lakhs Rs (1st year)	0.33
Investment required for a total replacement (Lakhs Rs)[@3000 Rs per Fan with 50W at full speed]	5.34
Simple Pay Back (in Months)	191.33

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving in Lighting by replacing existing 16 No's CFL(15W) Lamps to 9W LED Bulb	
Existing Scenario	
24 numbers of CFL (15W) 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 CFL may be replaced to LED Bulb of 9W in phased manner and the savings will be of 40% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2400
No of fittings	16
Total load (kW)	0.24
Annual Energy Consumption (kWh)	173
Expected Annual Energy saving for replacing all fittings (kWh)	69
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.01
Investment required for complete replacements [@Rs 90 per fittings](Lakhs Rs)	0.01
Simple Pay Back (in Months)	31.25

Energy Saving Proposal	
Installation of 20kWp 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 10kW 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)	20
Total average kWh per day expected (3.5kWh/day average)	75.00
Total annual Generating Capacity (kWh)	27375
Cost of energy generated annually Lakhs Rs	3.64
Investment required (INR lakh)(Approx)	11.00
Simple Pay Back (in Months)	36.26
Life cycle in Yrs	25
Total Saving in Life Cycle (Approx) RS lakh	91.02

Executive Summary					
Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects					
St. Thomas College, Ranni					
Sl No	Projects	Investment	Cost saving	SPB	Energy saved
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr
1	Energy Saving in Lighting by replacing existing 34 No's T12 (55W) Lamps to 18W LED Tube	0.10	0.07	16.96	902
2	Energy Saving in Lighting by replacing existing 64 No's T8 (40W) Lamps to 18W LED Tube	0.19	0.081	28.41	1014
3	Energy Saving in Lighting by replacing existing 16 No's CFL(15W) Lamps to 9W LED Bulb	0.01	0.006	31.25	69
4	Energy Saving by replacing existing 178 No's in-efficient ceiling fans with Energy Efficient Five star fans	5.34	0.335	191.33	4187
5	Installation of 20kWp Solar Power Plant	11.00	3.641	36.26	27375
	Total	**16.55**	**4.06**	**60.84**	**32644**
(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

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	27.85
2	Carbon Sequrested tCO2e/yr	7.50
3	Carbon mitigated by Renewable Energy tCO2e/yr (Installed)	1.05
4	Carbon mitigated by Renewable Energy tCO2e/yr (Proposed)	19.98
5	Carbon mitigated by Energy Efficiency (Proposed) tCO2e/yr	4.51
6	Effective Carbon footprint tCO2e/yr	-5.18
7	Total No of Students	805
8	Specific Carbon Footprint kg CO2e/Student/Yr	-6.44

From this study it was found that carbon footprint of the campus to be **-6.44** $kgCO_2e$/ Student/ Year in place of current footprint i.e., **27.85** $kgCO_2e$/ student/ Year. To achieve this an investment of **27.55 lakhs Rs** is required through energy efficiency and renewable energy projects proposed. It will be around **3422 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	16.55
2	Cost of implementation in Renewable Energy Lakhs Rs	11.00
3	Total Lakhs Rs	27.55
4	Total number of students	805
5	Cost per student to make the campus carbon negative Rs/ Student	3422

REFERENCES

Reports and Books

- Towards campus climate neutrality: Simon Fraser University's carbon footprint (2007), Simon Fraser University, Bokowski, G., White, D., Pacifico, A., Talbot, S., DuBelko, A., Phipps, A.
- The bare necessities: How much household carbon do we really need? Ecological Economics (2010), 69, 1794–1804, Druckman, A., & Jackson, T.
- Home Energy Audit Manual (2017), Ottotractions & EMC Kerala, No.ES 26, Pp.114
- Screening of 37 Industrial PSUs in Kerala for Carbon Emission Reduction and CDM Benefits, (2011), Ottotractions & Directorate of Environment & climate Change, Kerala, No. ES-8, Pp.157

Website

- http://www.moef.nic.in/downloads/public-information/Report_INCCA.pdf
- https://ghgprotocol.org/sites/default/files/standards_supporting/Ch5_GHGP_Tech
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- https://beeindia.gov.in/sites/default/files/guidebook-Campus.pdf
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- http://www.sustainabilityoutlook.in/content/5-things-consider-you-plan-rooftop-pv-plant
- https://www.nrcan.gc.ca/energy/efficiency/transportation/20996
- https://www.americangeosciences.org/critical-issues/faq/how-does-recycling-save energy

OTTOTRACTIONS

6

TECHNICAL SUPPLEMENT

St. Thomas College, Ranni																
		Lights							Fans		IT			Others		
Sl No	Location	LED-T	LED-B	LED-SQ	T8	T12	ICL	CFL	CF	EF	Printer	Projector	PC	TV	AC (1TR)	Fridge
1	Principal	2		9					2		1		1	1		
2	Conf Hall	2			2				1				1		1	
3	Office	5			3				6		2		2			
4	Admn Room	1			4				3		3		1			
5	Manager					1			2		1		1			
6	Malayalam Dpmt	1							1							
7	3 Rooms	3							3							
8	4 Rooms					4			4							
9	9 Rooms					27			18							
10	Seminar Hall	3							6	1		1				
11	4 Rooms				4				4							
12	Botany department					1			2		1		1			1
13	Museum	1							2				1			
14	5 Classrooms	5							10							
15	Physics Department	2	1		2				5			1	1			
16	Computer lab				3				2				5			
17	3 Rooms							12	9							
18	3 Rooms	3							3							
19	3 Rooms				3				3							
20	English department	1				1			1				1			
21	6 Rooms				6				6							
22	Conf Hall		24						12							
23	3 Rooms						3		3							

24	Lab	3							4		1		24			
25	3 Departments	6			6				18							
26	6 Rooms				6				6							
27	9 Rooms	9							9							
28	4 Rooms							4	4							
29	3 Rooms	3							6							
30	2 Rooms				2				2							
31	3 Rooms	3							3							
32	5 Rooms				5				5							
33	Auditorium	8			18				13							
	Total	**61**	**25**	**9**	**64**	**34**	**3**	**16**	**178**	**1**	**9**	**2**	**39**	**1**	**1**	**1**
	Wattage	**20**	**10**	**20**	**40**	**55**	**100**	**18**	**80**	**60**	**100**	**120**	**200**	**100**	**1200**	**1200**
	Power	**1220**	**250**	**180**	**2560**	**1870**	**300**	**288**	**14240**	**60**	**900**	**240**	**7800**	**100**	**1200**	**1200**

St. Thomas College, Ranni
Pazhavangadi P.O., Kerala, India - 689673
RE-ACCREDITED BY NAAC AT B LEVEL
(Affiliated to Mahatma Gandhi University, Kottayam - Kerala)

7.1.2 Facilities for alternate sources of energy and energy conservation measures in the Institution

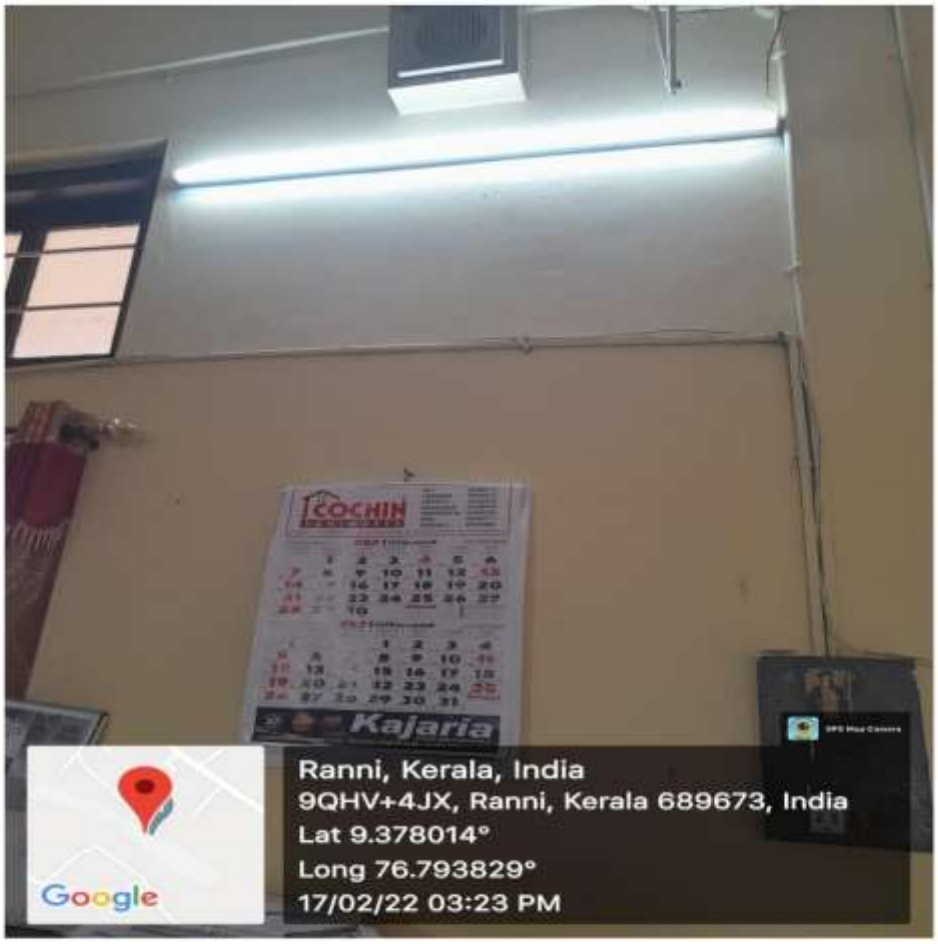
Photographs of the facilities for alternate sources of energy

Ph : 04735-226238, 226738 (O)
E-mail : stcranni@gmail.com, www.stcranni.ac.in

Solar Plant


GPS Map Camera
Ranni, Kerala, India
9QHV+4JX, Ranni, Kerala 689673, India
Lat 9.377066°
Long 76.793947°
25/03/22 02:33 PM
Google

LED tube light



Biogas Plant

CALL 1912

Demand/Disconnection Notice
(As per Reg 122 of Supply Code 2014)
Ranny North Section
0473-5226355

C#: 114607600773

Bill# : 460722050006 773
Conn Id : 6732710
Name : PRINCIPAL
St Thomas CollegeRa
C Status : Connected
Pole : 163.0
Trans : RANNY COLLEGE
Meter# : 0000300773
Bill Area : RDI/1/59
Bill Date : 01/05/2022
Due Date : 11/05/2022
Disconn Dt : 26/05/2022
Tariff : LT-6A NDom
Purpose : Educational Ins
S Deposit : 7210
Meter(MK) Status OK
Load : 22 KW
C Demand : 21.49 KVA
Phase : 3
Prv Rd Dt : 01/04/2022
Prs Rd Dt : 01/05/2022
Rt Rd(CNF) : 1

(3)

Prev. Payment

Prv Paid Dt : 12-04-2022
Prv Paid Rst : 5931

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KVH/R/I	2021	1526	495	575

Bill Details

Fixed Charges	1830.00
Meter Rent	17.70
Energy Charges	2671.72
Duty	267.15
Round off	0.35
Bill Amount	4557.00
Surcharge	2.00
Payable	4553.00

4553

Remarks
Prv Amnt 15 CGST 9% 1.35 SGST 9% 1.35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VI -1.35 /114607600766
15-05-2022 9:49:03 AM

CALL 1912

Demand/Disconnection Notice
(As per Reg 122 of Supply Code 2014)
Ranny North Section
0473-5226355

C#: 114607101987?

Bill# : 460722050006 19877
Conn Id : 12043671
Name : THE MANAGER
ST THOMAS COLLEGE
C Status : Not Using
Pole : 18V 17/17
Trans : KOIPPUZHA-KAREIMANTTY
Meter# : 22129
Bill Area : RDI/1/60
Bill Date : 01/05/2022
Due Date : 11/05/2022
Disconn Dt : 26/05/2022
Tariff : LT-6C NDom
Purpose : ATM Counter
S Deposit : 4578
Meter(MK) Status OK
Load : 6 KW
C Demand : 5.3 KVA
Phase : 3
Prv Status : Average
Rel Rd Dt : 01/05/2020
Prv Rd Dt : 01/04/2022
Prs Rd Dt : 01/05/2022
Rt Rd(CNF) : 1

(2)

Prev. Payment

Prv Paid Dt : 12-04-2022
Prv Paid Rst : 1098

Doorlock Details

Lst DI Dt : 01-07-2020
DI Count : 21

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KVH/R/I		5735	0	0

Bill Details

Fixed Charges	1098.00
Meter Rent	17.70
Energy Charges	0.00
Duty	0.00
Round off	0.30
Bill Amount	1098.00
Advance	0.00
Surcharge	1.00
Payable	1099.00

1099

Remarks
Prv Amnt 15 CGST 9% 1.35 SGST 9% 1.35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VI -1.35 /114607101987
05-05-2022 9:[illegible]

CALL

Ranny North Section
0473-5225155

2000
540-

(1)

Doorlock Details

Lst DI Dt : 07-07-2021
DI Count : 0

Readings & Cons

Bill Details

Remarks 1294/-

PRASAD DATHELAN
Meter Reader

KSEB

Demand/Disconnection Notice
(As per Reg 122 of Supply Code-2014)
Customer Care
1912
Ranny North Section
0473-5226355
KSEBL-GSTIN:32AAECK2277N1Z1

C#: 1146071019877

Bill#	:	4607220400095
Conn Id	:	12043471
Name	:	THE MANAGER
		ST. THOMAS COLLEGE
C Status	:	Not Using
Pole	:	IAY 17/17
Trans	:	KAIPPUZHA-KARIMKUTTY
Meter#	:	22129
Bill Area	:	M01/1/60
Bill Date	:	01/04/2022
Due Date	:	11/04/2022
Disconn Dt	:	25/04/2022
Tariff	:	LT-6C NDom
Purpose	:	ATM Counter
S Deposit	:	4578
Meter(MM)Status		DL
Load	:	6 KW
C Demand	:	5.3 KVA
Phase	:	3
Prv Status	:	Average
Avl Rd Dt	:	01/06/2020
Prv Rd Dt	:	01/03/2022
Prs Rd Dt	:	01/04/2022
Mt Rd(OMF)	:	1

Prev. Payment

Prv Paid Dt : 10-03-2022
Prv Paid Amt : 1099

DoorLock Details

Lst Dl Dt : 01-07-2020
Dl Count : 20

Readings & Cons.

