GREEN AUDIT REPORT

ST THOMAS COLLEGE (AUTONOMOUS)

THRISSUR

2020-21

OTTOTRACTIONS
Energy-Engineering-Environment

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Executed by

IRTC

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Report No: EA 774

2021-June

About IRTC

IRTC is a grant-in-aid institution of KSCSTE, Govt. of Kerala and a Core grant supported institution of DST, Govt. of India. They also supported by, ICSSR, UGC, NABARD, and various government departments. They also function as an accredited training centre of KILA, IKM, MPEDA, etc. and also as a Project Facilitation Agency for various government undertakings. IRTC has received prestigious **Kerala State Energy Conservation Award, 1999**.

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.

Acknowledgment

We were privileged to work together with the administration and staff of St.Thomas' College (Autonomous) Thrissur for their timely help extended to complete the audit and bringing out this report. We thank Dr.Ignatius Antony, Dr. Joy K L, Rev.Dr. Anil George K (IQAC Co Ordinator), Dr.Joby Paul (Co-Ordinator Green Audit Committee) for their advises and support during the audit.

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

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

Contents

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Certification

This is to certify that

The data collection has been carried out diligently and truthfully;

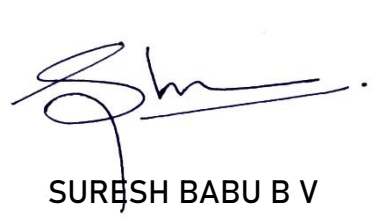
All data monitoring devices are in good working condition and have been calibrated or certified by approved agencies authorised and no tampering of such devices has occurred;

All reasonable professional skill, care and diligence had been taken in preparing the 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 green audit for the period 2018-21 has been carried out in accordance with the various rules and regulations in India.

This Certificate is issued to St Thomas College (Autonomous) on their request.

Dated this 5th day of October 2021.



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Introduction

1.1 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 (Autonomous) Thrissur 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 (Autonomous), Thrissur

St. Thomas College (Autonomous), Thrissur, is the premier Catholic College in Kerala founded by His Excellency Rt. Rev. Adolphus Medlycott, Ph.D, the Vicar Apostolic of Trichur. The College has a meritorious educational tradition and is one of the leading centres of higher education in Kerala since 1919. This institution is older than all the Universities in Kerala and currently is one of the largest and most reputed Arts and Science Colleges in the State.

The College has 21 departments, 15 PG programmes 23 UG programmes and 10 research centres. The college is situated at the heart of the Thrissur city in an academic-friendly atmosphere. The college is located in 11.68 hectares of land spanning across the Thrissur city with a total built up area 16567 m^2.

Occupancy Details					
Particulars	2016-17	2017-18	2018-19	2019-20	2020-21
Total Students	2661	2665	2776	3051	3256
Staffs	155	159	162	166	164
Total Occupancy of the college	2816	2824	2938	3217	3420

For calculating per capita carbon emission estimation, only the student strength is taken into account and the data of 2019-20 is taken for assessment because of the lock down due to the pandemic year 20-21

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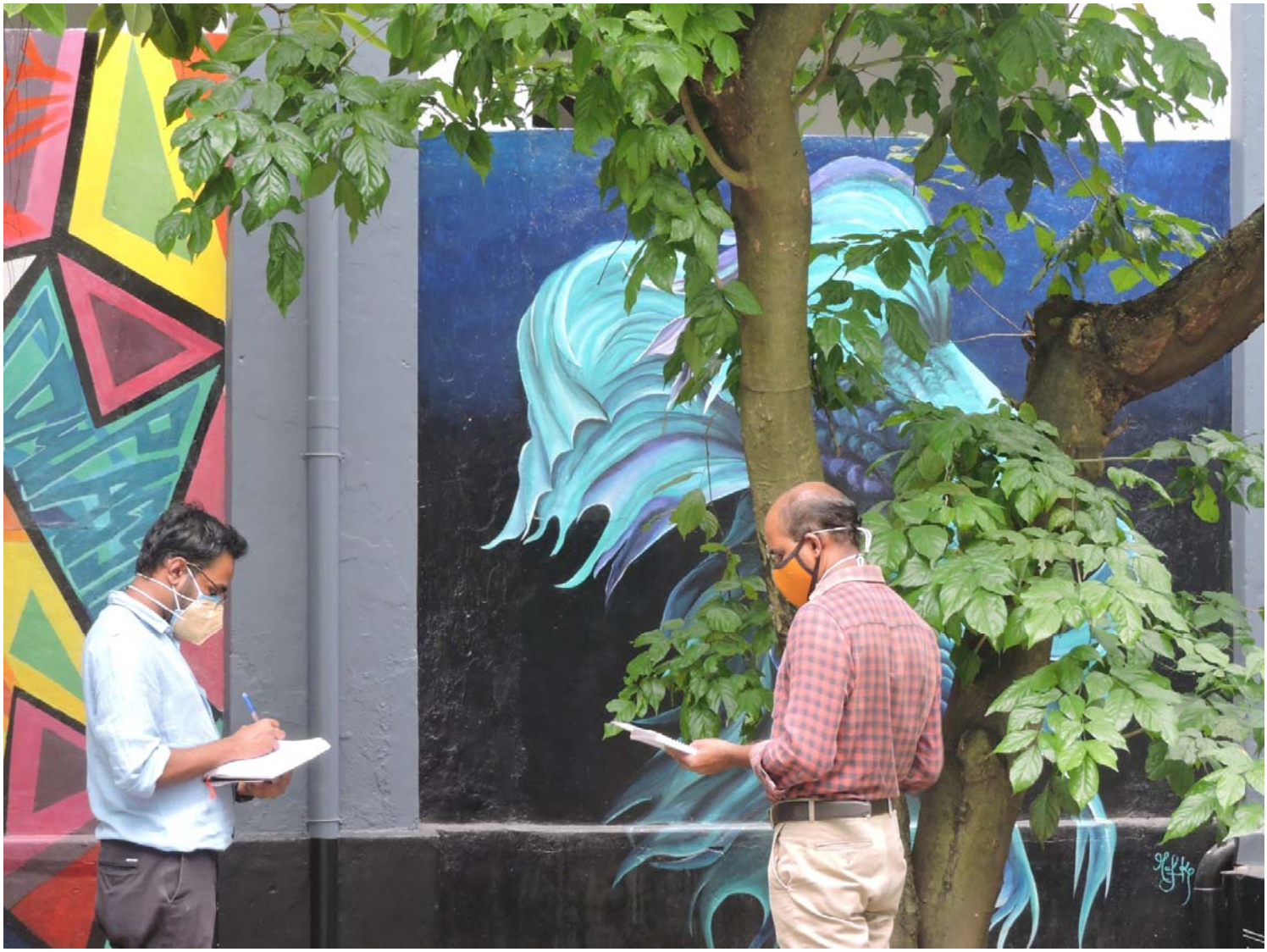
METHODOLOGY



