GREEN AUDIT REPORT

FAROOK TRAINING COLLEGE

KOZHIKODE

Executed by

OTTOTRACTIONS
Energy - Engineering - Environment

2023

OTTOTRACTIONS
Energy - Engineering - Environment

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

Empanelled Energy Auditor:EMCEEA-0211F
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Energy-Engineering-Environment

Green Audit Report
Farook Training College, Kozhikode
Report No: EA 1094/GA /2023

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

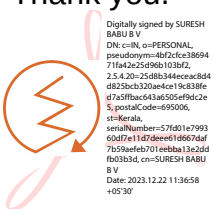
We were privileged to work together with the administration and staff of Farook Training College, Kozhikode. We are grateful to them for the timely help extended to complete the audit and bringing out this report.

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

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

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

Thank you.



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

Preface

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

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

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

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

B Zachariah
Director, OTTOTRACTIONS

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Introduction

Background

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

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

The Green Audit of **Farook Training College, Kozhikode** 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.

FAROOK TRAINING COLLEGE

Farook Training College, established in 1961 by Rauzathul Uloom Association, is the first teacher training college managed by Muslim Minority in the state to promote the cause of education in Malabar, to provide quality teacher education to all classes of people, to attract and encourage talented students towards teaching profession, especially from among financially and educationally backward Muslim minority students and the other marginalized sections of the society. The College was initially affiliated to the University of Kerala and later it was affiliated to University of Calicut in 1968

All the courses offered are recognized by National Council for teacher Education. The College has excellent infrastructure and premium faculty. The college is to make distinctive and eloquent contribution to the course of teacher education and to promote research in various branches of teacher education. The college seeks to nature the quest for excellence by assuring and providing opportunities that are equitable and accessible to students from backgrounds of any disadvantage and thereby build their capacities through commitment to the profession and values of high stature.

Occupancy Details					
Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
Total Students	276	288	316	328	324
Staffs	37	37	37	37	37
Total Occupancy of the college	313	325	353	365	361

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	Farook Training College, Kozhikode									
2	Address (include telephone, fax & e-mail)	Farook Training College Paruthipara Rd, Farook College, 673632 farooktc06@gmail.com 0495 2440662									
3	Year of Establishment	1961									
4	Name of building and Total No. of Electrical Connections/building	FTC College (1)									
5	Total Number of Students	Boys	-	Girls	-	Total	324				
6	Total Number of Staff	37									
7	Total Occupancy	361									
8	Total area of green cover	60%									
9	Type of Electrical Connection	HT	0	LT	1						
10	Total Connected Load (kW)	24									
11	Average Maximum Demand (KVA)	-									
12	Total built up area of the building (M^2)	4383.02									
13	Number of Buildings	2									
14	Average system Power Factor	0.99									
15	Details of capacitors connected	Nil									
16	Transformer Details (Nos., kVA, Voltage ratio)	TR 1									
		0									
17	DG Set Details (kVA)	DG1	DG2	DG3	DG4	DG5	Remarks				
		15	15								
18	Details of motors	Rating		Nos.		Remarks					
		5 to 10		3							
		10 to 50									
		Above 50									
19	Brief write-up about the firm and the energy/environmental conservation activities already undertaken.	Energy conservation projects, Rain water harvesting									
20	Contact Person & Telephone number	Principal									
		9496363353									

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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 361 occupants of these campuses will reach same number of households. This message will spread to at least 1444 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.

