Initiatives towards Green House Gas reduction

Introduction:

GHG accounting and reporting at the institution is based on the following principles:

- RELEVANCE
- COMPLETENESS
- CONSISTENCY
- TRANSPARENCY
- ACCURACY

Scope 1: Direct GHG emissions Companies report GHG emissions from sources they own or control as scope 1. Direct GHG emissions are principally the result of the following types of activities undertaken by the company:

- Generation of electricity, heat, or steam. These emissions result from combustion of fuels in stationary sources, e.g., boilers, furnaces, turbines
- Physical or chemical processing.
- Most of these emissions result from manufacture or processing of chemicals and materials, e.g., cement, aluminum, adipic acid, ammonia manufacture, and waste processing
- Transportation of materials, products, waste, and employees. These emissions result from the combustion of fuels in company owned/controlled mobile combustion sources (e.g., trucks, trains, ships, airplanes, buses, and cars)
- Fugitive emissions. These emissions result from intentional or unintentional releases, e.g., equipment leaks from joints, seals, packing, and gaskets; methane emissions from coal mines and venting; hydrofluorocarbon (HFC) emissions during the use of refrigeration and air conditioning equipment; and methane leakages from gas transport.
- SALE OF OWN-GENERATED ELECTRICITY Emissions associated with the sale of own-generated electricity to another company are not deducted/netted from scope 1. This treatment of sold electricity is consistent with how other sold GHG intensive products are accounted, e.g., emissions from the production of sold clinker by a cement company or the production of scrap steel by an iron and steel company are not subtracted from their scope 1 emissions. Emissions

associated with the sale/transfer of own-generated electricity may be reported in optional information.

Scope 2: Electricity indirect GHG emissions

- Companies report the emissions from the generation of purchased electricity that is consumed in its owned or controlled equipment or operations as scope 2.
- Scope 2 emissions are a special category of indirect emissions.
- For many companies, purchased electricity represents one of the largest sources of GHG emissions and the most significant opportunity to reduce these emissions.
- Accounting for scope 2 emissions allows companies to assess the risks and opportunities associated with changing electricity and GHG emissions costs. Another important reason for companies to track these emissions is that the information may be needed for some GHG programs. Companies can reduce their use of electricity by investing in energy efficient technologies and energy conservation. Additionally, emerging green power markets provide opportunities for some companies to switch to less GHG intensive sources of electricity. Companies can also install an efficient on site co-generation plant, particularly if it replaces the purchase of more GHG intensive electricity from the grid or electricity supplier. Reporting of scope 2 emissions allows transparent accounting of GHG emissions and reductions associated with such opportunities.

Of the many sources of emissions enlisted above, covered under Scope 1, with regards to Sathyabama Institution the “Transportation of materials, products, waste, and employees”are the major sources of emissions resulting from the combustion of fuels in the vehicles operated by the institution including trucks and buses.Scope 2 emissions from the institution are accounted by the emission associated with the consumption of purchased electricity from the electricity board and which has options of getting replaced with available renewable sources of energy.

Sathyabama Institute of Science and Technology is environmentally conscious and has taken all major steps in carbon footprint reduction.

Initiative 1:Biodiesel Plant for the usage in Institutional buses and Gensets.

The institution operates a pilot scale biodiesel production unit that converts 50 litres of waste cooking oil generated in the institution mess. This initiative prevents approximately 15,000 to 20,000 Litres of waste cooking oil from being consumed, thrown into the sewer line or dumped onto the landfill every year. The waste cooking oil is properly assessed and converted into Biodiesel. The produced biodiesel is evaluated to meet the ASTM standards. Five of the institution buses are operated with B15 blends of diesel. Also, two of the Gensets are powered with B-100. With this initiative the institution has reduced 52.250 TCO2E from 405 TCO2E per annum by operating biodiesel powered buses and gensets which is 352.750 TCO2E. The institution has set it's target to achieve 50 TCO2E by increasing i) Number of buses powered with biodiesel and ii) Percentage of biodiesel from 15% to 20% for which the trials are successfully completed.

Fig.1 Pilot Scale Biodiesel Production Facility (50 L per batch)

Fig.2 Biodiesel (B-15) Powered Buses

Initiative 2 :Biodiesel for pumpsets and gensets in Mittapalli, Aadhanur, Eachampoondi, Meensuruti villages