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 2862 occupants of this campuses will reach same number of households. This message will spread to at least 11,500 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).

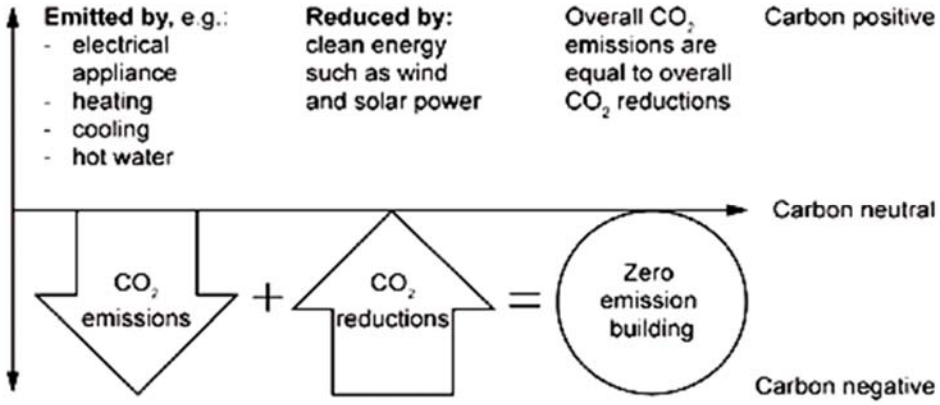
Global Warming Potentials (IPCC Second Assessment Report)					
Species	Chemical formula	Lifetime (years)	Global Warming		
			20 years	100 years	500 years
Carbon dioxide	CO2	variable §	1	1	1
Methane *	CH4	12±3	56	21	6.5
Nitrous oxide	N2O	120	280	310	170
HFC-23	CHF3	264	9100	11700	9800
HFC-32	CH2F2	5.6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

The campus operates 1 vehicles for its logistics.

Carbon emission from transportation is 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 in the technical supplements of this document.

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RESULTS AND DISCUSSIONS

3.1 CARBON FOOTPRINT ESTIMATION

3.1.1 ENERGY

a. Electricity

Electricity is purchased from Thrissur Corporation under one HT connection and 5 LT Connections, the details are given below.

Electricity Connection Details (2020-21) (HT Connection)		
ST.THOMAS COLLEGE (AUTONOMOUS)		
1	Name of the Consumer	St. Thomas' College (Autonomous), Thrissur, Kerala, India - 680001
2	Tariff	HT 4 A
3	Consumer Number	HTLXV
4	Contract Demand (kVA)	60
5	Connected Load	109.47
6	Annual Electricity Consumption (kWh)	53054

LT Connection details		
Sl.No	Consumer No.	Connected Load (kW)
1	108	44
2	4259-B	5
3	4816	7
4	9594-A	10
5	I/1646	5

Electricity Bill Analysis (from 2016 to 2021)

HT consumer details

HT-LXV Consumption					
Annual unit consumption in kWh					
Year	2016-17	2017-18	2018-19	2019-20	2020-21
kWh	82501.00	84476.00	75337.00	76205.00	53054.00