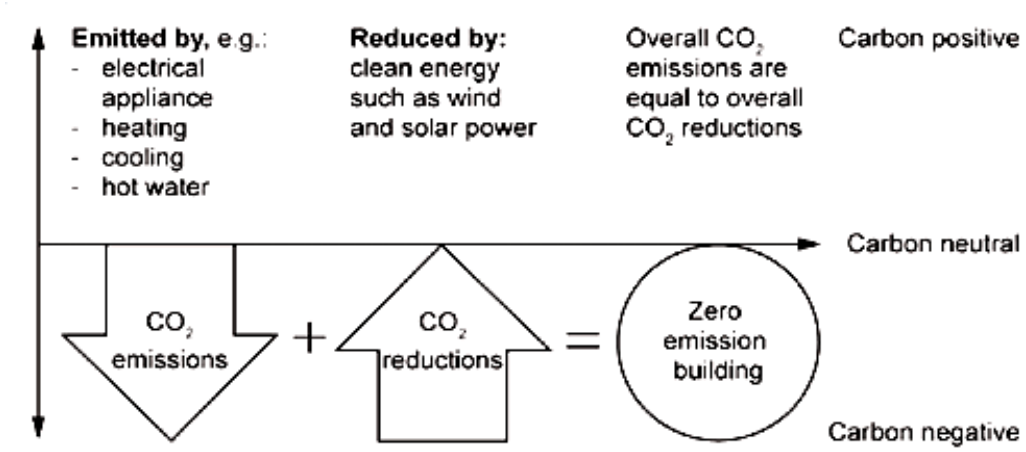
Global Warming Potential (GWP) is a measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide. The Global Warming Potential (GWP) was developed to allow comparisons of the global warming impacts of different gases. Specifically, it is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

3.1 CARBON FOOTPRINT ESTIMATION

3.1.1 ENERGY

a. Electricity

Electricity is purchased from KSEB under 1 LT Connections, the details are given below.

Electricity Connection Details		
Farook Training College, Kozhikode		
1	Name of the Consumer	Farook Training College, Kozhikode
2	Tariff	LT-6A/Ndom
3	Consumer Numbers	1166336002400
4	Connected Load Total (kW)	24
5	Annual Electricity Consumption (kWh)	17811

Electricity Bill Analysis

Electricity Bill Details (2022-23)						
Name of the Consumer			**Farook Training College, Kozhikode**			
Connected Load (kW)			**24**	Consumer no	**1166336002400**	
Tariff		**LT-6A/Ndom**		Section	**Ramanattukara**	
Month	kWh	Fixed charge (Rs)	Energy charge (Rs)	Duty (Rs)	Meter rent (Rs)	Total amount to be paid (Rs)
Apr	1957	1920	12995	1300	17.7	16377
May	1312	1920	8714	871	17.7	11620
Jun	1729	1920	11483	1148	17.7	14697
Jul	1815	1920	12049	1205	17.7	15325
Aug	1374	1920	9121	912	17.7	12072
Sep	1260	1920	8368	837	17.7	11236
Oct	1356	1920	9001	900	17.7	11939
Nov	1161	1920	7706	771	17.7	10500
Dec	1230	1920	8167	817	17.7	11012
Jan	1532	1920	10172	1017	17.7	13240
Feb	1449	1920	9620	962	17.7	12627
Mar	1636	1920	10865	1087	17.7	14010

Electricity Bill Details (2021-22)						
Name of the Consumer			**Farook Training College, Kozhikode**			
Connected Load (kW)			**24**	Consumer no	**1166336002400**	
Tariff		**LT-6A/Ndom**		Section	**Ramanattukara**	
Month	kWh	Fixed charge (Rs)	Energy charge (Rs)	Duty (Rs)	Meter rent (Rs)	Total amount to be paid (Rs)
Apr	957	1920	6356	636	17.7	9000
May	847	1920	5625	563	17.7	8188
Jun	686	1920	4556	456	17.7	7000
Jul	493	1920	3271	327	17.7	5572
Aug	1912	1920	12695	1269	17.7	16043
Sep	1010	1920	6707	671	17.7	9390
Oct	1277	1920	8480	848	17.7	11360
Nov	1371	1920	9105	910	17.7	12054
Dec	1450	1920	9630	963	17.7	12638
Jan	1770	1920	11756	1176	17.7	15000
Feb	1642	1920	10901	1090	17.7	14050
Mar	1605	1920	10658	1066	17.7	13780

