

Carbon footprints of higher education institutions: a case study of Rajarata University of Sri Lanka

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Introduction

It is well evident that the human impact on the climate system is the highest in history because it is clear that recent anthropogenic emissions of green- house gases. Recent climate changes have had widespread impacts on human and natural systems (Pachauri, 2015). Present day, global climate change has already had observable effects on the environment such as global warming, changing precipitation pattern, Sea level rising and melting glaciers etc. are caused various direct and indirect impacts. Among these causes of climate changing phenomenon Greenhouse Gas (GHG) plays the major role to change the climate. In present day carbon dioxide (CO₂) exist in the atmosphere 406.94 parts per million is considered as the main GHG responsible for the climate change. Carbon Footprint (CFp) is defined as an aggregate amount of GHG emissions, consisting mainly of CO₂, associated with an individual, organization, event or production.

CF_p is one of the most effective and common measures of the effect of an individual, community, industry or country on the environment. Normally, when driving a car, van or another vehicle the engine burns fuel which creates a certain amount of CO₂ which based on its amount of fuel consumption and distance of travelling. As well as, when heating a house with electricity, that electricity generating process also has emitted a certain amount of CO₂ directly and indirectly. Not only that but also when buying food, cloths, pharmaceuticals and any of good that also emitted certain amount of CO₂ in various stage of their production process. So, the CFp provides the quantity of CO₂ emitted to the atmosphere according to the requirements and needs of an individual or organization. The worldwide average CFp is 4.00 metric tons/year and average Sri Lankan individual's CFP is 0.61 metric tons/year and as well as, the worldwide target is to maintain the CFp at the level of 2 tons per year (www.carbonfootprint.com). According to Li et al. (2014), Universities as centralized organization with their long-term planning with specific time frames and dense populations, are ideal places to examine these carbon mitigation strategies. Therefore, it is important to estimate the CFp of individuals as well as university level to in order to take effective measures for carbon reductions.

Methodology

This study employed both primary and secondary data. Primary data were collected through the field observations, interviews and questionnaires. A random sample of 200 undergraduate students allocating 50 lots to each faculty was used in a way to include 50 percent of male as well as female students of each faculty. Secondary data were collected from different sources such as internet, books, journals and some selected websites. In addition to that this study used the online CFP calculator for calculating the student's annual CFP (www.carbonfootprint.com). This study focused on the students of four faculties of the Rajarata University of Sri Lanka and the two services of the university which do highly contribute to carbon emission namely; electricity and transportation. This study has taken into account of students activities of traveling, energy usage, vehicle they use and secondary consumptions (products and services) such as consumption of food and drink products, pharmaceuticals, cloths and textiles, paper based products, computer and IT products, paper based products, TV radio and phone products, motor vehicles, furniture and other, hotel restaurants and pubs, TP mobile call cost, banking and finance, insurance, education and recreational.

Formulas used are;

$$\text{Electricity} = \text{Use (kWh/yr)} * \text{EF (kg CO}_2\text{e/kWh)} = \text{emissions (kg CO}_2\text{e/yr)} \quad (1)$$

$$\text{Vehicle} = \text{Distance (km/yr)} * \text{EF (kg CO}_2\text{e/km)} = \text{emissions (kg CO}_2\text{e/yr)} \quad (2)$$

Secondary consumption (products and services)

$$\text{Clothes} = \text{spend (\$/month)} * 12 * \text{EF (kg CO}_2\text{e/\$)} = \text{emissions (kg CO}_2\text{e/yr)} \quad (3)$$

$$\text{Recreational} = \text{spend (\$/month)} * 12 * \text{EF (kg CO}_2\text{e/\$)} = \text{emissions (kg CO}_2\text{e/yr)} \quad (4)$$

Source: Wilson (2012)

In this research, CFP was calculated through the automatic online calculator and the examples formulas of the energy, vehicles and transport are emphasize through the above calculations. The method using for secondary CFP (products and services) based on annual monetary allocations.

Results and discussion

This study found that the undergraduate student's average CFP at Rajarata University of Sri Lanka is 1.06 of tons per year. Results of this study further revealed that the total CFP among the undergraduates of the university was 3906.57 metric tons annually. Also, Universities' male undergraduates average CFP is 1.05 metric tons whereas female average is 1.06 of metric tons per year. Results of this study found that the students of the FMGT emit 1406.42 metric tons with average of 0.99 metric tons of CFP per undergraduate annually (See Figure 1 & 2). The study further revealed that FSSH account 1183.12 of metric

tons annually with average of 1.05 metric tons. FAS is responsible for 845.30 metric tons of CFp released annually with average of 1.21 metric tons which is the highest among the four faculties. The FAC accounts 471.73 metric tons with individual average 0.98. As well as when consider the university services CFp, the electricity CFp was 704.04 metric tons per year and vehicle and transportation CFp recorded 141 metric tons per year. However, when focus these all three scenarios; undergraduate CFp, vehicles and transport CFp and Electricity CFp, the total CFp was 4751.61 metric tons per year. The study further revealed that the CFp is mainly based on student's consumption styles. However, the undergraduate CFp of the Rajarata University average CFp is always under the designated target level in the global context.

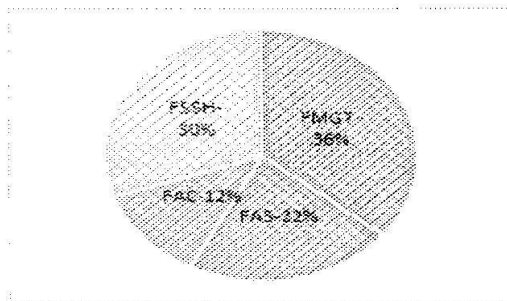


Figure 1 Annual total CFp among the faculties

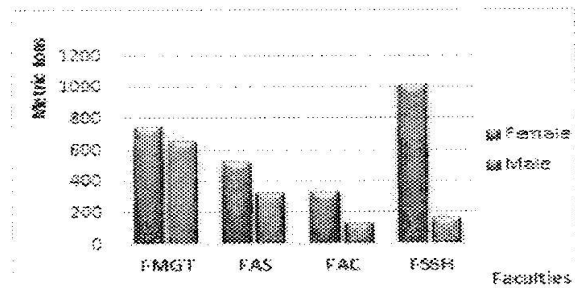


Figure 2 Annual undergraduate's CFp among the faculties

Conclusion and recommendation

Calculating the CFp may provide the directions to priorities the steps to take carbon mitigation measures. According to the calculator, secondary consumption CFp range is higher than the energy and travel. So, it is recommended to apply 4R concept in order to change the student's consumption styles to reduce their CFp. As well as, it is important to encourage the students to take energy saving measures in their activities. The students also can take measures like switching off the unnecessary lights, careful utilization of water resources, unplug electricity when not in use, minimizing food waste, walking and cycling among them. When services were considered, CFp of transport can change it to the sustainable transport concept for transport in interior of the university and exterior. Also can use foot bicycles for traveling within the university system and pooling vehicles in order to reduce the number of trips are some of the measures that can be taken by the university in order to reduce the institutional level CFp. Not only that but also can use other environmental friendly energy source like solar power where there is a huge potential to use at Rajarata University of Sri Lanka.

Keywords- *Climate change, Carbon Footprint, Green House Gases, Undergraduates*

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