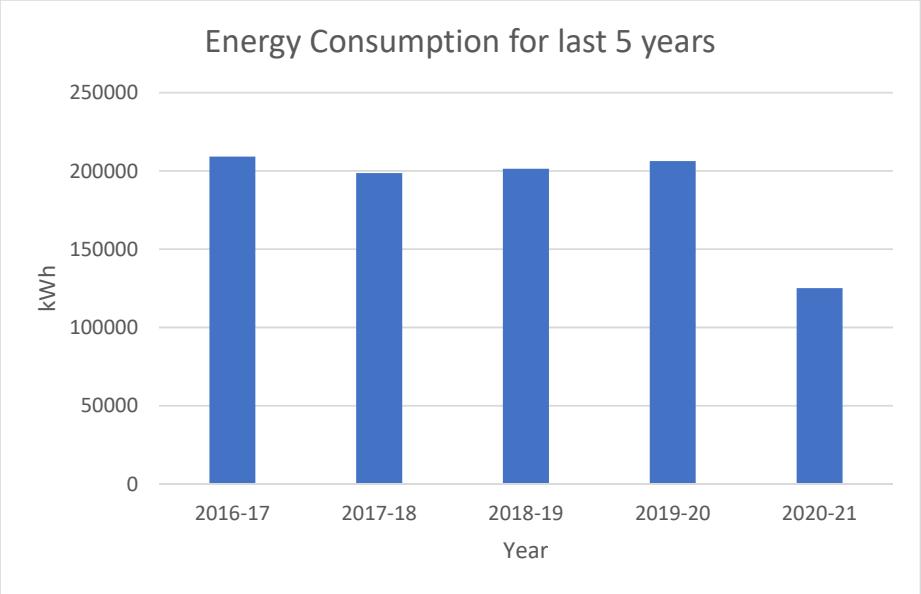
LT Consumer details

LT Consumer Nos		kWh/Yr				
		2016-17	2017-18	2018-19	2019-20	2020-21
1	108	50913.33	47680.00	51260.00	53800.00	42386.00
2	4259-B	6072.00	6152.00	8331.00	9425.00	3868.00
3	4816	20113.00	22397.00	18132.00	43212.00	23395.00
4	9594-A	3903.00	3626.00	2712.00	2353.00	1129.00
5	I/1646	24601.00	25855.00	36292.00	605.00	146.00
	Total	105602.33	105710.00	116727.00	109395.00	70924.00

The baseline data of energy consumption for the last 5 year is given below.,

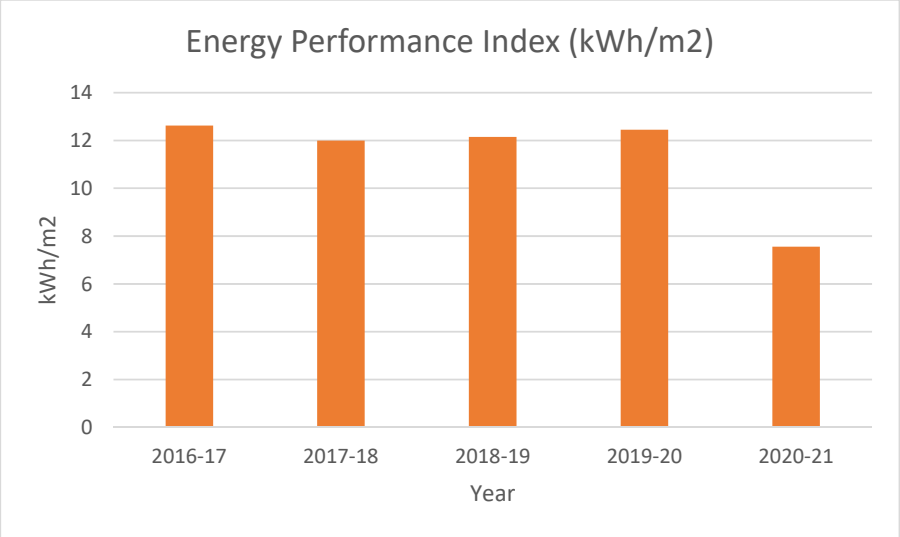
Base Line Energy Data						
ST.THOMAS COLLEGE (AUTONOMOUS)						
		2016-17	2017-18	2018-19	2019-20	2020-21
1	Electricity KSEB (kWh)	188103	190186	192064	185600	123978
2	Electricity Solar - Off grid (kWh)	0.00	0.00	6300.00	6300.00	6300.00
3	Electricity (KSEB + Off grid) kWh	188103	190186	198364	191900	130278
4	Electricity Grid Tied (kWh)	0.00	0.00	0.00	18900.00	18900.00
5	Diesel (L)	4138.46	2840.28	1916.04	1743.51	194.03
6	LPG (kg)	3800.00	4180.00	4389.00	3610.00	1824.00
7	Biogas (m3)	0.00	0.00	0.00	0.00	300.00

Energy Consumption Profile						
Sl No	Fuel	2016-17	2017-18	2018-19	2019-20	2020-21
		(kCal)				
1	Electricity	161768867	163559960	170593040	165034000	112039080
2	Diesel	43453846	29822917	20118409	18306818	2037313
3	LPG	45600000	50160000	52668000	43320000	21888000
4	Biogas	0.00	0.00	0.00	0.00	1050000.00
Total		250822713	243542877	243379449	226660818	137014393



Specific Energy Consumption

OTTOTRACTIONS- ENERGY AUDIT						
ST.THOMAS COLLEGE (AUTONOMOUS)						
Energy Performance Index (EPI)						
Sl No	Particulars	2016-17	2017-18	2018-19	2019-20	2020-21
1	Total building area (m^2)	16567.00	16567.00	16567.00	16567.00	16567.00
2	Annual Energy Consumption (kCal)	250822712.82	243542876.67	237961449.09	242914818.18	153268393.43
3	Annual Energy Consumption (kWh)	291654.32	283189.39	276699.36	282459.09	178219.06
4	Total Energy in Toe	25.08	24.35	23.80	24.29	15.33
5	Specific Energy Consumption kWh/m^2	17.60	17.09	16.70	17.05	10.76



In 2020-21 the energy consumption was less due to lock down based on covid 19 pandemic.

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. The waste such produced is Transfer to Thrissur Corporation for management.

Degradable Waste

Degradable Waste Generation

ST.THOMAS COLLEGE (AUTONOMOUS)					
	2016-17	2017-18	2018-19	2019-20	2020-21
Waste generated in kg /day	56.32	56.48	58.76	64.34	68.4
Waste generated in kg /Yr	11264	11296	11752	1930.2	1368

In 20-21, due to pandemic only staffs were available in the campus

Non-Degradable waste

Solid non degradable Waste Generation

ST.THOMAS COLLEGE (AUTONOMOUS)					
	2016-17	2017-18	2018-19	2019-20	2020-21
Waste paper generated in kg /day	2.816	2.82	2.94	3.22	3.42
Waste plastic generated in kg /day	0.9856	0.9884	1.0283	1.12595	1.197
Waste paper generated in kg /Yr	371.71	372.77	387.82	212.32	150.48
Waste plastic generated in kg /Yr	130.10	130.47	135.74	74.31	52.67

3.4. Transportation

The college owns car (diesel) for transporting. The diesel consumed by the vehicle of the college from 2016-17 to 2020-21 are given below.