Electricity Bill Details (2020-21)						
Name of the Consumer			**Farook Training College, Kozhikode**			
Connected Load (kW)			**24**	Consumer no	**1166336002400**	
Tariff		**LT-6A/Ndom**		Section	**Ramanattukara**	
Month	kWh	Fixed charge (Rs)	Energy charge (Rs)	Duty (Rs)	Meter rent (Rs)	Total amount to be paid (Rs)
Apr	957	1920	6356	636	17.7	9000
May	948	1920	6296	630	17.7	8933
Jun	596	1920	3960	396	17.7	6338
Jul	1328	1920	8815	881	17.7	11732
Aug	1075	1920	7139	714	17.7	9870
Sep	987	1920	6551	655	17.7	9217
Oct	854	1920	5672	567	17.7	8240
Nov	663	1920	4403	440	17.7	6830
Dec	892	1920	5926	593	17.7	8522
Jan	842	1920	5594	559	17.7	8153
Feb	1358	1920	9016	902	17.7	11955
Mar	1068	1920	7090	709	17.7	9816

Electricity Bill Details (2019-20)						
Name of the Consumer			**Farook Training College, Kozhikode**			
Connected Load (kW)			**24**	Consumer no	**1166336002400**	
Tariff		**LT-6A/Ndom**		Section	**Ramanattukara**	
Month	kWh	Fixed charge (Rs)	Energy charge (Rs)	Duty (Rs)	Meter rent (Rs)	Total amount to be paid (Rs)
Apr	969	1920	6433	643	17.7	9085
May	1093	1920	7256	726	17.7	10000
Jun	3118	1920	20702	2070	17.7	24940
Jul	1489	1920	9889	989	17.7	12925
Aug	1569	1920	10415	1042	17.7	13510
Sep	1635	1920	10856	1086	17.7	14000
Oct	1303	1920	8651	865	17.7	11550
Nov	1438	1920	9546	955	17.7	12544
Dec	957	1920	6356	636	17.7	9000
Jan	2093	1920	13900	1390	17.7	17382
Feb	1703	1920	11306	1131	17.7	14500
Mar	1468	1920	9749	975	17.7	12770

Electricity Bill Details (2018-19)						
Name of the Consumer			**Farook Training College, Kozhikode**			
Connected Load (kW)			**24**	Consumer no	**1166336002400**	
Tariff		**LT-6A/Ndom**		Section	**Ramanattukara**	
Month	kWh	Fixed charge (Rs)	Energy charge (Rs)	Duty (Rs)	Meter rent (Rs)	Total amount to be paid (Rs)
Apr	598	1920	3971	397	17.7	6350
May	598	1920	3971	397	17.7	6350
Jun	407	1920	2702	270	17.7	4940
Jul	996	1920	6613	661	17.7	9286
Aug	-114	1920	-754	-75	17.7	1100
Sep	975	1920	6473	647	17.7	9130
Oct	1310	1920	8695	870	17.7	11599
Nov	1558	1920	10343	1034	17.7	13430
Dec	1406	1920	9339	934	17.7	12314
Jan	1519	1920	10084	1008	17.7	13142
Feb	1608	1920	10679	1068	17.7	13803
Mar	1318	1920	8754	875	17.7	11664

Annual Electricity Consumption (kWh)						
Consumer No	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**Connected Load (kW)**
1166336002400	12179	18834	11569	15021	17811	24
TOTAL	12179	18834	11569	15021	17811	24

b. Diesel

Diesel Consumption Details				
	Transportation	Generator	Total	cost
	in L	in L	in L	in Rs
18-19	0	83.01	83	7944
19-20	0	84.71	85	8106
20-21	0	86.44	86	8272
21-22	0	88.20	88	8441
22-23	0	90.00	90	8613

c. Petrol

Petrol Consumption Details				
	Transportation	Generator	Total	cost
	in L	in L	in L	in Rs
18-19	646	0.00	646	61789
19-20	659	0.00	659	63050
20-21	672	0.00	672	64337
21-22	686	0.00	686	65650
22-23	700	0.00	700	66990

d. LPG

LPG Consumption Details					
	2018-19	2019-20	2020-21	2021-22	2022-23
No Cylinders	10	10	6	11	12
Canteen/Lab LPG Consumption in kg	150.0	150.0	90.0	165.0	180.0
Total in kg	150.0	150.0	90.0	165.0	180.0