Unit	Curr	Prev	Cons	Avg
KWH/A/I		5735	0	0

Bill Details

Fixed Charges	:	1080.00
Meter Rent	:	17.70
Energy Charges	:	0.00
Duty	:	0.00
Round off	:	0.30
Bill Amount	:	1098.00
Advance	:	0.65

Payable : [illegible]

Remarks
Mtr Rent 15 CGST 9%: 1.35 SGST 9%: 1.35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1.35 /11000766
04-04-2022 12:55:40 PM

KSEB

Demand/Disconnection Notice
(As per Reg 122 of Supply Code-2014)
Customer Care
1912
Ranny North Section
0473-5226355
KSEBL-GSTIN:32AAECK2277N1Z1

C#: 1146070013641

Bill#	:	4607220400096
Conn.Id	:	6786199
Name	:	MANAGER
		ST. THOMAS CHURCHRA
C Status	:	Connected
Pole	:	IAY 17/17
Trans	:	KAIPPUZHA-KARIMKUTTY
Meter#	:	15695131
Bill Area	:	M01/1/61
Bill Date	:	01/04/2022
Due Date	:	11/04/2022
Disconn Dt	:	26/04/2022
Tariff	:	LT-7A Com
Purpose	:	Hostel/Lodges/G
S Deposit	:	17058
Meter(MM)Status		OK
Load	:	16 KW
C Demand	:	15 KVA
Phase	:	3
Prv Rd Dt	:	01/03/2022
Prs Rd Dt	:	01/04/2022
Mt Rd(OMF)	:	1

Prev. Payment

Prv Paid Dt : 10-03-2022
Prv Paid Amt : 14242

Readings & Cons.

Unit	Curr	Prev	Cons	Avg
KWH/A/I	38905	37512	1393	930

Bill Details

Fixed Charges	:	[illegible]
Meter Rent	:	17.70
Energy Charges	:	12954.93
Duty	:	1295.49
Round off	:	-0.03
Bill Amount	:	16508.00

Payable : 16508.00

Remarks
Mtr Rent 15 CGST 9%: 1.35 SGST 9%: 1.35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1.35 /11000766
04-04-2022 12:50:47 PM

KSEB

Demand/Disconn[illegible]
(As per Reg 122 of [illegible]2014)
Customer Care
1912
Ranny North Section
0473-5226355
KSEBL-GSTIN:32AAECK2277N1Z1

C#: 11460760[illegible]773

Bill#	:	4607220400054
Conn Id	:	6732710
Name	:	PRINCIPAL
		St Thomas CollegeRa
C Status	:	Connected
Pole	:	T63.D
Trans	:	RANNY COLLEGE
Meter#	:	0000000773
Bill Area	:	M01/1/59
Bill Date	:	01/04/2022
Due Date	:	11/04/2022
Disconn Dt	:	26/04/2022
Tariff	:	LT-6A NDom
Purpose	:	Educational Ins
S Deposit	:	7210
Meter(MM)Status		OK
Load	:	22 KW
C Demand	:	21.49 KVA
Phase	:	3
Prv Rd Dt	:	01/03/2022
Prs Rd Dt	:	01/04/2022
Mt Rd(OMF)	:	1

Prev. Payment

Prv Paid Dt : 10-03-2022
Prv Paid Amt : 6253

Readings & Cons.

Unit	Curr	Prev	Cons	Avg
KWH/A/I	1526	899	627	[illegible]

Bill Details

Fixed Charges	:	1430.00
Meter Rent	:	17.70
Energy Charges	:	[illegible]
Duty	:	407.55
Round off	:	0.25
Bill Amount	:	5931.00

Payable : 5931.00

Remarks
Mtr Rent 15 CGST 9%: 1.35 SGST 9%: 1.35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1.35 /11000766
04-04-2022 12:58:24 PM

Demand/Disconnection Notice
(Rs per Reg 122 of Supply Code 2014)
Customer Care
1912
Ranny North Sect ..
0473 5226125

C#: 11460730138642

Bill# : 460722040D0892 13642
Conn Id : 6786205
Name : Manager
ST Thomas Church&a
C Status : Connected
Pole : T63_0
Trans : RANNY COLLEGE
Meter# : 0011202013
Bill Area : MD1/1/ST
Bill Date : 01/04/2022
Due Date : 11/04/2022
Disconn Dt: 26/04/2022
Tariff : LT-6A NOon
Purpose : Educational Ins
S Deposit : 3306
Meter(MM) Status OK
Load : 16 KW
C Demand : 16 KVA
Phase : 3
Prv Rd Dt : 01/03/2022
Prs Rd Dt : 01/04/2022
Mt Rd(DMF): 1

4

Prev. Payment

Prv Paid Dt : 10-03-2022
Prv Paid Amt : 2374

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KWH/R/I	20443	20277	166	140

Bill Details

Fixed Charges	1040 00
Meter Rent	17 70
Energy Charges	945 20
Duty	94 62
Round off	0 48
Bill Amount	2099 00
Payable	2099 00

2099

Remarks
Mtr Rent 15 CCST 9% 1 35 SGST 9% 1 35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1 35 /110000766
04-04-2022 12 53 27 PM

Demand/Disconnection Notice
(Rs per Reg 122 of Supply Code 2014)
Customer Care
1912
Ranny North Sect ..
0473 5226125

C#: 11460790116949

Bill# : 460722040D0893 16949
Conn Id : 6798950
Name : Principal
PATHANAMTHITTA
C Status : Connected
Pole : T63_0
Trans : RANNY COLLEGE
Meter# : 0011201577
Bill Area : MD1/1/SB
Bill Date : 01/04/2022
Due Date : 11/04/2022
Disconn Dt: 26/04/2022
Tariff : LT-6A NOon
Purpose : Educational Ins
S Deposit : 6598
Meter(MM) Status OK
Load : 35 KW
C Demand : 35 KVA
Phase : 3
Prv Rd Dt : 01/03/2022
Prs Rd Dt : 01/04/2022
Mt Rd(DMF): 1

15

Prev. Payment

Prv Paid Dt : 10-03-2022
Prv Paid Amt : 4011

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KWH/R/I	43755	43453	252	315

Bill Details

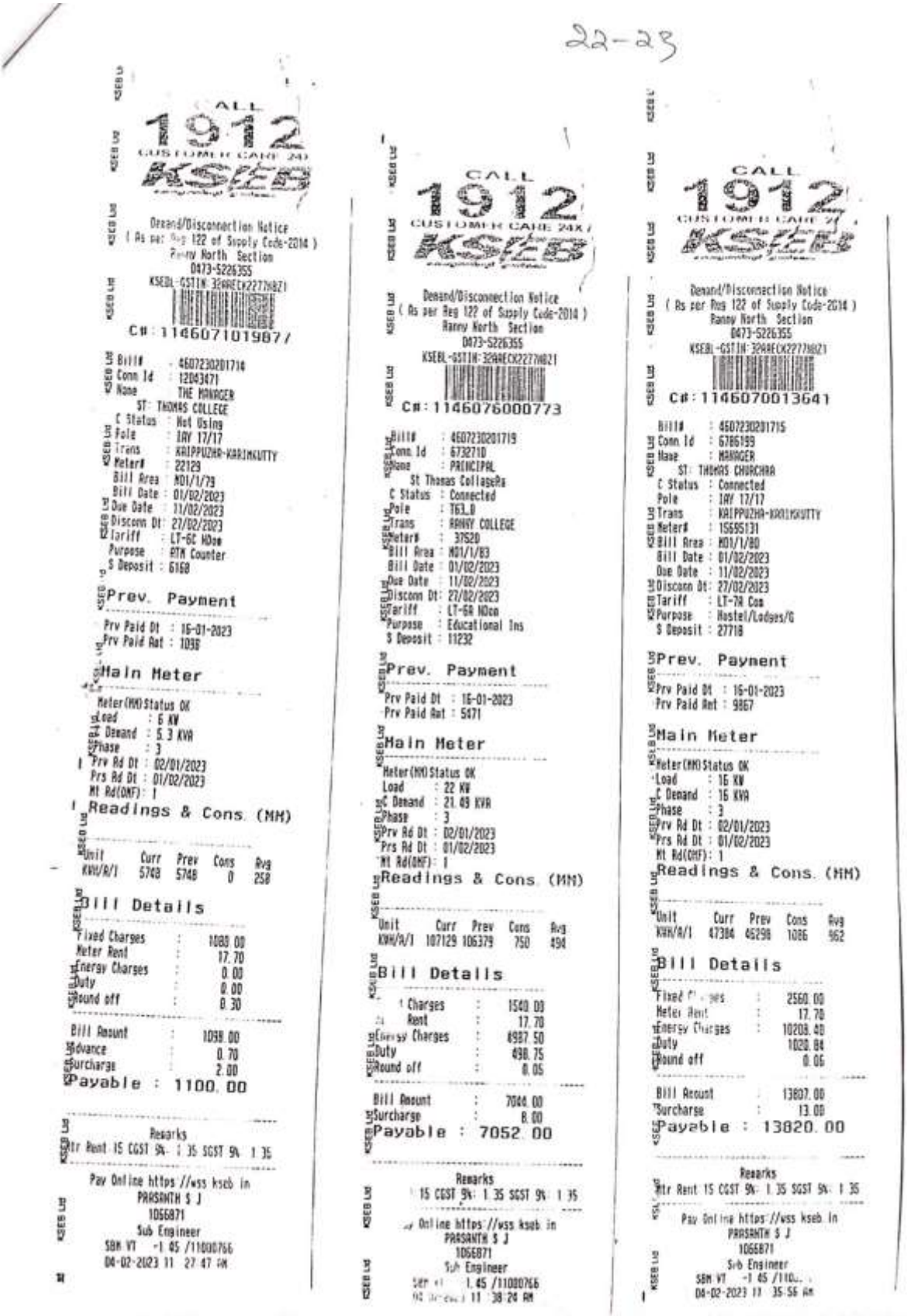
Fixed Charges	2275 00
Meter Rent	17 70
Energy Charges	1664 40
Duty	[illegible]
Round off	0 40
Bill Amount	4124 00
Payable	4124 00

4124

Remarks
Mtr Rent 15 CCST 9% 1 35 SGST 9% 1 35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1 35 /110000765
04-04-2022 12 55 16 PM

22-23



CALL 1912 CUSTOMER CARE 24X7 KSEB

Demand/Disconnection Notice
(As per Reg 122 of Supply Code-2014)
Ranny North Section
0473-5226355
KSEBL-GSTIN: 32AAECK2277H1Z1

C#: 1146071019877

Bill# : 460723020171A
Conn Id : 12043471
Name : THE MANAGER
ST THOMAS COLLEGE
C Status : Not Using
Pole : IAY 17/17
Trans : KAIPPUZHA-KARIMKUTTY
Meter# : 22129
Bill Area : ND1/1/79
Bill Date : 01/02/2023
Due Date : 11/02/2023
Disconn Dt : 27/02/2023
Tariff : LT-6C NDom
Purpose : ATM Counter
$ Deposit : 6168

Prev. Payment

Prv Paid Dt : 16-01-2023
Prv Paid Amt : 1098

Main Meter

Meter(MM) Status OK
Load : 6 KW
Demand : 5.3 KVA
Phase : 3
Prv Rd Dt : 02/01/2023
Prs Rd Dt : 01/02/2023
Mt Rd(CMF) : 1

Readings & Cons. (MM)

Unit	Curr	Prev	Cons	Avg
KWH/R/1	5748	5748	0	258

Bill Details

Fixed Charges	:	1080.00
Meter Rent	:	17.70
Energy Charges	:	0.00
Duty	:	0.00
Round off	:	0.30
Bill Amount	:	1098.00
Advance	:	0.70
Surcharge	:	2.00
Payable	:	1100.00

Remarks
Mtr Rent 15 CGST 9%: 1.35 SGST 9%: 1.35

Pay Online https://wss.kseb.in
PRASANTH S J
1056871
Sub Engineer
SBM VT -1.05 /11000766
04-02-2023 11:27:47 AM

CALL 1912 CUSTOMER CARE 24X7 KSEB

Demand/Disconnection Notice
(As per Reg 122 of Supply Code-2014)
Ranny North Section
0473-5226355
KSEBL-GSTIN: 32AAECK2277H1Z1