Diesel Consumption

Year	Diesel (L)
2016-17	4138.46
2017-18	2840.28
2018-19	1916.04
2019-20	1743.51
2020-21	194.03

*the details are taken from the log book

Carbon Emission Profile (2020-21)

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 2016-17

Sl. No.	Particulars	2016-17	tCO2e
1	Electricity (kWh)	188103.3	154.2
2	Diesel (L)	4138.46	5.79
3	LPG (kg)	3800.00	5.70
4	Biogas (m3)	0.00	0.00
5	Degradable Waste in kg/yr.	11264	7.10
6	Paper Waste in kg/yr	371.71	0.21
7	Plastic Waste in kg/yr	130.10	0.04
Total Carbon Foot Print tCO2e/yr			173.09

Carbon Foot Print 2017-18

Sl. No.	Particulars	2017-18	tCO2e	tCO2e
1	Electricity (kWh)	190186.0	156.0	122.3
2	Diesel (L)	2840.28	9.09	0.62
3	LPG (kg)	4180.00	6.27	2.74
4	Biogas (m3)	0.00	0.00	0.42
5	Degradable Waste in kg/yr.	11296.00	7.12	0.86
6	Paper Waste in kg/yr	372.77	0.21	0.08
7	Plastic Waste in kg/yr	130.47	0.04	0.02
Total Carbon Foot Print tCO2e/yr			178.68	127.07

Carbon Foot Print 2019-20

Sl. No.	Particulars	2019-20	tCO2e
1	Electricity (kWh)	210800.0	172.9
2	Diesel (L)	1743.51	5.58
3	LPG (kg)	3610.00	5.42
4	Biogas (m3)	0.00	0.00
5	Degradable Waste in kg/yr.	1930.20	1.22
6	Paper Waste in kg/yr	212.32	0.12
7	Plastic Waste in kg/yr	74.31	0.03
Total Carbon Foot Print tCO2e/yr			185.21

Carbon Foot Print 2020-21

Sl. No.	Particulars	2020-21	tCO2e
1	Electricity (kWh)	149178.0	122.3
2	Diesel (L)	194.03	0.62
3	LPG (kg)	1824.00	2.74
4	Biogas (m3)	300.00	0.42
5	Degradable Waste in kg/yr.	1368.00	0.86
6	Paper Waste in kg/yr	150.48	0.08
7	Plastic Waste in kg/yr	52.67	0.02
Total Carbon Foot Print tCO2e/yr			127.07

Mitigation Through Renewable Energy

Sl No	Source	2019-20	tCO2e	2020-21	tCO2e
1	Electricity Consumption kWh /Yr (Solar)	25200.00	20.66	25200.00	20.66
2	Biogas Consumption in M3/yr	0.00	0.00	300.00	0.42
				Total tCO2e	20.66

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	2016-17	2017-18	2018-19	2019-20	2020-21
Total number of trees	223	242	248	273	281
Carbon sequestrated by trees in the campus (tCO_2e)	37.08	39.03	43.37	45.65	48.06

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 3.18. 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

Carbon sequestrated by each species of trees in the campus compound is given in the Table.3.19 Detailed calculation results are listed out in the tables provided in the technical supplements of 'Carbon sequestration'.

Form 5										
Sl. No	Name of tree (common name/ scientific name)	Circumference	Stem diameter (cm)	Height of trees (m)	Total weight of tree (Kg)	Weight of carbon in the tree* (tCO_2e)	No. of similar trees	Total carbon sequestrated (tCO_2e)	Carbon Sequestrated by each species	Average age (years)
1	Teak	106	33.74	6	141.80	0.19	10	1.885	0.188	9
2	Teak	97	30.88	5.2	102.91	0.14	2	0.274	0.137	6

3	Teak	101	32.15	5.6	120.16	0.16	3	0.479	0.160	7
4	Mango Tree	62	19.74	4	32.34	0.04	10	0.430	0.043	4
5	coconut palm	56	17.83	7	46.17	0.06	40	2.455	0.061	8
6	coconut palm	53	16.87	6	35.45	0.05	20	0.942	0.047	7
7	coconut palm	57	18.14	7	47.84	0.06	22	1.399	0.064	9
8	coconut palm	55	17.51	6	38.18	0.05	50	2.537	0.051	7
9	coconut palm	52	16.55	6	34.13	0.05	1	0.045	0.045	7
10	coconut palm	94.72	30.15	3	56.61	0.08	2	0.150	0.075	7
11	Macaranga peltata	140	44.56	8	329.82	0.44	3	1.315	0.438	9
12	Mahagoni	166.4	52.97	11	640.66	0.85	1	0.851	0.851	12
13	Jack tree	172.72	54.98	10	627.50	0.83	8	6.672	0.834	12
14	Bridelia retusa	132	42.02	8	293.20	0.39	1	0.390	0.390	7
15	Teak	114	36.29	9	246.02	0.33	16	5.232	0.327	12
16	Tamarind	136	43.29	9	350.14	0.47	4	1.861	0.465	10
17	Teak	122	38.81	10	312.66	0.42	21	8.726	0.416	14
18	Mango Tree	108	34.38	9	220.81	0.29	1	0.293	0.293	8
20	sandpaper tree	90	28.65	7	119.26	0.16	1	0.159	0.159	6
23	Acacia mangium	112	35.65	9	237.47	0.32	2	0.631	0.316	9
24	Acacia	108	34.38	8	196.27	0.26	1	0.261	0.261	9
25	Macaranga peltata	139	44.20	8	324.44	0.43	2	0.862	0.431	10
26	Teak	119	38.00	10	299.77	0.40	4	1.594	0.398	9
27	coconut palm	68	21.65	8	77.81	0.10	10	1.034	0.103	8
28	Nutmeg	62	19.74	7	56.60	0.08	1	0.075	0.075	10
29	Rubber tree	68	21.65	6	58.36	0.08	25	1.939	0.078	8