Base Line Energy Data						
Farook Training College, Kozhikode						
		2018-19	2019-20	2020-21	2021-22	2022-23
1	Electricity KSEB (kWh)	12179	18834	11569	15021	17811
2	Electricity DG (kWh)	270	270	270	270	270
3	Electricity Solar, Off grid (kWh)	0	0	0	0	0
4	Electricity (KSEB + DG + Off grid) kWh	12449	19104	11839	15291	18081
5	Electricity Grid Tied (kWh)	0	0	0	0	0
6	Diesel (L)	83.01	84.71	86.44	88.20	90.0
7	LPG (kg)	150.00	150.00	90.00	165.00	180.00
8	Biogas generated/year (kg)	0.00	0.00	0.00	0.00	0.00

Energy Consumption Profile						
Sl No	Fuel	2018-19	2019-20	2020-21	2021-22	2022-23
		kCal				
1	Electricity	10706332	16429502	10181550	13150377	15549310
2	Diesel	871638	889426	907578	926100	945000
3	LPG	1800000	1800000	1080000	1980000	2160000
4	Biogas	0	0	0	0	0
Total		13377970	19118929	12169128	16056477	18654310

Thermal Fuel Consumption					
Farook Training College, Kozhikode					
	2018-19	2019-20	2020-21	2021-22	2022-23
Annual LPG consumption in kg	150.0	150.0	90.0	165.0	180.0
Annual Diesel consumption in L	83.0	84.7	86.4	88.2	90.0
Annual petrol consumption in L	646	659	672	686	700
Annual Biogas consumption in kg	0.00	0.00	0.00	0.00	0.00

3.2. Specific Energy Consumption

OTTOTRACTIONS- ENERGY AUDIT						
Farook Training College, Kozhikode						
Energy Performance Index (EPI)						
Sl No	**Particulars**	2018-19	2019-20	2020-21	2021-22	2022-23
1	Total building area (m^2)	4383.02	4383.02	4383.02	4383.02	4383.02
2	Annual Energy Consumption (kCal)	13377970	19118929	12169128	16056477	18654310
3	Annual Energy Consumption (kWh)	15556	22231	14150	18670	21691
4	Total Energy in Toe	1.34	1.91	1.22	1.61	1.87
5	Specific Energy Consumption kWh/m^2	3.55	5.07	3.23	4.26	4.95

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					
Farook Training College, Kozhikode					
Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
Total Occupancy	313	325	353	365	361
Waste generated in kg /day	6.26	6.5	7.06	7.3	7.22
Waste generated in kg /Yr	1377.2	1430	1553.2	1606	1588.4

Non-Degradable waste

Solid non degradable Waste Generation					
Farook Training College, Kozhikode					
Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
Total Occupancy	313	325	353	365	361
Waste paper generated in kg /day	0.0626	0.065	0.0706	0.073	0.0722
Waste plastic generated in kg /day	0.0939	0.0975	0.1059	0.1095	0.1083
Waste paper generated in kg /Yr	13.77	14.30	15.53	16.06	15.88
Waste plastic generated in kg /Yr	20.66	21.45	23.30	24.09	23.83

3.4. Transportation

The college have no vehicles for logistics

Carbon Emission Profile (2022-23)

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

Emission Factors		
Item	Factor	Unit
Electricity	0.00082	tCo2e/kWh
Diesel	0.0032	tCo2e/kg
LPG	0.0015	tCo2e/kg
Biogas	0.0014	tCo2e/kg
Petrol	0.0031	tCo2e/kg
Food Waste	0.00063	tCo2e/kg
Paper Waste	0.00056	tCo2e/kg