C#: 1146076000773

Bill# : 460723020171B
Conn Id : 673271D
Name : PRINCIPAL
St Thomas College,Ra
C Status : Connected
Pole : T63_0
Trans : RANNY COLLEGE
Meter# : 37520
Bill Area : ND1/1/E3
Bill Date : 01/02/2023
Due Date : 11/02/2023
Disconn Dt : 27/02/2023
Tariff : LT-6A NDom
Purpose : Educational Ins
$ Deposit : 11232

Prev. Payment

Prv Paid Dt : 16-01-2023
Prv Paid Amt : 5471

Main Meter

Meter(MM) Status OK
Load : 22 KW
C Demand : 21.09 KVA
Phase : 3
Prv Rd Dt : 02/01/2023
Prs Rd Dt : 01/02/2023
Mt Rd(CMF) : 1

Readings & Cons. (MM)

Unit	Curr	Prev	Cons	Avg
KWH/R/1	107129	106379	750	498

Bill Details

Fixed Charges	:	1540.00
Meter Rent	:	17.70
Energy Charges	:	4987.50
Duty	:	498.75
Round off	:	0.05
Bill Amount	:	7044.00
Surcharge	:	8.00
Payable	:	7052.00

Remarks
15 CGST 9%: 1.35 SGST 9%: 1.35

Pay Online https://wss.kseb.in
PRASANTH S J
1056871
Sub Engineer
SBM VT -1.05 /11000766
04-02-2023 11:38:24 AM

CALL 1912 CUSTOMER CARE 24X7 KSEB

Demand/Disconnection Notice
(As per Reg 122 of Supply Code-2014)
Ranny North Section
0473-5226355
KSEBL-GSTIN: 32AAECK2277H1Z1

C#: 1146070013641

Bill# : 460723020171C
Conn Id : 6786199
Name : MANAGER
ST THOMAS CHURCHAR
C Status : Connected
Pole : IAY 17/17
Trans : KAIPPUZHA-KARIMKUTTY
Meter# : 15695131
Bill Area : ND1/1/BD
Bill Date : 01/02/2023
Due Date : 11/02/2023
Disconn Dt : 27/02/2023
Tariff : LT-7A Com
Purpose : Hostel/Ladges/G
$ Deposit : 27718

Prev. Payment

Prv Paid Dt : 16-01-2023
Prv Paid Amt : 9867

Main Meter

Meter(MM) Status OK
Load : 16 KW
C Demand : 15 KVA
Phase : 3
Prv Rd Dt : 02/01/2023
Prs Rd Dt : 01/02/2023
Mt Rd(CMF) : 1

Readings & Cons. (MM)

Unit	Curr	Prev	Cons	Avg
KWH/R/1	47384	46298	1086	962

Bill Details

Fixed Charges	:	2560.00
Meter Rent	:	17.70
Energy Charges	:	10209.40
Duty	:	1020.84
Round off	:	0.06
Bill Amount	:	13807.00
Surcharge	:	13.00
Payable	:	13820.00

Remarks
Mtr Rent 15 CGST 9%: 1.35 SGST 9%: 1.35

Pay Online https://wss.kseb.in
PRASANTH S J
1056871
Sub Engineer
SBM VT -1.05 /110...
04-02-2023 11:35:56 AM

22-23

KSEB Ltd

1912

Disconnection Notice
(Reg 122 of Supply Code-2014)
Ranny North Section
0473-5226355
KSEB GSTIN: 32AAECK2271A1Z1

C# 1146073013642

Bill# 460723020171B
Conn Id 6786205
Name Manager
ST Thomas ChurchRa
Status Connected
Sole : TR3.0
Trans RANNY COLLEGE
Meter# 09415531
Bill Area : RD1/1/92
Bill Date : 01/02/2023
Due Date : 11/02/2023
Discom Dt : 27/02/2023
Tariff : LT-6A NDom
Purpose : Educational Ins
Deposit 47**

Prev Payment

Prv Paid Dt : 16-01-2023
Prv Paid Amt : 2777

Main Meter

Meter(MM) Status OL
Load : 16 KW
Dc Demand : 16 KVA
Phase : 3
Prv Rd Dt : 02/01/2023
Prs Rd Dt : 01/02/2023
Mt Rd(DNF) : 1

Readings & Cons (MM)

Unit	Curr	Prev	Cons	Rvg
KWH/R/I		23931	303	303

Bill Details

Fixed Charges	:	1120.00
Meter Rent	:	17.70
Energy Charges	:	1757.40
Duty	:	175.74
Round off	:	0.16
Bill Amount	:	3071.00
Surcharge	:	4.00
Payable	:	3075.00

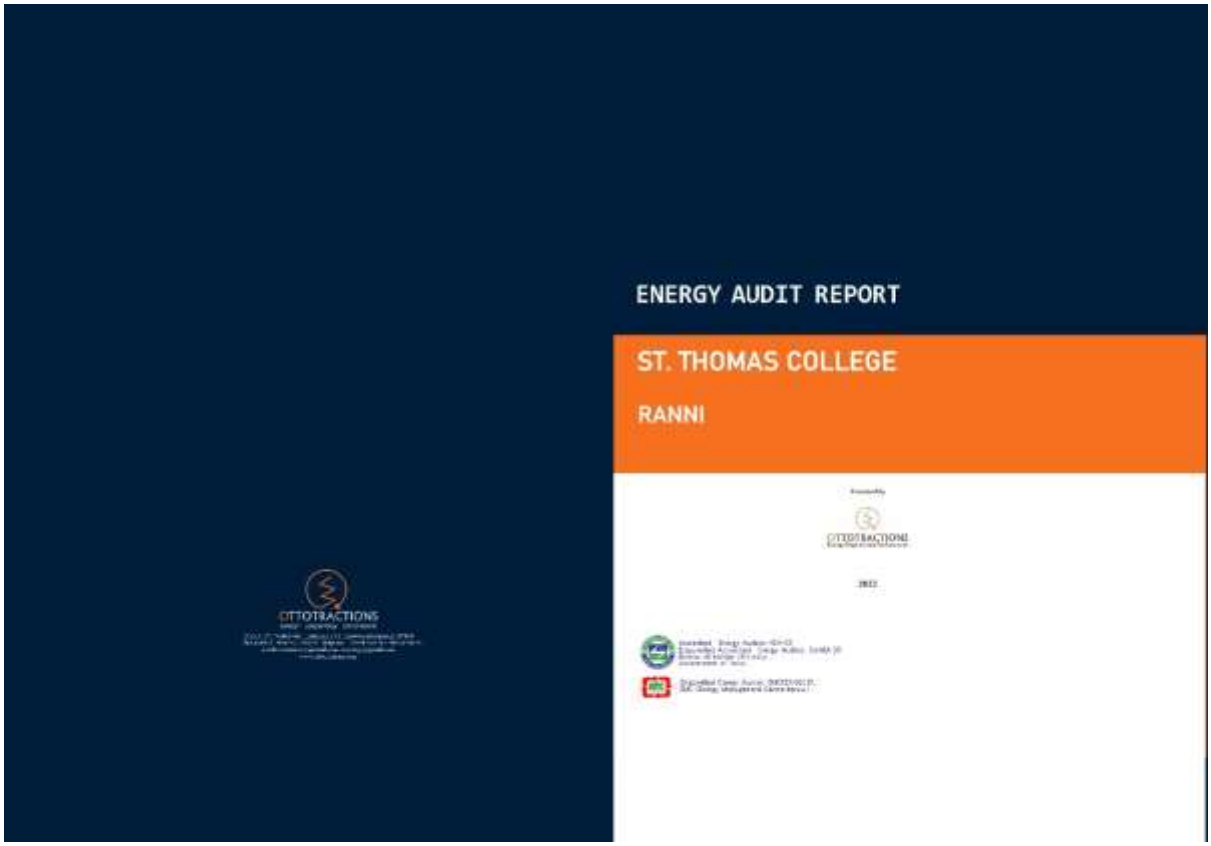
Remarks
Mtr Rent 15 CGST 9% 1.35 SGST 9% 1.35

Pay Online https://wss.kseb.in
PRASANTH S J
1255871
SBM V1 05/11000766
08-02-2023

Sl. No.	Scientific name	Malayalam name	English Name	No.
1.	*Artocarpus heterophyllus*	പ്ലാവ്	JACKFRUIT TREE	12
2.	*Mangifera indica*	മാവ്	MANGO	9
3.	*Saracaasoca*	അശോകം	ASHOKA TREE	1
4.	*Mimusposelengi*	ഇലഞ്ഞി	BULLET WOOD	2
5.	*Tectona grandis*	തേക്ക്	TEAK	84
6.	*Cocos nucifera*	തെങ്ങ്	COCONUT TREE	21
7.	*Artocarpus hirsutus*	ആഞ്ഞിലി	WILD JACK	7
8.	*Delonix regia*	ഗുൽമോഹർ	ROYAL PRINCIANA	4
9.	*Swietenia macrophylla*	മഹാഗണി	MAHAGONY	38
10.	*Annona muricata*	മുള്ളാത്ത	SOURSOP TREE	7
11.	*Cassia fistula*	കണിക്കൊന്ന	GOLDEN SHOWER TREE	8
12.	*Psidium guajava*	പേര	GUAVA TREE	10
13.	*Nephelium lappaceum*	റംബൂട്ടാൻ	RAMBUTAN	3
14.	*Peltophorum pterocarpum*	മഞ്ഞവാക	COPPER POD	3
15.	*Polyathia longifolia*	അരണമരം	FALSE ASHOKA	6
16.	*Casuarina equisetifolia*	പൂള	CATURINA	1
17.	*Palmacaea*	അലങ്കാര പന	ORNAMENTAL PALM	10
18.	*Pimenta dioica*	സർവ്വസുഗന്ധി	ALL SPICE	1
19.	*Lagerstroemia speciosa*	മണിമരുത്	PRIDE OF INDIA	2
20.	*Caruca papaya*	പപ്പായ	PAPAYA	2
21.	*Cinnamumum verum*	വഴന	BAY LEAF	1
22.	*Albizia julibrissin*	പൂവാക	PERSIAN SILK TREE	1
23.	*Araucaria heterophylla*	ഒരകേറിയ	ARAUCARIA	1
24.	*Palmacaea*	അലങ്കാര പന	HYOPHORBE	1
25.	*Ficus exasperata*	തേരകം	SAND PAPER TREE	1

Report- Energy Audit

2020-2023



ENERGY AUDIT REPORT

ST. THOMAS COLLEGE

RANNI

OTTOTRACTIONS

Energy Audit Report
St. Thomas College, Ranni
Report No: EA 1004
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. Thomas College, Ranni 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. Thomas College, Ranni					
Sl No	Projects	Investment	Cost saving	SPB	Energy saved
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr
1	Energy Saving in Lighting by replacing existing 34 No's T12 (55W) Lamps to 18W LED Tube	0.10	0.07	16.96	902
2	Energy Saving in Lighting by replacing existing 64 No's T8 (40W) Lamps to 18W LED Tube	0.19	0.081	28.41	1014
3	Energy Saving in Lighting by replacing existing 16 No's CFL(15W) Lamps to 9W LED Bulb	0.01	0.006	31.25	69
4	Energy Saving by replacing existing 178 No's in-efficient ceiling fans with Energy Efficient Five star fans	5.34	0.335	191.33	4187
5	Installation of 20kWp Solar Power Plant	11.00	3.641	36.26	27375
	Total	**16.55**	**4.06**	**60.84**	**32644**
(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.)					

1

Introduction

A detailed energy audit has been carried out at St. Thomas College Ranni by OTTOTRACTIONS in March 2023. 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

The history of the college is embedded in the history of Ranni. The college is situated on the top of a serene hill, in a sylvan surrounding, away from the din and bustle of the city, easily accessible and is at a walkable distance from the heart of Ranni town. The college was established in 1964, as a junior college by St Thomas Valiyapally Ranni, a pioneer parish of the Syrian Knanaya Arch Diocese of Malankara, with the whole hearted support of the then Bishop late lamented His Excellency Abraham Mor Clemis to meet the educational needs of the youth of the local community. The college was upgraded to a first grade college in 1968 and is the only institution for higher education in this part of the country. When the de-

linking of Pre Degree sector was made possible by the government on administrative measures we were left with graduate and Post Graduate courses. During its 53 years of illustrious existence, the college gave birth to brilliant academicians, administrators, politicians and entrepreneurs.

The college aims at creating cultured and educated citizens who love God and their country. With its rural background and `Gurukula' atmosphere, the college fosters uninterrupted pursuit of knowledge. The first Principal, Late Prof. K. A. Mathew, served as minister and PSC member in the Kerala State. He played a vital role in upgrading the junior college to a first grade one in 1968. As the Golden Jubilee project St. Thomas College of Advanced Studies, Edamury, Ranni, a Self-Financing College affiliated to M.G. University, Kottayam was established in June 2014. In March 2016, the College was assessed and re-accredited in the second cycle by the National Assessment and Accreditation Council (NAAC) of UGC and graded at B level.