30	sandpaper tree	48	15.36	5	24.49	0.03	1	0.033	0.033	14
31	Millettia pinnata	48	15.28	7	33.92	0.05	1	0.045	0.045	14
32	Golden Shower Tree	50	15.92	6	31.55	0.04	1	0.042	0.042	15
33	false ashoka	50.8	16.17	8	43.43	0.06	2	0.115	0.058	16
34	Jack tree	104	33.10	8	182.00	0.24	1	0.242	0.242	16
35	Paradise Tree	48	15.28	8	38.77	0.05	1	0.052	0.052	14
36	Teak	248.92	79.23	10	1303.30	1.73	2	3.464	1.732	14
37	Neem	52	16.55	8	45.50	0.06	1	0.060	0.060	16
38	Mango Tree	125	39.79	4	131.46	0.17	1	0.175	0.175	14
39	coconut palm	68	21.65	4	38.90	0.05	1	0.052	0.052	8
40	Malay Apple	48	15.28	4	19.39	0.03	1	0.026	0.026	8
41	Golden Shower Tree	55	17.51	4	25.45	0.03	1	0.034	0.034	8
42	Champaca	126	40.11	4	133.58	0.18	2	0.355	0.178	10
						Total	277	47.19	9.43	

Details of the trees having diameter more than 15cm and having heights above 150cm from ground level is taken for the study

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 **185.21 tCO_2e** per year (2019-20) by the campus. The total carbon sequestration by trees in the campus compound is **45.65 tCO_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 of last five completed financial years.

Specific CO2 Footprint

Amount of Carbon to be mitigated for Low Carbon Campus						
Sl No	Particulars	2016-17	2017-18	2018-19	2019-20	2020-21
1	Total carbon emission tCO2e	173.09	178.68	177.87	185.21	127.07
2	Total carbon sequestration tCO2e	37.08	39.03	43.37	45.65	48.06
3	Amount of carbon mitigated through renewable energy tCO2e	0.00	0.00	0.00	20.66	21.08
4	To be mitigated tCO2e	136.00	139.65	134.50	118.89	57.93
5	Total No of Students	2661	2665	2776	3051	3256
6	Specific Carbon Footprint kg CO2e/Student/Yr	51.11	52.40	48.45	38.97	17.79

Specific Carbon Footprint kg CO2e/Student/Yr	
2016-17	51.11
2017-18	52.40
2018-19	48.45
2019-20	38.97
2020-21	17.79

The total specific carbon emission is estimated as 38.97 kg of CO_2e per student for the year 2019-20. The last completed financial year 2020-21 is not considered for benchmarking due to the lockdown imposed during Covid 19 pandemic year.

4

Carbon Mitigation Plans

The total emission of the carbon dioxide per student is **49.94** kg per year (assessment year 2019-20). 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.

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'

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 (AUTONOMOUS)						
Greenhouse Gas Mitigation through Major Energy Efficiency Projects						
Sl No	Projects	Energy saved(Yearly)		Sustainability (Years)	First year ton of CO_2 mitigated	CO_2 mitigated through out life
		(kWh)	MWh	Years		
1	Energy Saving in Lighting by replacing existing 96 No's T12 Lamps to 18W LED Tube	2830.08	2.83	10	2.07	20.66
2	Energy Saving in Lighting by replacing existing 121 No's T8 Lamps to 18W LED Tube	2928.20	2.93	10	2.14	21.38
3	Energy Saving in Lighting by replacing existing 13 No's IC Lamps to 18W LED Tube	936	0.94	10	0.68	6.83
4	Energy Saving by replacing existing 579 No's in-efficient ceiling fans with Energy Efficient Five star fans	7795	7.80	10	5.69	56.90
	Total	8731	9	10	6	64

OTTOTRACTIONS- ENERGY AUDIT						
ST.THOMAS COLLEGE (AUTONOMOUS)						
Greenhouse Gas Mitigation through Renewable Energy Projects						
Sl No	Projects	Energy saved(Yearly)		Sustainability (Years)	First year ton of CO_2 mitigated	Tons of CO_2 mitigated through out
		(kWh)	MWh	Years		
1	Installation of 125 kW Solar Power Plant (proposed)	159688	159.69	10	116.57	1165.72
	Total	159688	160	10	117	1166

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving in Lighting by replacing existing 96 No's T12 Lamps to 18W LED Tube	
Existing Scenario	
96 numbers of T12 lamps were identified during the energy audit field survey in the campus including all buildings. During discussion with staffs it is observed that the average utility of these fittings are of 80%.	
Proposed System	
The existing T12 may be replaced to LED tube of 18 W 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)	1600
No of fittings	96
Total load (kW)	5.28
Annual Energy Consumption (kWh)	4224
Expected Annual Energy saving for replacing all fittings (kWh)	2830
Cost of Power	13.00
Annual saving in Lakhs Rs (1st year)	0.37
Investment required for complete replacements [@Rs 450 per fittings](Lakhs Rs)	0.43
Simple Pay Back (in Months)	14.09