Carbon Foot Print 2022-23

Carbon Foot Print											
Sl. No.	Particulars	2018-19	tCO_2e	2019-20	tCO_2e	2020-21	tCO_2e	2021-22	tCO_2e	2022-23	tCO_2e
1	Electricity (kWh)	12179.2	9.99	18834.1	15.44	11569	9.49	15021	12.32	18081	14.83
2	Diesel (L)	83.013	0.27	84.707	0.27	86	0.28	88	0.28	90	0.29
3	LPG (kg)	150	0.23	150	0.23	90	0.14	165	0.25	180.00	0.27
4	Biogas (kg)	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.000
5	Degradable Waste in kg/yr.	1377.2	0.87	1430	0.90	1553.2	0.98	1606.0	1.01	1588.4	1.00
6	Paper Waste in kg/yr	13.772	0.01	14.3	0.01	15.53	0.01	16.06	0.01	15.88	0.01
Total Carbon Foot Print tCO_2e/yr			11.35		16.85		10.89		13.87		16.39

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	2018-19	2019-20	2020-21	2021-22	2022-23
Total No of Trees	47	47	47	47	47
Carbon sequestrated by trees in the campus (tCO2e)	3.0	3.4	3.7	4.1	4.61

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 in campus		
Sl.No	Name of Trees	Number
1	Prickly Custard Apple	1
2	Jackfruit tree	1
3	Bread Fruit	1
4	Bilimbi	1
5	Neem	2
6	Purple Orchid Tree	2
7	Sappan Wood	1
8	Golden Shower	3
9	Coconut	1
10	Monterey Cypress	1
11	Fern Palm	1
12	Malabar Gamboge	1
13	Chinese juniper	1
14	Henna Plant	1
15	Mango Tree	4
16	Sapota	1
17	Great Morinda	2
18	Rambutan	1
19	Indian Gooseberry	1
20	Mast Tree	14
21	Hongay Oil Tree	3
22	Guava	1
23	Black Plum	1
24	Teak	1
Total		47

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 **16.39tCO$_2$e** per year by the campus. The total carbon sequestration by trees in the campus compound is **4.61tCO$_2$e**. 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	2020-21	2021-22	2022-23
1	Total carbon emission tCO2e	11.35	16.85	13.87	16.39	16.39
2	Total carbon sequestration tCO2e	3.02	3.36	3.73	4.15	4.61
3	Amount of carbon mitigated through renewable energy tCO2e	0.00	0.00	0.00	0.00	0.00
4	To be mitigated tCO2e	8.33	13.49	10.13	12.24	11.78
5	Total No of Students	313	325	353	365	361
6	Specific Carbon Footprint kg CO2e/Student/Yr	26.61	41.50	28.71	33.55	32.64

The total specific carbon footprint is estimated as **32.64** kg of CO_2e per student for the year 2022-23.

4

Carbon Mitigation Plans

The total emission of the carbon dioxide per student is **16.39** 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 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						
Farook Training College, Kozhikode						
Greenhouse Gas Mitigation through Major Energy Efficiency Projects						
Sl No	Projects proposed	Energy saved (Yearly)		Sustainability (Years)	First year ton of CO2 mitigated	Expected Tons of CO2 mitigated throughout life cycle
		(kWh)	MWh	Years		
1	Energy Saving in Lighting by replacing existing 2 No's T8 (40W) Lamps to 18W LED Tube	42	0.04	10	0.03	0.31
2	Energy Saving in Lighting by replacing existing 15 No's T12 (55W) Lamps to 18W LED Tube	398	0.40	10	0.29	2.91
3	Energy Saving in Lighting by replacing existing 4 No's CFL (15W) Lamps to 9W LED Bulb	17	0.02	10	0.01	0.13
4	Energy Saving by replacing existing 131 No's in-efficient ceiling fans with Energy Efficient Five star fans	2465	2.46	10	1.80	17.99
Total		**2922**	**3**	**10**	**2.13**	**21.33**

OTTOTRACTIONS- ENERGY AUDIT						
Farook Training College, Kozhikode						
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

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving in Lighting by replacing existing 2 No's T8 (40W) Lamps to 18W LED Tube	
Existing Scenario	
2 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	2
Total load (kW)	0.08
Annual Energy Consumption (kWh)	77
Expected Annual Energy saving for replacing all fittings (kWh)	42
Cost of Power	9.15
Annual saving in Lakhs Rs (1st year)	0.00
Investment required for complete replacements [@Rs 300 per fittings] (Lakhs Rs)	0.01
Simple Pay Back (in Months)	18.63