Occupancy Details			
Particulars	2020-21	2021-22	2022-23
Total Students	900	881	805
Staffs	64	64	64
Total Occupancy of the college	964	945	869

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. Jomon J S, Project Engineer
5. Amrutha A M, Data Analyst
6. Anjana B S, Project Assistant

2

Process description

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

BASELINE DATA SHEET FOR GREEN AUDIT								
1	Name of the Organisation	St. Thomas College, Ranni						
2	Address (include telephone, fax & e-mail)	St. Thomas College, Ranni, Pathanamthitta, 689641, stcranni@gmail.com,+91 8301057965						
2	Year of Establishment	1964						
3	Name of building and Total No. of Electrical Connections/building	St. Thomas college (8)						
4	Total Number of Students	Boys		Girls		Total	805	
5	Total Number of Staff	64						
6	Total Occupancy	869						
7	Total area of green cover	50%						
8	Type of Electrical Connection	HT	0	LT	8			
9	Total Connected Load (kW)	107						
10	Average Maximum Demand (KVA)	-						
11	Total built up area of the building (M^2)	8317						
12	Number of Buildings	5						
13	Average system Power Factor	0.96						
14	Details of capacitors connected	NA						
15	Transformer Details (Nos., kVA, Voltage ratio)	TR 1						
		NA						
15	DG Set Details (kVA,)	DG1	DG2	DG3	DG4	DG5	Remarks	
		10						
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 8 LT Connections, the details are given below. A 10 kVA Diesel Generator are in operation at this campus

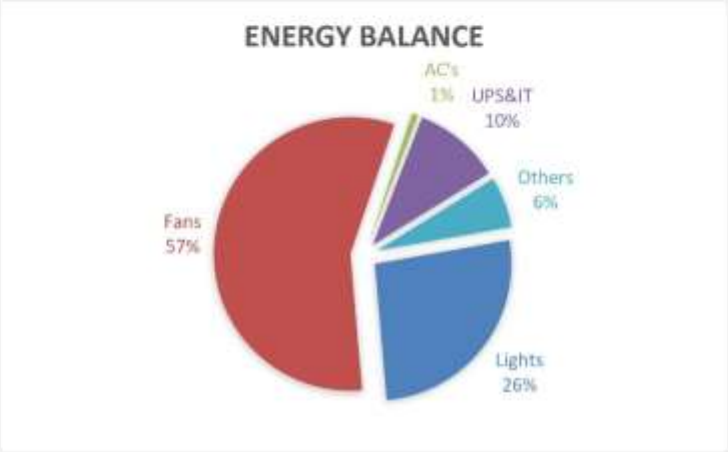
Electricity Connection Details		
St. Thomas College, Ranni		
1	Name of the Consumer	St. Thomas College, Ranni
2	Tariff	LT-6A 3Ph
3	Consumer Numbers	1146072000540, 1146071019877, 1146079005428, 1146073013642, 1146070013641, 1146079016949, 1146076000773, 1146071019877
5	Connected Load Total (kW)	107
6	Annual Electricity Consumption (kWh)	29879

3.2. Thermal Energy / Transportation

There are no vehicles operated from college for transportation. LPG is used for cooking in the canteen and diesel is used to operate Diesel Generators.

4

Energy Balance



57 % of the total energy consumed in this facility is used to operate Fans. Lighting uses 26% UPS and IT Uses AC uses 10%. Air-conditioners uses 1% and Others uses 6%.

OTTOTRACTIONS

5

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 **8.00 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

2022-2023			
Name of the Consumer		**St. Thomas College, Ranni**	
Connected load	**2**	Consumer no	**1146072000540**
Tariff	LT-6A 3Ph	Section	**Ranny North**
Month	**kWh**	**Rs (Total)**	**Rs/kwh**
May-22	208	1294	**6.22**
Jul-22	221	1483	**6.72**
Sep-22	127	941	**7.39**
Nov-22	141	1041	**7.39**
Jan-23	121	1012	**8.39**
Mar-23	176	1473	**8.39**

Name of the Consumer		**St. Thomas College, Ranni**	
Connected load	**16**	Consumer no	**1146073013642**
Tariff	LT-6A 3Ph	Section	**Ranny North**
Month	**kWh**	**Rs (Total)**	**Rs/kwh**
Apr-22	166	2099	**12.64**
May-22	180	1799	**9.99**
Jun-22	457	4566	**9.99**
Jul-22			
Aug-22	349	3074	**8.81**
Sep-22			
Oct-22	697	6137	**8.81**
Nov-22	475	4185	**8.81**
Jan-23			
Mar-23	436	2548	**5.84**

2022-2023			
Name of the Consumer		St. Thomas College, Ranni	
Connected load	16	Consumer no	1146070013641
Tariff	LT-6A 3Ph	Section	Ranny North
Month	**kWh**	**Rs (Total)**	**Rs/kwh**
May-22	1272	10161	**7.99**
Jul-22	1393	16508	**11.85**
Sep-22	934	12235	**13.10**
Nov-22	865	11522	**13.32**
Jan-23			
Mar-23	1106	14123	**12.77**

2022-2023			
Name of the Consumer		St. Thomas College, Ranni	
Connected load	35	Consumer no	1146079016949
Tariff	LT-6A 3Ph	Section	Ranny North
Month	**kWh**	**Rs (Total)**	**Rs/kwh**
Apr-22	315	4124	**13.09**
May-22	242	3812	**15.75**
Jul-22	0	0	
Sep-22	271	4197	**15.49**
Oct-22	286	4066	**14.22**
Nov-22	320	4554	**14.22**
Jan-23	294	4178	**14.22**
Mar-23	271	4483	**16.54**

Diesel

The campus has a Diesel Generator. The details of Diesel consumption is given below.

Diesel Consumption Details				
	Transportation	Generator	Total	cost
	in L	in L	in L	in Rs
20-21	0	310	310	28800
21-22	0	323	323	30060
22-23	0	328	328	31200

Annual Electricity Consumption (kWh)				
Consumer No	**2020-21**	**2021-22**	**2022-23**	Connected Load (kW)
1146072000540	210	672	993	2
1146071019877	5387	4487	516	6
1146079005428	2090	1164	1971	4
1146073013642	2446	2108	4731	16
1146070013641	3102	12628	13368	16
1146079016949	3476	3513	2999	35
1146076000773	4068	8099	3834	22
1146071019877	1445	1656	1468	6
Total	**20778**	**32671**	**29879**	**107**

Base Line Energy Data				
St. Thomas College, Ranni				
		2020-21	2021-22	2022-23
1	Electricity KSEB (kWh)	20778	32671	29879
2	Electricity DG (kWh)	929	970	985
3	Electricity Solar , Off grid (kWh)	0.00	0.00	0.00
4	Electricity (KSEB + DG + Off grid) kWh	21707	33641	30864
5	Electricity Grid Tied (kWh)	1214	1214	1278
6	Diesel (L)	0	0	0
7	LPG (kg)	60.00	75.00	75.00
8	Biogas (m3)	0.00	0.00	0.00

Energy Consumption Profile				
Sl No	Fuel	2020-21	2021-22	2022-23
		(kCal)		
1	Electricity	18667740	28931009	26543354
2	Diesel	0	0	0
3	LPG	720000	900000	900000
4	Biogas	0	0	0
Total		19387740	29831009	27443354

Solar Power Plant

Solar Power Plant			
Capacity (kWp)	Annual Generation		
	2020-21	2021-22	2022-23
1	1214	1214	1278

OTTOTRACTIONS

Lighting

St. Thomas College, Ranni										
Sl.No	Location	Lights							Fans	
		LED-T	LED-B	LED-SQ	T8	T12	ICL	CFL	CF	EF
1	Principal	2		9					2	
2	Conf Hall	2			2				1	
3	Office	5			3				6	
4	Admn Room	1			4				3	
5	Manager					1			2	
6	Malayalam Dpmt	1							1	
7	3 Rooms	3							3	
8	4 Rooms					4			4	
9	9 Rooms					27			18	
10	Seminar Hall	3							6	1
11	4 Rooms				4				4	
12	Botany department					1			2	
13	Museum	1							2	
14	5 Classrooms	5							10	
15	Physics Department	2	1		2				5	
16	Computer lab				3				2	
17	3 Rooms							12	9	
18	3 Rooms	3							3	
19	3 Rooms				3				3	
20	English department	1				1			1	
21	6 Rooms				6				6	
22	Conf Hall		24						12	
23	3 Rooms						3		3	
24	Lab	3							4	
25	3 Departments	6			6				18	
26	6 Rooms				6				6	
27	9 Rooms	9							9	
28	4 Rooms							4	4	
29	3 Rooms	3							6	
30	2 Rooms				2				2	
31	3 Rooms	3							3	
32	5 Rooms				5				5	
33	Auditorium	8			18				13	
	Total	**61**	**25**	**9**	**64**	**34**	**3**	**16**	**178**	**1**

Lux Measurement

Sl. No:	Location	Lux Avg
1	Manager	69
2	Seminar Hall	77
3	Botany department	90
4	Museum	83
5	Physics Department	96
6	Computer lab	79
7	Lab	79
8	Auditorium	90

OTTOTRACTIONS

6

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. Thomas College, Ranni				
Energy Performance Index (EPI)				
Sl No	Particulars	2020-21	2021-22	2022-23
1	Total building area (m^2)	8317	8317	8317
2	Annual Energy Consumption (kCal)	19387740	29831009	27443354
3	Annual Energy Consumption (kWh)	22544	34687	31911
4	Total Energy in Toe	1.94	2.98	2.74
5	Specific Energy Consumption kWh/m^2	2.71	4.17	3.84

The Energy Performance Index (EPI) is

3.84 kWh/m^2

The EPI of 2022-23 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. THOMAS COLLEGE RANNI,
RANNI

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

OTTOTRACTIONS

8

Energy Conservation Measures and Recommendations

Executive Summary					
Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects					
St. Thomas College, Ranni					
Sl No	Projects	Investment	Cost saving	SPB	Energy saved
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr
1	Energy Saving in Lighting by replacing existing 34 No's T12 (55W) Lamps to 18W LED Tube	0.10	0.07	16.96	902
2	Energy Saving in Lighting by replacing existing 64 No's T8 (40W) Lamps to 18W LED Tube	0.19	0.081	28.41	1014
3	Energy Saving in Lighting by replacing existing 16 No's CFL(15W) Lamps to 9W LED Bulb	0.01	0.006	31.25	69
4	Energy Saving by replacing existing 178 No's in-efficient ceiling fans with Energy Efficient Five star fans	5.34	0.335	191.33	4187
5	Installation of 20kWp Solar Power Plant	11.00	3.641	36.26	27375
	Total	**16.55**	**4.06**	**60.84**	**32644**
(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

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal Code 1	
Energy Saving in Lighting by replacing existing 64 No's T8 (40W) Lamps to 18W LED Tube	
Existing Scenario	
64 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	64
Total load (kW)	2.56
Annual Energy Consumption (kWh)	1843
Expected Annual Energy saving for replacing all fittings (kWh)	1014
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.08
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.19
Simple Pay Back (in Months)	28.41

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal Code	
Energy Saving in Lighting by replacing existing 34 No's T12 (55W) Lamps to 18W LED Tube	
Existing Scenario	
257 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 67% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2400
No of fittings	34
Total load (kW)	1.87
Annual Energy Consumption (kWh)	1346
Expected Annual Energy saving for replacing all fittings (kWh)	902
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.07
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.10
Simple Pay Back (in Months)	16.96

OTTOTRACTIONS

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving by replacing existing 178 No's in-efficient ceiling fans with Energy Efficient Five star fans	
Existing Scenario	
There are 178 numbers of ceiling fans installed in the facility 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	178
Total load (kW)	12.46
Annual Energy Consumption (kWh)	14952
Expected Annual Energy saving, for total replacement(kWh)	4187
Cost of Power (Rs)	8.00
Annual saving in Lakhs Rs (1st year)	0.33
Investment required for a total replacement (Lakhs Rs)[@3000 Rs per Fan with 50W at full speed]	5.34
Simple Pay Back (in Months)	191.33

OTTOTRACTIONS

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving in Lighting by replacing existing 16 No's CFL(15W) Lamps to 9W LED Bulb	
Existing Scenario	
24 numbers of CFL (15W) 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 CFL may be replaced to LED Bulb of 9W in phased manner and the savings will be of 40% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2400
No of fittings	16
Total load (kW)	0.24
Annual Energy Consumption (kWh)	173
Expected Annual Energy saving for replacing all fittings (kWh)	69
Cost of Power	8.00
Annual saving in Lakhs Rs (1st year)	0.01
Investment required for complete replacements [@Rs 90 per fittings](Lakhs Rs)	0.01
Simple Pay Back (in Months)	31.25

Energy Saving Proposal	
Installation of 20kWp 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 10kW 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)	20
Total average kWh per day expected (3.5kWh/day average)	75.00
Total annual Generating Capacity (kWh)	27375
Cost of energy generated annually Lakhs Rs	3.64
Investment required (INR lakh)(Approx)	11.00
Simple Pay Back (in Months)	36.26
Life cycle in Yrs	25
Total Saving in Life Cycle (Approx) RS lakh	91.02

Technical Supplements

St. Thomas College, Ranni																
Sl.No	Location	Lights							Fans		IT			Others		
		LED-T	LED-B	LED-SQ	T8	T12	ICL	CFL	CF	EF	Printer	Projector	PC	TV	AC (1TR)	Fridge
1	Principal	2		9					2		1		1	1		
2	Conf Hall	2			2				1				1		1	
3	Office	5			3				6		2		2			
4	Admn Room	1			4				3		3		1			
5	Manager					1			2		1		1			
6	Malayalam Dpmt	1							1							
7	3 Rooms	3							3							
8	4 Rooms					4			4							
9	9 Rooms					27			18							
10	Seminar Hall	3							6	1		1				
11	4 Rooms				4				4							
12	Botany department					1			2		1		1			1
13	Museum	1							2				1			
14	5 Classrooms	5							10							
15	Physics Department	2	1		2				5			1	1			
16	Computer lab				3				2				5			
17	3 Rooms							12	9							
18	3 Rooms	3							3							
19	3 Rooms				3				3							