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving in Lighting by replacing existing 121 No's T8 Lamps to 18W LED Tube	
Existing Scenario	
121 numbers of T8 lamps were identified during the energy audit field survey in the campus including all buildings. During discussion with staffs it is observed that the average utility of these fittings are of 80%.	
Proposed System	
The existing T8 may be replaced to LED tube of 18 W 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)	1600
No of fittings	121
Total load (kW)	6.66
Annual Energy Consumption (kWh)	5324
Expected Annual Energy saving for replacing all fittings (kWh)	2928
Cost of Power	13.00
Annual saving in Lakhs Rs (1st year)	0.38
Investment required for complete replacements [@Rs 450 per fittings](Lakhs Rs)	0.54
Simple Pay Back (in Months)	17.16

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving in Lighting by replacing existing 13 No's IC Lamps to 18W LED Tube	
Existing Scenario	
13 numbers of Incandescent Lamps lamps were identified during the energy audit field survey in the campus including all buildings. During discussion with staffs it is observed that the average utility of these fittings are of 80%.	
Proposed System	
The existing ICL may be replaced to LED bulb of 9 W in phased manner and the savings will be of 90 % (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	1600
No of fittings	13
Total load (kW)	1.30
Annual Energy Consumption (kWh)	1040
Expected Annual Energy saving for replacing all fittings (kWh)	936
Cost of Power	13.00
Annual saving in Lakhs Rs (1st year)	0.12
Investment required for complete replacements [@Rs 450 per fittings](Lakhs Rs)	0.06
Simple Pay Back (in Months)	5.77

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving by replacing existing 290 No's in-efficient ceiling fans with Energy Efficient Five star fans	
Existing Scenario	
There are 290 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)	1600
Total numbers of ordinary fans	290
Total load (kW)	20.30
Annual Energy Consumption (kWh)	25984
Expected Annual Energy saving, for total replacement(kWh)	7795
Cost of Power (Rs)	13.00
Annual saving in Lakhs Rs (1st year)	1.01
Investment required for a total replacement (Lakhs Rs)[@1500 Rs per Fan with 50W at full speed]	4.35
Simple Pay Back (in Months)	51.51

Installation of 125 kW Solar Power Plant (proposed)	
Existing Scenario	
There is a good potential of solar power electricity generation. The availability of sunlight is very high. 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 125kW 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)	125
Total average kWh per day expected (3.5kWh/day average)	437.50
Total annual Generating Capacity (kWh)	159688
Cost of energy generated annually Lakhs Rs	20.76
Investment required (INR lakh)(Approx)	68.75
Simple Pay Back (in Months) lakh Rs	39.74
Life cycle in Yrs	25
Total Saving in Life Cycle (Approx) Rs Lakh	518.98

OTTOTRACTIONS- ENERGY AUDIT

Executive Summary

Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects

ST.THOMAS COLLEGE (AUTONOMOUS)

Sl No	Projects	Investment	Cost saving	SPB	Energy saved	
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr	toE/Yr
1	Energy Saving in Lighting by replacing existing 96 No's T12 Lamps to 18W LED Tube	0.43	0.37	14.09	2830	0.24
2	Energy Saving in Lighting by replacing existing 121 No's T8 Lamps to 18W LED Tube	0.54	0.38	17.16	2928	0.25
3	Energy Saving in Lighting by replacing existing 13 No's IC Lamps to 18W LED Tube	0.06	0.12	5.77	936	0.08
4	Energy Saving by replacing existing 290 No's in-efficient ceiling fans with Energy Efficient Five star fans	4.35	1.01	51.51	7795	0.67
	Total	**5.39**	**1.88**	**22.13**	**14489.48**	**1.25**

(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. toE is tonne of oil equivalent)

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	185.21
2	Carbon Sequrested tCO2e/yr	44.83
3	Carbon mitigated by Renewable Energy tCO2e/yr	20.66
4	Carbon mitigated by Energy Efficiency (Proposed) tCO2e/yr	6.37
5	Carbon mitigated by solar power plant (Proposed) (125kWp)	116.57
6	Effective Carbon footprint tCO2e/yr	-18.72
7	Total No of Students	3256
8	Specific Carbon Footprint kg CO2e/Student/Yr	-5.75

From this study it was found that carbon footprint of the campus to be -5.75 kgCO_2e/ Student/ Year in place of current footprint i.e., 38.97 kgCO_2e/ student/ Year (in 2019-20). This will be achieved after implementing energy efficiency projects and implementation of additional 125 kWp solar power plant. To achieve this an investment of **74.14 lakhs Rs** is required through energy efficiency and renewable energy projects proposed. It will be around **2277 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	5.39
2	Cost of implementation in Renewable Energy Lakhs Rs	68.75
3	Total Lakhs Rs	74.14
4	Total number of students	3256
5	Cost per student to make the campus carbon negative Rs/ Student	2277

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OTTOTRACTIONS
Energy-Engineering-Environment