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving in Lighting by replacing existing 15 No's T12 (55W) Lamps to 18W LED Tube	
Existing Scenario	
15 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	15
Total load (kW)	0.83
Annual Energy Consumption (kWh)	594
Expected Annual Energy saving for replacing all fittings (kWh)	398
Cost of Power	9.15
Annual saving in Lakhs Rs (1st year)	0.04
Investment required for complete replacements [@Rs 300 per fittings] (Lakhs Rs)	0.05
Simple Pay Back (in Months)	14.83

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving by replacing existing 131 No's in-efficient ceiling fans with Energy Efficient Five star fans	
Existing Scenario	
There are 131 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	131
Total load (kW)	9.17
Annual Energy Consumption (kWh)	8803
Expected Annual Energy saving, for total replacement(kWh)	2465
Cost of Power (Rs)	9.15
Annual saving in Lakhs Rs (1st year)	0.23
Investment required for a total replacement (Lakhs Rs) [@3000 Rs per Fan with 50W at full speed]	3.93
Simple Pay Back (in Months)	209.10

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving in Lighting by replacing existing 4 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	4
Total load (kW)	0.06
Annual Energy Consumption (kWh)	43
Expected Annual Energy saving for replacing all fittings (kWh)	17
Cost of Power	12.26
Annual saving in Lakhs Rs (1st year)	0.002
Investment required for complete replacements [@Rs 90 per fittings](Lakhs Rs)	0.004
Simple Pay Back (in Months)	20.39

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

Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects					
Farook Training College, Kozhikode					
Sl No	Projects	Investment	Cost saving	SPB	Energy saved
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr
1	Energy Saving in Lighting by replacing existing 2 No's T8 (40W) Lamps to 18W LED Tube	0.01	0.004	18.63	42
2	Energy Saving in Lighting by replacing existing 15 No's T12 (55W) Lamps to 18W LED Tube	0.05	0.04	14.83	398
3	Energy Saving in Lighting by replacing existing 4 No's CFL(15W) Lamps to 9W LED Bulb	0.004	0.002	20.39	17
4	Energy Saving by replacing existing 131 No's in-efficient ceiling fans with Energy Efficient Five star fans	3.93	0.23	209.10	2465
5	Installation of 10kWp Solar Power Plant	5.50	1.820	36.26	13688
	Total	**9.48**	**2.09**	**59.84**	**16610**
(The saving are projected as per the assumed operation time observed based in the discussions with the plant officials. The data of saving percentages are taken from BEE guide books and field measurements.)					

5

CONCLUSION

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

Net Carbon Emission after implementing Energy Efficiency projects and Renewable Energy Projects Proposed		
1	Total Carbon Foot Print tCO2e/yr	16.39
2	Carbon Sequestrated tCO2e/yr	4.61
3	Carbon mitigated by Renewable Energy tCO2e/yr (Installed)	0.00
4	Carbon mitigated by Renewable Energy tCO2e/yr (Proposed)	9.99
5	Carbon mitigated by Energy Efficiency (Proposed) tCO2e/yr	2.13
6	Effective Carbon footprint tCO2e/yr	-0.34
7	Total No of Students	324
8	Specific Carbon Footprint kg CO2e/Student/Yr	-1.05

From this study it was found that carbon footprint of the campus to be **-1.05**kgCO_2e/ Student/ Year in place of current footprint i.e.,**16.39** kgCO_2e/ student/ Year. To achieve this, an investment of **9.48Lakhs Rs** is required through energy efficiency and renewable energy projects proposed. It will be around **2927 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	3.98
2	Cost of implementation in Renewable Energy Lakhs Rs	5.50
3	Total Lakhs Rs	9.48
4	Total number of students	324
5	Cost per student to make the campus carbon negative Rs/ Student	2927

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OTTOTRACTIONS
Energy-Engineering-Environment