20	English department	1				1			1				1			
21	6 Rooms				6				6							
22	Conf Hall		24						12							
23	3 Rooms						3		3							
24	Lab	3							4		1		24			
25	3 Departments	6			6				18							
26	6 Rooms				6				6							
27	9 Rooms	9							9							
28	4 Rooms							4	4							
29	3 Rooms	3							6							
30	2 Rooms				2				2							
31	3 Rooms	3							3							
32	5 Rooms				5				5							
33	Auditorium	8			18				13							
	Total	**61**	**25**	**9**	**64**	**34**	**3**	**16**	**178**	**1**	**9**	**2**	**39**	**1**	**1**	**1**
	Wattage	**20**	**10**	**20**	**40**	**55**	**100**	**18**	**80**	**60**	**100**	**120**	**200**	**100**	**1200**	**1200**
	Power	**1220**	**250**	**180**	**2560**	**1870**	**300**	**288**	**14240**	**60**	**900**	**240**	**7800**	**100**	**1200**	**1200**

CALL 1912

Demand/Disconnection Notice
(As per Reg 122 of Supply Code 2014)
Ranny North Section
0473-5226355

C#: 114607600773

Bill# : 460722050006 773
Conn Id : 6732710
Name : PRINCIPAL
St Thomas CollegeRa
C Status : Connected
Pole : 163.0
Trans : RANNY COLLEGE
Meter# : 0000300773
Bill Area : RDI/1/59
Bill Date : 01/05/2022
Due Date : 11/05/2022
Disconn Dt : 26/05/2022
Tariff : LT-6A NDom
Purpose : Educational Ins
S Deposit : 7210
Meter(MK) Status OK
Load : 22 KW
C Demand : 21.49 KVA
Phase : 3
Prv Rd Dt : 01/04/2022
Prs Rd Dt : 01/05/2022
Rt Rd(CNF) : 1

(3)

Prev. Payment

Prv Paid Dt : 12-04-2022
Prv Paid Rst : 5931

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KWH/R/I	2021	1526	495	575

Bill Details

Fixed Charges	:	1830.00
Meter Rent	:	17.70
Energy Charges	:	2671.72
Duty	:	267.15
Round off	:	0.35
Bill Amount	:	4557.00
Surcharge	:	2.00
Payable	:	4559.00

4553

Remarks
Prv Arrear 15 CGST 9% 1.35 SGST 9% 1.35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VI +1 36 /1140876
05-05-2022 9 09 03 AM

CALL 1912

Demand/Disconnection Notice
(As per Reg 122 of Supply Code 2014)
Ranny North Section
0473-5226355

C#: 114607101987?

Bill# : 460722050006 19877
Conn Id : 12043671
Name : THE MANAGER
ST THOMAS COLLEGE
C Status : Not Using
Pole : 18V 17/17
Trans : KOIPPUZHA-KAREIMANTTY
Meter# : 22129
Bill Area : RDI/1/60
Bill Date : 01/05/2022
Due Date : 11/05/2022
Disconn Dt : 26/05/2022
Tariff : LT-6C NDom
Purpose : ATM Counter
S Deposit : 4578
Meter(MK) Status OL
Load : 6 KW
C Demand : 5.3 KVA
Phase : 3
Prv Status : Average
Rel Rd Dt : 01/05/2020
Prv Rd Dt : 01/04/2022
Prs Rd Dt : 01/05/2022
Rt Rd(CNF) : 1

(2)

Prev. Payment

Prv Paid Dt : 12-04-2022
Prv Paid Rst : 1098

Doorlock Details

Lst DI Dt : 01-07-2020
DI Count : 21

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KWH/R/I		5735	0	0

Bill Details

Fixed Charges	:	1080.00
Meter Rent	:	17.70
Energy Charges	:	0.00
Duty	:	0.00
Round off	:	0.30
Bill Amount	:	1098.00
Advance	:	0.00
Surcharge	:	1.00
Payable	:	1099.00

1099

Remarks
Rt Rnd 15 CGST 9% 1.35 SGST 9% 1.35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VI +1 36 /1140876
05-05-2022 9 09 03 AM

CALL

Ranny North Section
0473-5226355

2000
540-

St Thomas Collegeha
Connected
Pole 179.0
Trans POOVATHUMOOZHA
Bill# 00108/1980
Bill Area 004/2/83
Bill Date 01/05/2022
Due Date 12/05/2022
Disconn dt 27/05/2022
Tariff LT-6A NDom
Purpose Educational Ins
S Deposit 900
Meter(MK) Status OK
Load 7 KW
C Demand 7 KVA
Phase 3
Prv Status Average
Rel Rd Dt 01/04/2022
Prv Rd Dt 01/05/2022
Prs Rd Dt 01/06/2022
Rt Rd(CNF) 1

(1)

01-04-2022
940

Lock Details

Lst DI Dt 27-07-2021
DI Count 6

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KWH/R/I		1344	3201	1

Bill Details

Fixed Charges	:	1080.00
Meter Rent	:	17.70
Energy Charges	:	0.00
Duty	:	0.00
Round off	:	0.30
Bill Amount	:	1098.00
Advance	:	0.00
Surcharge	:	1.00
Payable	:	1099.00

1294/-

Remarks
Rt Rnd 15 CGST 9% 1.35 SGST 9% 1.35

Pay Online https://wss.kseb.in
PRASAD D'SILVA
Meter Reader
SBM VI +1 36 /1140876
05-05-2022 9 09 03 AM

CALL 1912

Ranni North Section
0473-5226155

CB 114601/7801/1604

Bill# 0507220500084
Conn Id 6780950
Name Principal
Address1&2
C Status Connected
Pole 161.0
Town RANNI COLLEGE
Meter# 02112015??
Bill Area MCU/LSS
Bill Date 01/05/2022
Due Date 11/05/2022
Disconn Dt 26/05/2022
Tariff LT-6A KDom
Purpose Educational Ins
S Deposit 6598
Meter/MR Status Ok
Load 35 KW
C Demand 35 KVA
Phase 3
Prv Rd Dt 01/04/2022
Prv Rd Dt 01/05/2022
Nt Rd(DAY) 1

16945

6

Prev. Payment

Prv Paid Dt 12-04-2022
Prv Paid Amt 8124

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KWH/KVAH	44557	43755	802	154

Bill Details

Fixed Charges	1875.00
Meter Rent	17.70
Energy Charges	1371.00
Duty	137.98
Round off	-0.68
Bill Amount	3401.00
Surcharge	2.00
Payable :	3412.00

3812

Remarks
Mtr Rent 15 (Old 9% 1.35 Sur 9% 1.35

Pay Online https://ssp.kseb.in

BIJU D
Sub Engineer
SBM VT -1.36 /11420.52
05-05-2022 9:48:13 AM

CALL 1912

Ranni North Section
0473-5226155

CB 114601/8011/3641

Bill# 0507220500081
Conn Id 6780199
Name MANAGER
ST Thomas Orphanage
C Status Connected
Pole 10V 17/17
Town KARIPPACHIRAMMOOTTIL
Meter# 25595131
Bill Area MCU/LSS
Bill Date 01/05/2022
Due Date 11/05/2022
Disconn Dt 26/05/2022
Tariff LT-7B Com
Purpose Hostel/Lodges/C
S Deposit 17650
Meter/MR Status Ok
Load 16 KW
C Demand 16 KVA
Phase 3
Prv Rd Dt 01/04/2022
Prv Rd Dt 01/05/2022
Nt Rd(DAY) 1

13641

5

Prev. Payment

Prv Paid Dt 12-04-2022
Prv Paid Amt 16508

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KWH/KVAH	35677	35505	172	1143

Bill Details

Fixed Charges	
Meter Rent	
Energy Charges	
Duty	
Round off	
Bill Amount	
Surcharge	6.00
Payable :	

10161

Remarks

BIJU D
Sub Eng.
SBM VT -1.36
05-05-2022 9:

CALL 1912

Ranni North Section
0473-5226155

CB 114601/3013/3642

Bill# 0507220500083
Conn Id 6780515
Name
ST Thomas Orphanage
C Status Connected
Pole 161.0
Town RANNI COLLEGE
Meter# 25595133
Bill Area MCU/LSS
Bill Date 01/05/2022
Due Date 11/05/2022
Disconn Dt 26/05/2022
Tariff LT-6A KDom
Purpose Educational Ins
S Deposit 3305
Meter/MR Status Ok
Load 16 KW
C Demand 16 KVA
Phase 3
Prv Rd Dt 01/04/2022
Prv Rd Dt 01/05/2022
Nt Rd(DAY) 1

13642

4

Prev. Payment

Prv Paid Dt 12-04-2022
Prv Paid Amt 2099

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KWH/KVAH	20561	20403	158	154

Bill Details

Fixed Charges	1500.00
Meter Rent	17.70
Energy Charges	217.60
Duty	62.26
Round off	0.44
Bill Amount	1798.00
Surcharge	1.00
Payable :	1799.00

1799

Remarks
Mtr Rent 15 (Old 9% 1.35 Sur 9% 1.35

Pay Online https://ssp.kseb.in

BIJU D
Sub Engineer
SBM VT -1.36 /11420.52
05-05-2022 9:44:13 AM

Demand/Disconnection Notice
(As per Reg 122 of Supply Code 2014)
Customer Care
1912
Ranny North Section
0473-5226355
KSEBL-GSTIN: 32AAECK2277N1Z1
C#: 1146071019877
Bill# : 460722040089S 19877
Conn Id : 12043471
Name : THE MANAGER
ST. THOMAS COLLEGE
C Status : Not Using
Pole : IRY 12/17
Trans : K6GPPUZHR-kRRINGUTTY
Meter# : 22129
Bill Area : M31/1/69
Bill Date : 01/04/2022
Due Date : 11/04/2022
Discom Dt : 25/04/2022
Tariff : LT-6C NDom
Purpose : GTA Counter
S Deposit : 4578
Meter(MM) Status OL
Load : 6 KW
C Demand : 5.3 KVA
Phase : 3
Prv Status: Average
Nxt Rd Dt : 01/05/2023
Prv Rd Dt : 01/03/2022
Prs Rd Dt : 01/04/2022
Mt Rd(DMF): 1

Prev. Payment
Prv Paid Dt : 10-03-2022
Prv Paid Amt : 1099

DoorLock Details
Lst DI Dt : 01-07-2020
DI Count : 20

Readings & Cons.

Unit	Curr	Prev	Cons	Avg
KWH/K/I	5735	0	0	

Bill Details

Fixed Charges	1080 00
Meter Rent	17 70
Energy Charges	0 00
Duty	0 00
Round off	0 30
Bill Amount	1098 00
Advance	0 00
Payable	1098 00

Remarks
Mtr Rent 15 CGST 9% 1 35 SGST 9% 1 35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1.35 /11000756
04-04-2022 12:55:40 PM

(9)

Demand/Disconnection Notice
(As per Reg 122 of Supply Code 2014)
Customer Care
1912
Ranny North Sec...n
0473-5226355
KSEBL-GSTIN: 32AAECK2277N1Z1
C#: 1146070013641
Bill# : 460722040089S 13641
Conn.Id : 6786199
Name : MANAGER
ST. THOMAS CHURCHES
C Status : Connected
Pole : IRY 17/17
Trans : K6GPPUZHR-kRRINGUTTY
Meter# : 15695131
Bill Area : M31/1/61
Bill Date : 01/04/2022
Due Date : 11/04/2022
Discom Dt : 25/04/2022
Tariff : LT-7A Com
Purpose : Hostel/Lodges/G
S Deposit : 17058
Meter(MM) Status OK
Load : 16 KW
C Demand : 15 KVA
Phase : 3
Prv Rd Dt : 01/03/2022
Prs Rd Dt : 01/04/2022
Mt Rd(DMF): 1

Prev. Payment
Prv Paid Dt : 10-03-2022
Prv Paid Amt : 14242

Readings & Cons.

Unit	Curr	Prev	Cons	Avg
KWH/K/I	38935	37512	1353	950

Bill Details

Fixed Charges	[illegible]
Meter Rent	17 70
Energy Charges	12954 93
Duty	1295 49
Round off	-0 09
Bill Amount	16500 00
Payable	16500 00

Remarks
Mtr Rent 15 CGST 9% 1 35 SGST 9% 1 35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1.35 /11000766
04-04-2022 12:50:47 PM

(8)

Demand/Discon... (As per Reg 122 of ...2016)
Customer Care
1912
Ranny North Sec...n
0473-5226355
KSEBL-GSTIN: 32AAECK2277N1Z1
C#: 11460760[illegible]
Bill# : 460722040089S 783
Conn Id : 6732710
Name : PRINCIPAL
St Thomas College Pa
C Status : Connected
Pole : T63.0
Trans : RANNY COLLEGE
Meter# : 0000000773
Bill Area : M31/1/59
Bill Date : 01/04/2022
Due Date : 11/04/2022
Discom Dt : 25/04/2022
Tariff : LT-6A NDom
Purpose : Educational Ins
S Deposit : 7210
Meter(MM) Status OK
Load : 22 KW
C Demand : 21.09 KVA
Phase : 3
Prv Rd Dt : 01/03/2022
Prs Rd Dt : 01/04/2022
Mt Rd(DMF): 1

Prev. Payment
Prv Paid Dt : 10-03-2022
Prv Paid Amt : 6253

Readings & Cons.