ARTC

6

TECHNICAL SUPPLEMENT

Sl NO	Floor	Location	Light									
			T12	T8	T5	CFL	ICL	LEDT	LEDB	Spot LED	LEDD 12W	LED F
1	ADM B	FIrst Floor	3	1	0	1	1	67	23	2	23	0
2		Ground Floor	27	0	0	9	0	62	1	9	97	0
3	ACD B	Ground Floor	11	1				38	1			
4		First Floor						24				
5		Second Floor						164	16			
6	JB	Basement	6	4				21	3			
7		Ground Floor	5	21				4			6	
8		First Floor	14	4		25		1	1			
9		Second Floor	25	4				1	8			
10		Third Floor		10		6		4				
11	CMS	Ground Floor				27		1	13			
12		First Floor	3			31		3	7			
13		Second Floor				2		6	9	5	1	1
14	PG Hostel	Ground Floor				2	4	7	2			
15		First Floor				2	4	8	2			
16		Second Floor				2	4	8	2			
17	Hostel	Single, Double Rooms, Mess	2	76				4	12			
		Total	96	121	0	107	13	423	100	16	127	1
		Wattage	55	40	28	30	100	18	30	3	12	150
		Power	5.3	5	0	3.2	1.3	7.61	3	0.048	1.524	0.15

Sl NO	Floor	Location	FAN					IT									
			T12	T8	T5	CFL	ICL	LEDT	CF	EF	WF	PF	TV	PC	UPS	Scanner	PRINTER
1	ADM B	FIrst Floor	3	1	0	1	1	67	70	1	0	1	1	12	0	0	0
2		Ground Floor	27	0	0	9	0	62	52	3	3	2	5	37	0	0	0
3	ACD B	Ground Floor	11	1				38	17	1				1			
4		First Floor						24	40								
5		Second Floor						164	116								
6	JB	Basement	6	4				21	40	2				19			
7		Ground Floor	5	21				4	32	1			1	10			
8		First Floor	14	4		25		1	20	1	10	1		33			
9		Second Floor	25	4				1	38					2			
10		Third Floor		10		6		4	41								
11	CMS	Ground Floor				27		1	1		4			28			
12		First Floor	3			31		3	4		14			1			
13		Second Floor				2		6	9					19			
14	PG Hostel	Ground Floor				2	4	7	7								
15		First Floor				2	4	8	8								
16		Second Floor				2	4	8	8								
17	Hostel	Single, Double Rooms, Mess	2	76				4	76								
		Total	96	121	0	107	13	423	579	9	31	4	7	162	0	0	0
		Wattage	55	40	28	30	100	18	80	60	55	55	60	60	3000	25	60
		Power	5.3	5	0	3.2	1.3	7.61	46	1	2	0	0	9.7	0	0	0

Sl NO	Floor	Location	AC												
			Scanner	PRINTER	Projector	Photocopy	OTHER	1	1.5	2	4	cooler	Fridge	Lift	purifier
1	ADM B	FIrst Floor	0	0	11	0	0	0	0	0	2	0	0	0	1
2		Ground Floor	0	0	3	1	0	0	0	0	0	1	0	0	1
3	ACD B	Ground Floor								1					
4		First Floor			2								0		
5		Second Floor											4		
6	JB	Basement			1										
7		Ground Floor										1			
8		First Floor			3						5	1			
9		Second Floor			1							1			
10		Third Floor										1			
11	CMS	Ground Floor							1	2					1
12		First Floor						1		3					
13		Second Floor							1	4					
14	PG Hostel	Ground Floor													
15		First Floor													
16		Second Floor													
17	Hostel	Single, Double Rooms, Mess													
		Total	0	0	21	1	0	1	2	10	7	5	4	0	3
		Wattage	25	60	100	800	60	1500	2000	2500	9000	200	500	5000	40
		Power	0	0	2.1	0.8	0	1.5	4	25	63	1	2	0	0.12

ST.THOMAS COLLEGE (AUTONOMOUS)													
Electricity Bill Analysis 2020-21													
Months	kWh				kVA							Rs (Total)	Rs/kWh
	Z1	Z2	Z3	Total	Z1	Z2	Z3	Max	PF	Penalty	Incentive		
Apr	3655	791	1454	5900	31	12	11	31	0.94	76		37096	6.29
May	1007	342	691	2740	8	7	5	8	0.91	345		39362	14.37
Jun	2217	506	926	3649	21	8	5	21	0.93	230		34228	9.38
Jul	2045	392	616	3053	18	8	6	18	0.91	389		41715	13.66
Aug	1453	360	613	2426	12.3	7	4	12.3	0.87	849		37708	15.54
Sep	1752	336	514	2602	23	15	5	23	0.89	582		38753	14.89
Oct	2681	404	602	3687	27	7	7	27	0.92	353		46153	12.52
Nov	2937	418	649	4004	25	9	6	25	0.94	127		48099	12.01
Dec	2579	435	646	3660	21.3	10.3	9	21.3	0.92	351		45995	12.57
Jan	4549	732	1284	6565	30.4	12	9	30.4	0.96		208	65563	9.99
Feb	4140	644	1240	6024	36.4	11	13	36.4	0.97		380	61400	9.99
Mar	6085	940	1719	8744	43.41	13.5	9.5	43.41	0.98		830	80063.00	9.16
Average	2925.00	525.00	912.83	4421.17	24.73	9.98	7.46	24.73	0.93	366.89		48011.25	11.70
Total	35100.00	6300.00	10954.00	53054.00	296.81	119.80	89.50	296.81	11.14	4402.67		576135.00	

Electricity Bill Analysis 2019-20								
Consumer No			HT-LXV					
Months	kWh				Electricity Cost (Rs)			
	2016-17	2017-18	2018-19	2019-20	2016-17	2017-18	2018-19	2019-20
Apr	4497	4954	4730	3654	37339	40558	50605	32760
May	4045	4883	4148	3522	47837	52758	34239	42563
Jun	7183	6892	5928		63413	72487	55461	
Jul	7140	7901	6667	8577	67442	73122	64864	80396
Aug	7874	7957	5080	7081	72142	83342	53120	72046
Sep	5963	6230	7451	6629	59729	60658	68738	67952
Oct	7355	7692	6174	7304	68276	69256	60252	72348
Nov	8078	8022	7532	8059	57605	71756	70419	76804
Dec	7237	7259	6064	7207	67950	67482	59963	71704
Jan	7799	7820	6623	9248	71332	70383	66554	85629
Feb	7554	7120	6866	8238	70989	66595	64601	82612
Mar	7776	7746	8074	6686	72181	70959	76084	68655
Total	82501.00	84476.00	75337.00	76205.00		799356.00		
Avg	6875.08	7039.67	6278.08	6927.73				