6

TECHNICAL SUPPLEMENT

Farook Training College, Kozhikode																							
Sl.No	Location	Lights								Fans					IT				AC	Others			
		LED-T	LED-B (9)	LED-B	LED (18W)	LED (30W)	T8	T12	CFL	CF	BLDC	WF	EF	PF	Printer	Photostat	Projector	PC	1 TR	PA	TV	Fridge	Induction Cooker
1	UGC Remedial Coaching Centre							1		1								1					
2	DECCE	2								3													
3	Physical Science Lab	2								3													
4	MEd Class 2		1			1				4								1			1		
5	Corridor		1		4	1				1													
6	Physiology Lab	2								2													
7	Research Scholars	2						2		5													
8	MEd Class 1	4								4													
9	Conference Hall				26							10			1				4	1	1		
10	Library	5	3			4				16					1			9					
11	Lunch room	2								2													
12	IQAC				5					3					1								
13	Exam Room							1		1													
14	Multipurpose Hall	2								7													
15	Principal				12					2	1							1	1				
16	Visitors Lounge				5					1													
17	Staff room	1			16					18					2							1	
18	Office	1			12		1	1		9					6	3		5					1
19	Auditorium Block	7		4						8		8					1			1			

20	Rest Room×2							2		4													
21	Science Classroom		3						1	3		1									1		
22	Corridor	1	7		3				1														
23	Malayalam Classroom							2		2							1						
24	Social Science	1							1	2							1	1					
25	English Class I		1					2		3													
26	Social Science 1	1						2		3											1		
27	Physical Science							1		1							1						
28	Malayalam I		3							4								1			1		
29	English Class 2	1					1			2							1						
30	Maths I	1	1					1		4													
31	Natural Science I		1						1	3							1						
32	Physical Classroom		3							4										1	1		
33	Canteen	1																					
34	Maths 2		1							2							1						
35	Computer Lab	6								4								25	2				
	Total	**42**	**25**	**4**	**83**	**6**	**2**	**15**	**4**	**131**	**1**	**19**	**0**	**0**	**11**	**3**	**7**	**44**	**7**	**3**	**6**	**1**	**1**

1912
CUSTOMER CARE 24X7
KSEB

Demand/Disconnection Notice
(As per Reg 122 of Supply Code-2014)
Ramanattukara Section
0495-2440319
KSEBL-GSTIN:32AAECK2277N8Z1

C#: 1166336002400

Bill# : 6633231200442
Conn.Id : 1135596
Name : PRINCIPAL
FAROOK TRAINING CO
Status : Connected
Tariff : CR121/4
Trans : S S SUHARA
Meter# : 4305903
Bill Area : MOS/3/118
Bill Date : 01/12/2023
Due Date : 11/12/2023
Disconn Dt: 26/12/2023
Tariff : LT-6A NDom
Purpose : Educational Ins
Deposit : 25062

Prev. Payment

Pay Paid Dt : 08-11-2023
Pay Paid Amt : 14006

Main Meter

Meter(MM) Status OK
Load : 24 KW
Demand : 23.372 KVA
Phase : 3
Pay Rd Dt : 01/11/2023
Cons Rd Dt : 01/12/2023
Cons Rd(OMF): 1

Readings & Cons. (MM)

Unit	Curr	Prev	Cons	Avg
KWH/A/1	93822	91720	2102	1482

Bill Details

Fixed Charges	:	1920.00
Meter Rent	:	17.70
Energy Charges	:	13978.30
Duty	:	1397.83
Fuel Sur.	:	189.18
Monthly Fuel Sur.	:	210.20
Round off	:	-0.21
Bill Amount	:	17713.00

Payable : 17713.00

Remarks
Auto Recovery FS @ 10 Paise/unit
Meter Rent:15 CGST 9%: 1.35 SGST 9%: 1.35

Pay Online https://wss.kseb.in
NAIFA RAZAK
1070194
Sub Engineer
SBM:VT -1.47 /11002712
04-12-2023 9:47:45 AM

TREE FLORA OF
FAROOK TRAINING COLLEGE CAMPUS

(in the alphabetical order of species)