Unit	Curr	Prev	Cons	Avg
KWH/K/I	1516	899	627	565

Bill Details

Fixed Charges	1430 00
Meter Rent	17 70
Energy Charges	[illegible]
Duty	427 55
Round off	0 25
Bill Amount	5931 00
Payable	5931 00

Remarks
Mtr Rent 15 CGST 9% 1 35 SGST 9% 1 35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1.35 /11000766
04-04-2022 12:58:24 PM

(7)

Demand/Disconnection Notice
(Rs per Reg 122 of Supply Code 2014)
Customer Care
1912
Ranny North Sect ..
0473 5226125
C#: 1146073013642

Bill# : 460722040D0892 13642
Conn Id : 6786205
Name : Manager
ST Thomas Church&a
C Status : Connected
Pole : T63_0
Trans : RANNY COLLEGE
Meter# : 0011202013
Bill Area : MD1/1/ST
Bill Date : 01/04/2022
Due Date : 11/04/2022
Disconn Dt: 26/04/2022
Tariff : LT-6A NOon
Purpose : Educational Ins
S Deposit : 3306
Meter(MM) Status OK
Load : 16 KW
C Demand : 16 KVA
Phase : 3
Prv Rd Dt : 01/03/2022
Prs Rd Dt : 01/04/2022
Mt Rd(DMF): 1

4

Prev. Payment

Prv Paid Dt : 10-03-2022
Prv Paid Amt : 2374

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KWH/R/I	20443	20277	166	140

Bill Details

Fixed Charges	1040 00
Meter Rent	17 70
Energy Charges	945 20
Duty	94 62
Round off	0 48
Bill Amount	2099 00
Payable	2099 00

2099

Remarks
Mtr Rent 15 CGST 9% 1 35 SGST 9% 1 35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1 35 /110000766
04-04-2022 12 53 27 PM

Demand/Disconnection Notice
(Rs per Reg 122 of Supply Code 2014)
Customer Care
1912
Ranny North Sect ..
0473 5226125
C#: 1146079016949

Bill# : 460722040D0893 16949
Conn Id : 6798950
Name : Principal
PATHANAMTHITTA
C Status : Connected
Pole : T63_0
Trans : RANNY COLLEGE
Meter# : 0011201577
Bill Area : MD1/1/SB
Bill Date : 01/04/2022
Due Date : 11/04/2022
Disconn Dt: 26/04/2022
Tariff : LT-6A NOon
Purpose : Educational Ins
S Deposit : 6598
Meter(MM) Status OK
Load : 35 KW
C Demand : 35 KVA
Phase : 3
Prv Rd Dt : 01/03/2022
Prs Rd Dt : 01/04/2022
Mt Rd(DMF): 1

15

Prev. Payment

Prv Paid Dt : 10-03-2022
Prv Paid Amt : 4011

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KWH/R/I	43755	43453	252	315

Bill Details

Fixed Charges	2275 00
Meter Rent	17 70
Energy Charges	1654 00
Duty	[illegible]
Round off	0 65
Bill Amount	4124 00
Payable	4124 00

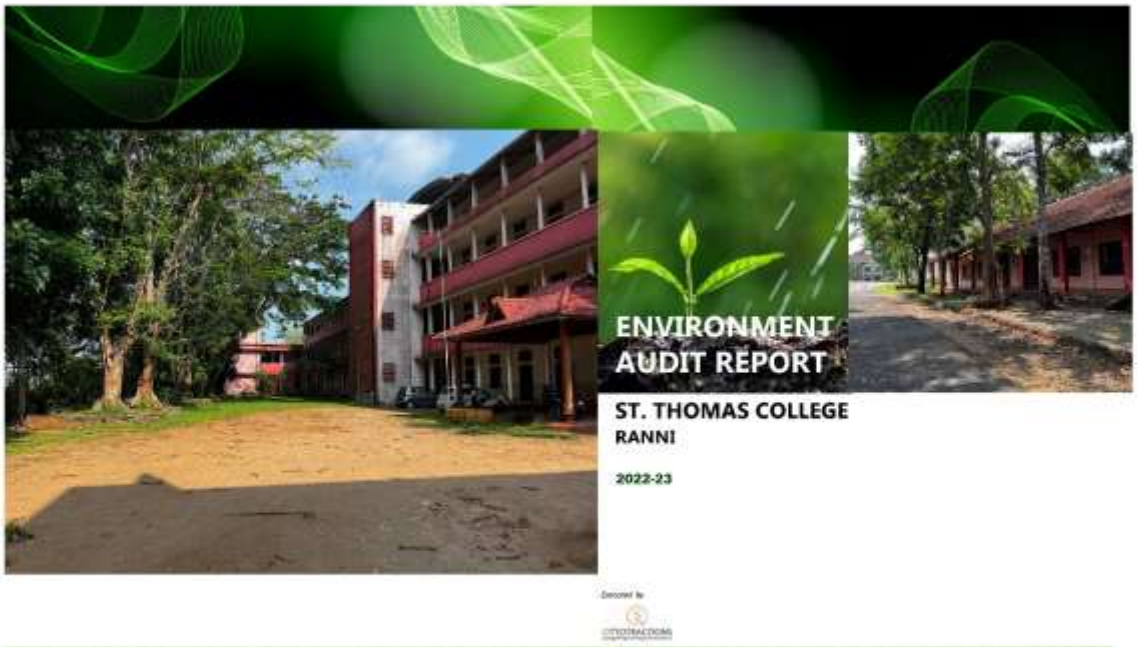
4124

Remarks
Mtr Rent 15 CGST 9% 1 35 SGST 9% 1 35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1 35 /110000765
04-04-2022 12 55 16 PM

Report- Environment Audit

2020-2023



ENVIRONMENT AUDIT REPORT

ST. THOMAS COLLEGE

RANNI

OTTOTRACTIONS

Environment Audit Report
ST. THOMAS COLLEGE, RANNI
EA 1004, 2023

Audit Team

Ottotractions

1	Er. Suresh Babu B V,	Accredited Energy Auditor, AEA 33
2	Er. B. Zachariah,	Director, Ottotractions
3	Er. Abin Baby,	Project Engineer,
4	Er. Joemon J S	Project Engineer,
5	Ms.Amrutha	Data Analyst
6	Ms.Anjana	Project Assistant

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 and ISO 14001-2015 Certified organization, which ensures the quality of its services.

Acknowledgment

We were privileged to work together with the administration and staff of St. Thomas College, Ranni 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 team OTTOTRACTIONS 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
Government of India

Contents

OTTOTRACTIONS

INTRODUCTION

St. Thomas College, Ranni has entrusted Ottotractions to carry out an environment audit of their campus building.

Each section contains recommendations for improvements relating to environmental issues, which are consolidated in the action plan in section 4.

OTTOTRACTIONS

BACKGROUND

The history of the college is embedded in the history of Ranni. The college is situated on the top of a serene hill, in a sylvan surrounding, away from the din and bustle of the city, easily accessible and is at a walkable distance from the heart of Ranni town. The college was established in 1964, as a junior college by St Thomas Valiyapally Ranni, a pioneer parish of the Syrian Knanaya Arch Diocese of

Malankara, with the whole hearted support of the then Bishop late lamented His Excellency Abraham Mor Clemis to meet the educational needs of the youth of the local community. The college was upgraded to a first grade college in 1968 and is the only institution for higher education in this part of the country. When the de-linking of Pre Degree sector was made possible by the government on administrative measures we were left with graduate and Post Graduate courses. During its 53 years of illustrious existence, the college gave birth to brilliant academicians, administrators, politicians and entrepreneurs.

The college aims at creating cultured and educated citizens who love God and their country. With its rural background and `Gurukula' atmosphere, the college fosters uninterrupted pursuit of knowledge. The first Principal, Late Prof. K. A. Mathew, served as minister and PSC member in the Kerala State. He played a vital role in upgrading the junior college to a first grade one in 1968. As the Golden Jubilee project St. Thomas College of Advanced Studies, Edamury, Ranni, a Self Financing College affiliated to M.G. University, Kottayam was established in June 2014. In March 2016, the College was assessed and re-accredited in the second cycle by the National Assessment and Accreditation Council (NAAC) of UGC and graded at B level.

Occupancy Details			
Particulars	2020-21	2021-22	2022-23
Total Students	900	881	805
Staffs	64	64	64
Total Occupancy of the college	964	945	869

Total student strength of the campus is 805. For calculating per capita carbon emission estimation, the student strength is taken into account.

OTTOTRACTIONS

ENVIRONMENTAL ISSUES

This section is broken down into the following different areas: waste, water, energy, resource and materials use and procurement. A final 'other' section is also included for any additional issues.

1.1. Waste

The way communities generate and manage their waste plays an absolutely key role in their ability to use resources efficiently. All buildings contain bins for both general waste and mixed recyclables (plastic bottles, card, cans and paper). On average each floor in the buildings areas has its own general waste bin and one recycling bin. When the bins are emptied by the cleaning staff. Bins are marked and kept in different colors for identification, however in some locations throughout the building it was unclear which bins were for which waste streams.

There are four basic ways in which campus can do **plastic** recycling **collection** services for **plastic** bottles and containers – curbside, drop-off, buy-back or deposit/refund programs. The first, and most widely accessible, **collection** method is curbside **collection** of recyclables. The campus is installed bins to collect plastic bottles and single use plastics. The college has given a proper awareness on plastic waste problems and they are discouraging the students or teachers to carry plastics to the campus. The Bhoomitra Sena Club is very active in the campus and do a verity of programs to build awareness on waste management. The reports on different activities of the club are attached as technical supplement of this report.

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. The degradable waste is treated in the biogas plant, the biogas generated is used in the kitchen. A state of art sewage treatment plant is installed in the campus

Degradable Waste Generation			
St. Thomas College, Ranni			
Particulars	2020-21	2021-22	2022-23
Total Occupancy	964	945	869
Waste generated in kg /day	19.28	18.9	17.38
Waste generated in kg /Yr	4241.6	4158	3823.6

Burning plastics shall be strictly restricted inside the campus. **Burning plastic** and other wastes releases dangerous substances such as heavy metals, Persistent Organic Pollutants, and other toxics into the air and ash waste residues. Such pollutants contribute to the development of asthma, cancer, endocrine disruption, and the global burden of disease.

Solid non degradable Waste Generation			
St. Thomas College, Ranni			
Particulars	2020-21	2021-22	2022-23
Total Occupancy	964	945	869
Waste paper generated in kg /day	0.1928	0.189	0.1738
Waste plastic generated in kg /day	0.2892	0.2835	0.2607
Waste paper generated in kg /Yr	42.42	41.58	38.24
Waste plastic generated in kg /Yr	63.62	62.37	57.35

WASTE MINIMIZATION AND RECYCLING		
1	Does your institute generate any waste?	Yes, Solid waste, Canteen waste, paper, plastic, Horticulture Waste etc.
	If so, what are they?	
2	What is the approximate amount of waste generated per day? (in Kilograms/) (approx.)	19
3	How is the waste generated in the institute managed? By	Reuse of one side printed Paper for internal communication. Kitchen waste is used to generate manures and biogas. Two types of Waste bins are provided at campus for biodegradable and non-biodegradable waste.

	1	Composting	In-house
	2	Recycling	In-house
	3	Reusing	In-house
	4	Others (specify)	
4	Do you use recycled paper in institute?		Yes
5	Do you use reused paper in institute?		Yes
6	How would you spread the message of recycling to others in the community? Have you taken any initiatives? If yes, please specify.		Number of awareness programs through Nature Club, Biodiversity Club and NSS Camp
7	Can you achieve zero garbage in your institute? If yes, how?		Not yet achieved. Possible through waste management plan.

Green Cover Audit			
1	**Is there a garden in your institute?**	**Yes**	
2	Do students spend time in the garden?	Yes	
3	Total number of Plants in Campus	Plant type	Approx. number
		Trees	236
		Ornamental	Not estimated
4	Number of Tree Plantation Drives organized by School per annum. (If Any)	Yes, through Nature Club and Biodiversity club plantation drives are organized.	
5	Number of Trees Planted in Last FY.	30	
	Survival Rate	90%	

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.

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. Detailed table is included in the technical supplement.

Carbon Sequestration			
Particulars	2020-21	2021-22	2022-23
Total No of Trees	236	236	236
Carbon sequestrated by trees in the campus (tCO2e)	6.4	7.1	7.50

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

Carbon sequestrated by each species of trees in the campus compound is given in the Table. Detailed calculation results are listed out in the tables provided in the technical supplements of 'Carbon sequestration'.