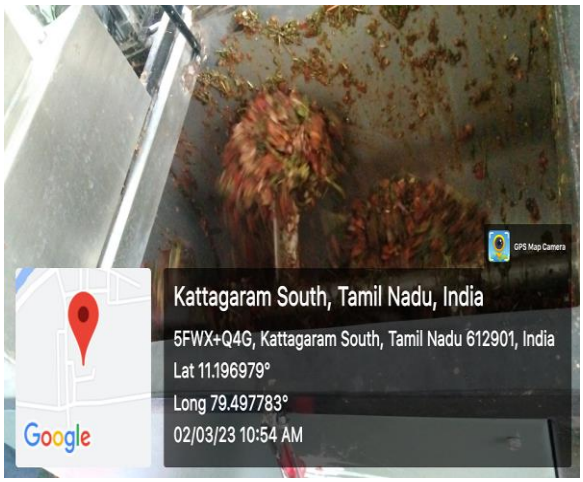
Apart from directly contributing , the institution through its biofuel promotion activities has also contributedto Carbon footprint reductions. About 2300 L of biodiesel has been given away for operating pumpsets in Mitapalli village, Aadhanur village, Eachampoondi village in Tamilnadu. The institution is also taking initiatives to provide biodiesel to power fish catching boats in Meensuruti village in Kattumannarkoil Taluk, Cuddalore district.In addition to the biodiesel plant commissioned in the Centre for Waste management Laboratory at Sathyabama Institute of Science and Technology, a pilot scale biodiesel plant has been set up in Cuddalore to cater to the diesel requirements in few of the villages in Kattumannarkoil Taluk. This way 0.94 TCO2E has been achieved indirectly by the initiatives taken by our institution during 2022-2023, which would have been 6.2 TCO2E if diesel was used instead. The biofuel initiatives of the institution have contributed to reduction of CO2E by 5.26 tonne. The target will be to increase in cumulative reduction of 5, 10,15,20 tonne year after year in next four years and achieve a total of 55 TCO2E by 2028. Through the Science Technology and Innovation hub established at Kattumannarkoil Taluk C,D block Cuddalore District around 150 marginal and non-workers including women have been trained to make biodiesel from waste cooking oil. They are given

sufficient awareness on the impact of consuming several times fried waste cooking oil and throwing away of the same on landfills and into the sewer lines.They have been trained to check the quality of the oil, categorize it for biodiesel production, divert it for other application like detergent soap making, 1 Litre biodiesel production and 20 L pilot scale biodiesel production.

Initiative 3

Diversion of Vegetable Market Waste to Accelerated Biocompost

Vegetable market waste is huge menace to the landfill and can be potentially converted into compost. A study was completed based on which a 100 kg capacity accelerated composting machine which operates with the bioformulation proven by the faculty of Sathyabama Institute of Science and Technology to convert Vegetable Market Waste to Compost has been successfully demonstrated in Eachampoondi Village,Cuddalore District. The Investigators from Centre for Waste Management ,Sathyabama Institute of Science and Technology are operating this project through the STI hub established at Cuddalore. More than 25 non-workers and marginal workers have been trained to collect, segregate and process the vegetable market waste generated at Meensuruti village Sandhai (Market Place) to produce compost. The characteristics in terms of nutrient value have been studied and proven in several fields.From 1 tonne of market waste 1.6 t CO2e is given out. By diverting this to accelerated compost 1.6 TCO2E can be reduced. Through the Vegetable Market Waste to Compost , Sathyabama has achieved reduction of 12.8 TCO2E in the last 8 months.



Vegetable Market Waste Compost

Initiative 4

Food Waste to Biogas

Based on the FAO's food waste emission factor of 2.5 ton CO_2e ton^{-1}, India's emission from food waste works out to **172 $MtCO_2e$ per year**. The institution caters to more than 15000 people through the extremely large cooking facility available in campus. Following the Food waste hierarchy, apart from donating the excess food for the needy, diverting the waste food for cattle and piglet farms, on an average 500 to 1000kg of food waste is diverted for biogas generation daily . Because of this initiative apart from saving three commercial cylinders every day, 2 to 2.5 TCO_2E has been reduced by diverting the food waste for biogas production instead of dumping on to the landfills. The institution has set up a 1 Tonne capacity biogas plant with Scrubber and Collecting Balloon facilities. The unit is continuously monitored by maintaining ideal pH, alkalinity and VFA in the anaerobic digestor.

By continuing to implement the above initiatives at a larger capacity the institution will thrive to achieve Net Zero by 2050.

Periodic energy and environmental audits are conducted by the institution audits in terms of the various types of waste generated and how the waste is effectively utilized or diverted for value added products production including biodiesel, biogas, biocompost, biochar etc., The energy audit is also pursued as per the GHG Protocol Corporate standard accounting for Scope 2 emissions as indicated in Section 5 of the document given in the link.

1. Does your university report its carbon emissions in line with the GHG Protocol Corporate Standard or another commonly used standard?

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   Being an educational institution, Scope 1 emissions is only in terms of Transportation of materials, products, waste, and employees that accounts to approximately 3.24 MT CO2E with an average of 100 buses operated for a total of 300 days in a year with a maximum of 40 Litres per day consumption of diesel. and Fugitive emissions that covers hydrofluorocarbon (HFC) emissions with 1.3 TCO2E per annum from one AC. With about 1000 ACs in campus it accounts to 0.013MTCO2E during the use of refrigeration and air conditioning equipment. Scope 2 emissions include the emissions related with the purchase of electricity from the board. Total emissions account to 3423000 TCO2E.