Sl. No	Scientific name	Malayalam Name	English Name	Family	World Distribution	No of trees
1	***Annona muricata*** L.	□□□□□ ൻ ചക്ക	Prickly Custard Apple	Annonaceae	Native of Central America & West Indies, introduced elsewhere	1
2	***Artocarpus heterophyllus*** Lamk.	പ്ലാവ്	Jack Fruit Tree	Moraceae	Widely cultivated in the tropics, origin is probably South India	1
3	***Artocarpus incisus*** (Thunb.) L.f.	കടച്ചക്ക	Bread Fruit	Moraceae	Native of Pacific Islands	1
4	***Averrhoa bilimbi*** L.	ഇരുമ്പൻപുളി, ഓർക്കാപുളി	Bilimbi	Oxalidaceae	Native of Malaysia, cultivated in other Tropical countries	1
5	***Azadirachta indica*** Juss.	വേപ്പ്	Neem	Meliaceae	Indo-Malesia	2
6	***Bauhinia variegata*** *L.*	ചുവന്ന മന്ദാരം	Purple Orchid Tree	Caesalpinioideae	Possibly native of China; wild in the sub Himalayan and India	2
7	***Caesalpinia sappan*** L.	ചപ്പങ്ങം	Sappan Wood	Caesalpinioideae	Indo-malesia	1
8	***Cassia fistula*** L.	കണിക്കൊന്ന	Golden Shower	Caesalpinioideae	Indo-Malesia	3
9	***Cocos nucifera*** L.	തെങ്ങ്	Coconut	Arecaceae	Indo-Pacific origin. Cultivated throughout the tropics	1
10	***Cupressus torulosa*** D.Don	ഹിമാലയൻ സൈപ്രസ്	Monterey Cypress	Cupressaceae	Native of south Asia	1
11	***Cycas circinalis*** L.	ഈന്ത്	Fern Palm	Cycadaceae	Indo-Malesia and Tropical East Africa	1
12	***Garcinia gummi-gutta*** (L.) Robs.	കുടമ്പുളി	Malabar Gamboge	Clusiaceae	South India and Sri Lanka;	1
13	***Juniperus chinensis*** L.	ചൈനീസ് ജൂനിപർ	Chinese Juniper	Cupressaceae	Native of northeast Asia	1
14	***Lawsonia inermis*** L.	□□□□□□ □□	Henna plant	Lythraceae	Central Asia and India	1

15	***Mangifera indica*** L.	മാവ്, മൂച്ചി	Mango Tree	Anacardiaceae	Indo-Malesia	4
16	***Manilkara zapota*** (L.) P. Royen	സപ്പോട്ട	Sapota	Sapotaceae	Native of South America; widely cultivated in the tropics	1
17	***Morinda citrifolia*** L.	മഞ്ഞപ്പിലാവ്	Great Morinda	Rubiaceae	Indo-Malesia to Australia	2
18	***Nephelium lappaceum*** L.	□□□□□ □□□□ൻ	Rambutan	Sapindaceae	Native of Malesia and China	1
19	***Phyllanthus emblica*** L.	നെല്ലിക്ക	Indian Gooseberry	Euphorbiaceae	Native to China, Taiwan, the Indian Sub-continent. Found throughout the tropics	1
20	***Polyalthia longifolia*** (Sonner) Thw.	അരണ മരം	Mast Tree	Annonaceae	Native of Sri Lanka, introduced to many tropical countries	14
21	***Pongamia pinnata*** (L.) Pierre	ഉങ്ങ്	Hongay Oil Tree	Fabaceae	Indo-Malesia	3
22	***Psidium guajava*** L.	പേരക്ക	Guava	Myrtaceae	Originally from Tropical America; now naturalised in the tropics	1
23	***Syzygium cumini*** (L.) Skeels	ഞാവൽ	Black Plum	Myrtaceae	Indo-Malesia	1
24	***Tectona grandis*** L.	തേക്ക്	Teak	Verbenaceae	South and South East Asia	1
	TOTAL					47

Ref: **Taxonomical and Ecological studies on the Tree Flora of Farook College campus** (**Kishore Kumar**, **2014**).