List of Trees and Plants		
Sl. No.	English Name	QTY
1	Jackfruit Tree	12
2	Mango	9
3	Ashoka Tree	1
4	BulletWood	2
5	Teak	84
6	Coconut	21
7	Wild Jack	7
8	Royal Princiana	4
9	Mahagony	38
10	Soursop Tree	7
11	Golden Shower Tree	8
12	Guava Tree	10
13	Rambutan	3
14	Copper Pod	3
15	False Ashoka	6
16	Caturina	1
17	Ornamental Palm	10
18	All Spice	1
19	Pride of India	2
20	Papaya	2
21	Bay Leaf	1
22	Persian Silk Tree	1
23	Araucaria	1
24	Hyophorbe	1
25	Sand Paper Tree	1
Total		236

3.1.1 ENERGY

a. Electricity

The total emission of the carbon dioxide per student is 22.21 kg per year. 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. All energy efficiency projects shall be implemented, So, the effective specific carbon emission per student is -6.44kg of CO_2 per year only

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 optimization
- Energy efficiency
- Renewable energy

Electricity Consumption

Electricity Connection Details		
St. Thomas College, Ranni		
1	Name of the Consumer	St. Thomas College, Ranni
2	Tariff	LT-6A 3Ph
3	Consumer Numbers	1146072000540, 1146071019877, 1146079005428, 1146073013642, 1146070013641, 1146079016949, 1146076000773, 1146071019877
5	Connected Load Total (kW)	107
6	Annual Electricity Consumption (kWh)	29879

Annual Electricity Consumption (kWh)				
Consumer No	**2020-21**	**2021-22**	**2022-23**	Connected Load (kW)
1146072000540	210	672	993	2
1146071019877	5387	4487	516	6
1146079005428	2090	1164	1971	4
1146073013642	2446	2108	4731	16
1146070013641	3102	12628	13368	16
1146079016949	3476	3513	2999	35
1146076000773	4068	8099	3834	22
1146071019877	1445	1656	1468	6
Total	**20778**	**32671**	**29879**	**107**

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 utilization 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 optimize its usage.

Currently, College 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 optimization 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 can install 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. 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'

Renewable Energy

1kWp Solar power plant is installed in the campus which helps offsetting the carbon foot print. The details of these projects are given in the concerned chapters.

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

OTTOTRACTIONS- ENERGY AUDIT						
St. Thomas College, Ranni						
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 34 No's T12 (55W) Lamps to 18W LED Tube	902	0.90	10	0.66	6.59
2	Energy Saving in Lighting by replacing existing 64 No's T8 (40W) Lamps to 18W LED Tube	1014	1.01	10	0.74	7.40
3	Energy Saving in Lighting by replacing existing 16 No's CFL(15W) Lamps to 9W LED Bulb	69	0.07	10	0.05	0.50
4	Energy Saving by replacing existing 178 No's in-efficient ceiling fans with Energy Efficient Five star fans	4187	4.19	10	3.06	30.56
Total		**6172**	**6**	**10**	**4.51**	**45.05**

OTTOTRACTIONS- ENERGY AUDIT						
St. Thomas College, Ranni						
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 through out life cycle
		(kWh)	MWh	Years		
1	Installation of 20kWp Solar Power Plant	27375	27.38	25	19.98	499.59
	Total	27375	27	25	19.98	500

OTTOTRACTIONS

General Environmental Awareness Questionnaire	
Are you aware of any environmental Laws pertaining to different aspects of environmental management?	Yes
Does your institute have any rules to protect the environment? List possible rules you could include.	Yes
Dose Environmental Ambient Air Quality Monitoring conducted by the Institute?	No
Dose Environmental Water and Wastewater Quality monitoring conducted by the Institute?	Yes
Dose stack monitoring of DG sets conducted by the Institute?	No
Is any warning notice, letter issued by state government bodies?	No
Dose any Hazardous waste generated by the Institute? If yes explain its category and disposal method	No
Are you aware of any environmental Laws pertaining to different aspects of environmental management?	Yes
Does your institute have any rules to protect the environment? List possible rules you could include.	Yes
Does housekeeping schedule in your campus?	Yes
Are students and faculties aware of environmental cleanliness ways? If Yes Explain	Yes
Does Important Days Like World Environment Day, Earth Day, and Ozone Day etc. eminent in Campus?	Yes
Does Institute participate in National and Local Environmental Protection Movement?	Yes
Does the institute have any Recognition/certification for environment friendliness?	No
Does the institute use renewable energy?	Yes
Does the Institution conduct a green/environmental audit of its campus?	Yes
Has the institution been audited / accredited by any other agency such as NABL, NABET, TQPM, NAAC etc.?	Yes (NAAC)

Best Practices and Initiatives	
Renewable Energy	Yes
Solar Power Plant	Yes
Energy Audit and Green Audit Conducted	Yes
Biogas Plant installed	No
Biodiversity Conservation	Yes
Green Cover	Yes
Tree Plantation Drives	Yes
ECO clubs	Yes
Groundwater Recharge	Yes
Rain Water Harvesting System.	Yes
Pollution Reduction Public Transportation	Yes
E Waste Management	Yes
Connected to authorized recycler	Yes
Solid Waste Management	Yes
Lifting of garbage from the campus on alternate days by the Municipal Corporation.	No
Adoption of Village	Yes
CSR	Yes
Water Conservation	Yes
Energy Conservation	Yes

OTTOTRACTIONS

RECOMMENDATIONS

1. Implement a utility monitoring program.
   - Allocate staff to carry out meter readings for electricity, waste and water on regular basis
   - Add monitoring data to spreadsheet so results can be viewed graphically
   - Compare with the utility bills meter readings in order to ensure accuracy;
2. Consider adopting and implementing a sustainable procurement policy which takes into account the whole life cycle of a product, and make sure environmental issues are written into tenders when contracting out.

3. Consider trialing recycled paper again – many recycled brands today, such as Evolve, are just as good as virgin paper.
4. Trial the use of re-manufactured (i.e., refilled) ink and toner cartridges rather than purchasing new ones.
5. Consider producing some designated 'environmental' pages on the intranet to make it easier for staff to find environmental information. If possible, a discussion forum could be set up to allow easy internal communications and staff to make suggestions for environmental improvements.
6. Environmental training could be formalized and carried out for all staff. It does not have to be too long or onerous, providing it covers key points, particularly in relation to waste so all staff are aware of the legal requirements. At the very least, environmental information should be included in the induction pack.
7. It is strongly recommended that environmental information is also given to students and staff during induction. It is particularly important for them to be aware of what waste they can dispose of on site and where they can dispose of it, and what waste streams they must take away with them.
8. Consider implementing an environmental management system to incorporate all improvements and monitoring requirements. It does not need to be a complex system certified to any particular standard, merely a way of ensuring that baselines are set and progress is measured. Formation of Environment Policy and communicated to all faculties and other staff.
9. Plan for Zero Waste Campus Project
10. E-waste monthly inventory be maintained at campus as per E waste rules 2016.
11. A Water Meter should be installed at the institute for monitoring of water consumption per capita.
12. Increase in Environmental promotional activities for spreading awareness at campus.
13. Environment/Green committee formation for regulating eco-friendly initiatives at campus premises and periphery.

OTTOTRACTIONS

CONCLUSION

This audit involved extensive consultation with all the campus team, interactions with key personnel on a wide range of issues related to Environmental aspects. The audit has identified several observations for making the campus premise more environmentally friendly. The recommendations are also mentioned with observations for St. Thomas college, Ranni team to initiate actions.

OTTOTRACTIONS

Carbon Foot Print							
Sl. No.	Particulars	2020-21	tCO2e	2021-22	tCO2e	2022-23	tCO2e
1	Electricity (kWh)	21707	17.80	33641	27.59	30864	25.31
2	Diesel (L)	0	0	0	0.00	0	0.00
3	LPG (kg)	60.00	0	75.00	0.11	75.00	0.11
4	Biogas (m3)	0.00	0	0.00	0.00	0.00	0.000
5	Degradable Waste in kg/yr.	4241.6	3	4158	2.62	3823.6	2.41
6	Paper Waste in kg/yr	42.42	0	41.58	0.02	38.24	0.02
Total Carbon Foot Print tCO2e/yr			20.59		30.34		27.85

Net Carbon Emission after implementing Energy Efficiency projects and Renewable Energy Projects Proposed		
1	Total Carbon Foot Print tCO2e/yr	27.85
2	Carbon Sequestrated tCO2e/yr	7.50
3	Carbon mitigated by Renewable Energy tCO2e/yr (Installed)	1.05
4	Carbon mitigated by Renewable Energy tCO2e/yr (Proposed)	19.98
5	Carbon mitigated by Energy Efficiency (Proposed) tCO2e/yr	4.51
6	Effective Carbon footprint tCO2e/yr	-5.18
7	Total No of Students	805
8	Specific Carbon Footprint kg CO2e/Student/Yr	-6.44

However, there is scope for further improvement, particularly in relation to waste minimization and energy monitoring. By implementing a basic environmental management system, current good practice can be formalized and a framework can be set up for monitoring, implementation of action plans and continual improvement.

The audit team observed that the overall site is maintained well from an environmental perspective. There are no major observations but few things are important to initiate urgently are waste management records by monthly inventory of hazardous waste, rainwater harvesting recharge; water balance cycle and periodic inspection of buildings; environment policy and initiation of composting at campus.

References

- The Environment [Protection] Act – 1986 (Amended 1991) & Rules-1986 (Amended 2010)
- The Petroleum Act: 1934 – The Petroleum Rules: 2002
- The Central Motor Vehicle Act: 1988 (Amended 2011) and The Central Motor Vehicle
- Rules:1989 (Amended in 2005)
- Energy Conservation Act 2010.
- The Water [Prevention & Control Of Pollution] Act – 1974 (Amended 1988) & the Water (Prevention & Control of Pollution) Rules – 1975
- The Water [Prevention & Control Of Pollution] Cess Act-1977 (Amended 2003) and Rules- 1978
- The Air [Prevention & Control Of Pollution] Act – 1981 (Amended 1987) The Air (Prevention & Control of Pollution) Rules – 1982
- The Gas Cylinders Rules – 2016 (Replaces the Gas Cylinder Rules – 1981
- E-waste management rules 2016
- Electrical Act 2003 (Amended 2001) / Rules 1956 (Amended 2006)
- The Hazardous Waste (Management and Handling and Trans-boundary Movement) Rules, 2008 (Amended 2016)
- The Noise Pollution Regulation & Control rules, 2000 (Amended 2010)
- The Batteries (Management and Handling) rules, 2001 (Amended 2010)
- Relevant Indian Standard Code practices

OTTOTRACTIONS

TECHNICAL SUPPLEMENTS

St. Thomas College, Ranni
Pazhavangadi P.O., Kerala, India - 689673
RE-ACCREDITED BY NAAC AT B LEVEL
(Affiliated to Mahatma Gandhi University, Kottayam - Kerala)

7.1.2 Facilities for alternate sources of energy and energy conservation measures in the Institution

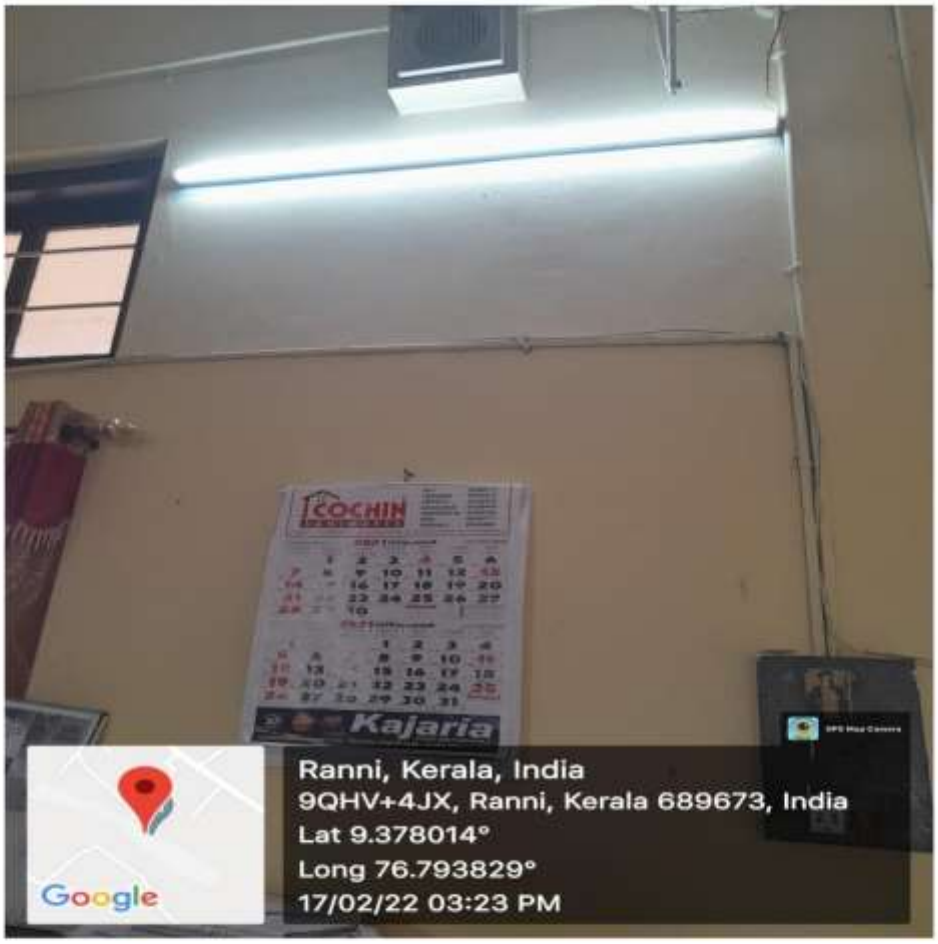
Photographs of the facilities for alternate sources of energy