ST.THOMAS COLLEGE (AUTONOMOUS)										
Electricity Bill Analysis 2019-20										
	Consumer No		108							
Months	kWh					Electricity Cost (Rs)				
	2016-17	2017-18	2018-19	2019-20	2020-21	2016-17	2017-18	2018-19	2019-20	2020-21
Apr			5080	4060	4860			32004	25578	31590
May			3360	3480	0			21168	21924	3593
Jun			3480	4640	9280			21924	29232	65286
Jul			4060	4500	2340			25578	28350	19627
Aug			4100	5040	2546			25830	32532	22354
Sep			3360	4500	3280			21168	29250	26348
Oct		4840	3980	3920	1980		30492	25074	25480	17053
Nov		4240	4120	4300	2660		26712	25956	27950	21915
Dec		3780	4640	4780	3900		23814	29232	31070	30781
Jan		2880	4920	4080	3420		18144	30996	26520	27349
Feb		4340	4160	6060	3740		27342	26208	39390	29637
Mar		3760	6000	4440	4380		23688	37800	28860	34213
Total	50913.33	47680.00	51260.00	53800.00	42386.00	0.00	150192.00	322938.00	346136.00	329746.00
Avg		3973.3								

ST.THOMAS COLLEGE (AUTONOMOUS)										
Electricity Bill Analysis 2019-20										
Consumer No	4259-B									
Months	kWh					Electricity Cost (Rs)				
	2016-17	2017-18	2018-19	2019-20	2020-21	2016-17	2017-18	2018-19	2019-20	2020-21
Apr	961	604	1197	1493	1633	7400	3805	8379	10451	13597
Jun	781	570	1042	1183	1583	6152	3591	7294	8281	12036
Aug	1130	1074	1427	1849	0	8671	7518	9989	12943	836
Oct	1179	1254	1571	1783	66	9048	8778	10997	12481	1293
Dec	1087	1434	1601	1509	549	8340	10038	11207	10563	4641
Feb	934	1216	1493	1608	37	7213	8512	10451	11256	1092
Total	6072.00	6152.00	8331.00	9425.00	3868.00	46824.00	42242.00	58317.00	65975.00	33495.00

ST.THOMAS COLLEGE (AUTONOMOUS)										
Electricity Bill Analysis 2019-20										
Consumer No 4816										
Months	kWh					Electricity Cost (Rs)				
	2016-17	2017-18	2018-19	2019-20	2020-21	2016-17	2017-18	2018-19	2019-20	2020-21
Apr	2510	3125	4094	7720	6833	17254	18887	25793	48636	44414
May										
Jun	2086	3301	2432	5259	5467	14316	20903	15321	33131	37830
Jul										
Aug	3420	3687	3567	9733	2016	23561	23228	22473	61317	15360
Sep										
Oct	3285	4334	3112	5250	2022	22625	27304	19604	34125	15403
Nov										
Dec	4265	3774	3037	7934	2554	29416	23776	19133	51571	19207
Jan										
Feb	4547	4176	1890	7316	4503	31371	26308	11907	47554	33143
Mar										
Total	20113.00	22397.00	18132.00	43212.00	23395.00	138543.00	140406.00	114231.00	276334.00	165357.00

ST.THOMAS COLLEGE (AUTONOMOUS)										
Electricity Bill Analysis 2019-20										
Consumer No	9594-A									
Months	kWh					Electricity Cost (Rs)				
	2016-17	2017-18	2018-19	2019-20	2020-21	2016-17	2017-18	2018-19	2019-20	2020-21
Apr										
May	520	1285	457	334	78	6600	10280	3381	2237	468
Jun										
Jul	539	888	334	310	218	6827	7884	2238	2077	4443
Aug										
Sep	521	0	519	338	211	6681	0	3840	2264	4392
Oct										
Nov	944	558	414	417	146	11068	4130	3063	3086	3800
Dec										
Jan	668	406	499	512	200	8318	3004	3693	3789	4516
Feb										
Mar	711	489	489	442	276	8697	3618	3618	3271	4870
Total	3903.00	3626.00	2712.00	2353.00	1129.00	48191.00	28916.00	19833.00	16724.00	22489.00

ST.THOMAS COLLEGE (AUTONOMOUS)										
Electricity Bill Analysis 2019-20										
Consumer No	I/1646									
Months	kWh					Electricity Cost (Rs)				
	2016-17	2017-18	2018-19	2019-20	2020-21	2016-17	2017-18	2018-19	2019-20	2020-21
Apr	3345	3751	4721	0	93	22821	22831	29743	0	1256
May										
Jun	3495	3749	3894	324	47	22276	23725	24531	1782	959
Jul										
Aug	4508	4191	4521	1	3	30880	26403	28482	5.51	671
Sep										
Oct	3675	4926	7301	231	1	25108	31033	45995	1317	671
Nov										
Dec	4504	4288	5238	48	1	30853	27014	32999	274	671
Jan										
Feb	5074	4950	10617	1	1	34803	31185	66887	6	671
Mar										
Total	24601.00	25855.00	36292.00	605.00	146.00	166741.00	162191.00	228637.00	3384.51	4899.00