Ph : 04735-226238, 226738 (O)
E-mail : stcranni@gmail.com, www.stcranni.ac.in

Solar Plant


GPS Map Camera
Ranni, Kerala, India
9QHV+4JX, Ranni, Kerala 689673, India
Lat 9.377066°
Long 76.793947°
25/03/22 02:33 PM
Google

LED tube light



Biogas Plant

Sl. No.	Scientific name	Malayalam name	English Name	No.
1.	*Artocarpus heterophyllus*	പ്ലാവ്	JACKFRUIT TREE	12
2.	*Mangifera indica*	മാവ്	MANGO	9
3.	*Saracaasoca*	അശോകം	ASHOKA TREE	1
4.	*Mimusposelengi*	ഇലഞ്ഞി	BULLET WOOD	2
5.	*Tectona grandis*	തേക്ക്	TEAK	84
6.	*Cocos nucifera*	തെങ്ങ്	COCONUT TREE	21
7.	*Artocarpus hirsutus*	ആഞ്ഞിലി	WILD JACK	7
8.	*Delonix regia*	ഗുൽമോഹർ	ROYAL PRINCIANA	4
9.	*Swietenia macrophylla*	മഹാഗണി	MAHAGONY	38
10.	*Annona muricata*	മുള്ളാത്ത	SOURSOP TREE	7
11.	*Cassia fistula*	കണിക്കൊന്ന	GOLDEN SHOWER TREE	8
12.	*Psidium guajava*	പേര	GUAVA TREE	10
13.	*Nephelium lappaceum*	റംബൂട്ടാൻ	RAMBUTAN	3
14.	*Peltophorum pterocarpum*	മഞ്ഞവാക	COPPER POD	3
15.	*Polyathia longifolia*	അരണമരം	FALSE ASHOKA	6
16.	*Casuarina equisetifolia*	പൂള	CATURINA	1
17.	*Palmacaea*	അലങ്കാര പന	ORNAMENTAL PALM	10
18.	*Pimenta dioica*	സർവ്വസുഗന്ധി	ALL SPICE	1
19.	*Lagerstroemia speciosa*	മണിമരുത്	PRIDE OF INDIA	2
20.	*Caruca papaya*	പപ്പായ	PAPAYA	2
21.	*Cinnamumum verum*	വഴന	BAY LEAF	1
22.	*Albizia julibrissin*	പൂവാക	PERSIAN SILK TREE	1
23.	*Araucaria heterophylla*	ഒരകേറിയ	ARAUCARIA	1
24.	*Palmacaea*	അലങ്കാര പന	HYOPHORBE	1
25.	*Ficus exasperata*	തേരകം	SAND PAPER TREE	1

CALL 1912

Demand/Disconnection Notice
(As per Reg 122 of Supply Code 2014)
Ranny North Section
0473-5226355

C#: 114607600773

Bill# : 460722050006 773
Conn Id : 6732710
Name : PRINCIPAL
St Thomas CollegeRa
C Status : Connected
Pole : 163.0
Trans : RANNY COLLEGE
Meter# : 0000300773
Bill Area : RDI/1/59
Bill Date : 01/05/2022
Due Date : 11/05/2022
Disconn Dt : 26/05/2022
Tariff : LT-6A NDom
Purpose : Educational Ins
S Deposit : 7210
Meter(RK) Status OK
Load : 22 KW
C Demand : 21.49 KVA
Phase : 3
Prv Rd Dt : 01/04/2022
Prs Rd Dt : 01/05/2022
Rt Rd(CNF) : 1

(3)

Prev. Payment

Prv Paid Dt : 12-04-2022
Prv Paid Rst : 5931

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KVH/R/I	2021	1526	495	575

Bill Details

Fixed Charges	1830.00
Meter Rent	11.70
Energy Charges	2671.72
Duty	267.15
Round off	0.35
Bill Amount	4551.00
Surcharge	2.00
Payable	4553.00

4553

Remarks
Prv Amnt 15 CGST 9% 1.35 SGST 9% 1.35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VI +1 36 /1140876
05-05-2022 9 09 03 AM

CALL 1912

Demand/Disconnection Notice
(As per Reg 122 of Supply Code 2014)
Ranny North Section
0473-5226355

C#: 114607101987?

Bill# : 460722050006 19877
Conn Id : 12043671
Name : THE MANAGER
ST THOMAS COLLEGE
C Status : Not Using
Pole : 18V 17/17
Trans : KOIPPUZHA-KAREIMANTTY
Meter# : 22129
Bill Area : RDI/1/60
Bill Date : 01/05/2022
Due Date : 11/05/2022
Disconn Dt : 26/05/2022
Tariff : LT-6C NDom
Purpose : ATM Counter
S Deposit : 4578
Meter(RK) Status OK
Load : 6 KW
C Demand : 5.3 KVA
Phase : 3
Prv Status : Average
Rel Rd Dt : 01/05/2020
Prv Rd Dt : 01/04/2022
Prs Rd Dt : 01/05/2022
Rt Rd(CNF) : 1

(2)

Prev. Payment

Prv Paid Dt : 12-04-2022
Prv Paid Rst : 1099

Doorlock Details

Lst DI Dt : 01-07-2020
DI Count : 21

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KVH/R/I		5735	0	0

Bill Details

Fixed Charges	1080.00
Meter Rent	11.70
Energy Charges	0.00
Duty	0.00
Round off	0.30
Bill Amount	1092.00
Advance	0.00
Surcharge	7.00
Payable	1099.00

1099

Remarks
Prv Amnt 15 CGST 9% 1.35 SGST 9% 1.35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VI +1 36 /1140876
05-05-2022 9 09 03 AM

CALL

Ranny North Section
0473-5226355

2000
540-

(1)

Doorlock Details

Lst DI Dt : 01-07-2021
DI Count : 0

Readings & Cons

Bill Details

Remarks 1294/-

PRASAD DATHEVAN
Meter T


CALL
1912
Ranni North Section
0473-5226155
Prev. Payment
Readings & Cons.
Bill Details
Remarks
BIJU D
Sub Engineer
16945
13641
13642
3872
10161
1799

Demand/Disconnection Notice
(As per Reg 122 of Supply Code 2014)
Customer Care
1912
Ranny North Section
0473-5226355
KSEBL-GSTIN: 32AAECK2277N1Z1
C#: 1146071019877

Bill# : 460722040089S 19877
Conn Id : 12043471
Name : THE MANAGER
ST. THOMAS COLLEGE
C Status : Not Using
Pole : IRY 12/17
Trans : K6GPPUZHR-kRRINGUTTY
Meter# : 22129
Bill Area : M31/1/69
Bill Date : 01/04/2022
Due Date : 11/04/2022
Discom Dt : 25/04/2022
Tariff : LT-6C NDom
Purpose : GTA Counter
S Deposit : 4578
Meter(MM) Status OL
Load : 6 KW
C Demand : 5.3 KVA
Phase : 3
Prv Status: Average
Nxt Rd Dt : 01/05/2022
Prv Rd Dt : 01/03/2022
Prs Rd Dt : 01/04/2022
Mt Rd(DMF): 1

(9)

Prev. Payment

Prv Paid Dt : 10-03-2022
Prv Paid Amt : 1098

DoorLock Details

Lst DI Dt : 01-07-2020
DI Count : 20

Readings & Cons.

Unit	Curr	Prev	Cons	Avg
KWH/R/1	5735	0	0	

Bill Details

Fixed Charges	1080 00
Meter Rent	17 70
Energy Charges	0 00
Duty	0 00
Round off	0 30
Bill Amount	1098 00
Advance	0 00
Payable	1098 00

1098

Remarks
Mtr Rent 15 CGST 9% 1 35 SGST 9% 1 35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1.35 /11000756
04-04-2022 12:55:40 PM

Demand/Disconnection Notice
(As per Reg 122 of Supply Code 2014)
Customer Care
1912
Ranny North Sec...n
0473-5226355
KSEBL-GSTIN: 32AAECK2277N1Z1
C#: 1146070013641

Bill# : 460722040089S 13641
Conn Id : 6786199
Name : MANAGER
ST. THOMAS CHURCHES
C Status : Connected
Pole : IRY 17/17
Trans : K6GPPUZHR-kRRINGUTTY
Meter# : 15695131
Bill Area : M31/1/61
Bill Date : 01/04/2022
Due Date : 11/04/2022
Discom Dt : 25/04/2022
Tariff : LT-7A Com
Purpose : Hostel/Lodges/G
S Deposit : 17058
Meter(MM) Status OK
Load : 16 KW
C Demand : 15 KVA
Phase : 3
Prv Rd Dt : 01/03/2022
Prs Rd Dt : 01/04/2022
Mt Rd(DMF): 1

(5)

Prev. Payment

Prv Paid Dt : 10-03-2022
Prv Paid Amt : 14242

Readings & Cons.

Unit	Curr	Prev	Cons	Avg
KWH/R/1	38935	37512	1353	950

Bill Details

Fixed Charges	[illegible]
Meter Rent	17 70
Energy Charges	12954 93
Duty	1295 49
Round off	-0 09
Bill Amount	16500 00
Payable	16500 00

16508

Remarks
Mtr Rent 15 CGST 9% 1 35 SGST 9% 1 35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1.35 /11000766
04-04-2022 12:50:47 PM

Demand/Discon... (As per Reg 122 of ... 2016)
Customer Care
1912
Ranny North Sec...n
0473-5226355
KSEBL-GSTIN: 32AAECK2277N1Z1
C#: 1146007/6UU[illegible]

Bill# : 460722040089S 783
Conn Id : 6732710
Name : PRINCIPAL
St Thomas College-Pa
C Status : Connected
Pole : T63.0
Trans : RANNY COLLEGE
Meter# : 0000000773
Bill Area : M31/1/59
Bill Date : 01/04/2022
Due Date : 11/04/2022
Discom Dt : 25/04/2022
Tariff : LT-6A NDom
Purpose : Educational Ins
S Deposit : 7210
Meter(MM) Status OK
Load : 22 KW
C Demand : 21.09 KVA
Phase : 3
Prv Rd Dt : 01/03/2022
Prs Rd Dt : 01/04/2022
Mt Rd(DMF): 1

(7)

Prev. Payment

Prv Paid Dt : 10-03-2022
Prv Paid Amt : 6253

Readings & Cons.

Unit	Curr	Prev	Cons	Avg
KWH/R/1	1516	899	627	565

Bill Details

Fixed Charges	1430 00
Meter Rent	17 70
Energy Charges	[illegible]
Duty	407 55
Round off	0 25
Bill Amount	5931 00
Payable	5931 00

5931

Remarks
Mtr Rent 15 CGST 9% 1 35 SGST 9% 1 35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1.35 /11000766
04-04-2022 12:58:24 PM

Demand/Disconnection Notice
(Rs per Reg 122 of Supply Code 2014)
Customer Care
1912
Ranny North Sect ..
0473 5226125
C#: 11460730138642

Bill# : 460722040D0892 13642
Conn Id : 6786205
Name : Manager
ST Thomas Church&a
C Status : Connected
Pole : T63_0
Trans : RANNY COLLEGE
Meter# : 0011202013
Bill Area : MD1/1/ST
Bill Date : 01/04/2022
Due Date : 11/04/2022
Disconn Dt: 26/04/2022
Tariff : LT-6A NOon
Purpose : Educational Ins
S Deposit : 3306
Meter(MM) Status OK
Load : 16 KW
C Demand : 16 KVA
Phase : 3
Prv Rd Dt : 01/03/2022
Prs Rd Dt : 01/04/2022
Mt Rd(DMF): 1

4

Prev. Payment

Prv Paid Dt : 10-03-2022
Prv Paid Amt : 2374

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KWH/R/I	20443	20277	166	140

Bill Details

Fixed Charges	1040 00
Meter Rent	17 70
Energy Charges	945 20
Duty	94 62
Round off	0 48
Bill Amount	2099 00
Payable	2099 00

2099

Remarks
Mtr Rent 15 CCST 9% 1 35 SGST 9% 1 35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1 35 /110000766
04-04-2022 12 53 27 PM

Demand/Disconnection Notice
(Rs per Reg 122 of Supply Code 2014)
Customer Care
1912
Ranny North Sect ..
0473 5226125
C#: 11460790816949

Bill# : 460722040D0893 16949
Conn Id : 6798950
Name : Principal
PATHANAMTHITTA
C Status : Connected
Pole : T63_0
Trans : RANNY COLLEGE
Meter# : 0011201577
Bill Area : MD1/1/SB
Bill Date : 01/04/2022
Due Date : 11/04/2022
Disconn Dt: 26/04/2022
Tariff : LT-6A NOon
Purpose : Educational Ins
S Deposit : 6598
Meter(MM) Status OK
Load : 35 KW
C Demand : 35 KVA
Phase : 3
Prv Rd Dt : 01/03/2022
Prs Rd Dt : 01/04/2022
Mt Rd(DMF): 1

15

Prev. Payment

Prv Paid Dt : 10-03-2022
Prv Paid Amt : 4011

Readings & Cons

Unit	Curr	Prev	Cons	Avg
KWH/R/I	43755	43453	252	315

Bill Details

Fixed Charges	2275 00
Meter Rent	17 70
Energy Charges	1654 40
Duty	[illegible]
Round off	0 40
Bill Amount	4124 00
Payable	4124 00

4124

Remarks
Mtr Rent 15 CCST 9% 1 35 SGST 9% 1 35

Pay Online https://wss.kseb.in
BIJU D
Sub Engineer
SBM VT -1 35 /110000765
04-04-2022 12 55 16 PM