



ELSEVIER



CrossMark

Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 197 (2015) 1156 – 1160

Procedia
Social and Behavioral Sciences

7th World Conference on Educational Sciences, (WCES-2015), 05-07 February 2015, Novotel
Athens Convention Center, Athens, Greece

Carbon Footprint of Environmental Science Students in Suan Sunandha Rajabhat University, Thailand

Tatsanawalai Utaraskul^{a,*}

^aFaculty of Sciences and Technology, Suan Sunandha Rajabhat University, 1 U-thong Nok Road, Dusit, Bangkok, Thailand. 10300

Abstract

Carbon footprint of 35 students in Environmental Science Program, Faculty of Science and Technology, Suan Sunandha Rajabhat University (SSRU) were measured based on web base Thai carbon footprint calculator program of Thailand Greenhouse Gas Management Organization (TGO). The program was evaluated based on 3 criteria which are transportation, food consumption and energy consumption by using electric appliances. The results revealed that students generate greenhouse gas emissions between 0.39 – 8.25 tCO₂e/yr. An average GHG emission is approximately 2.16 t CO₂e/yr. The mainly student's activities generated greenhouse gas were using electric appliance 1.05 tCO₂e/yr follow by food consumption 0.7 tCO₂e/yr and transportation 0.4 tCO₂e/yr, respectively. The greenhouse gas emission from transportation was less than other activities according to the student's lifestyle. Mostly, students in SSRU stay nearby the university area and travel by public transportation.

© 2015 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of Academic World Education and Research Center.

Keywords: Carbon footprint, Undergraduate student, Thailand

1. Introduction

Climate change has been the worldwide issue which is related with many factors. Especially, anthropogenic greenhouse gas (GHG) emissions are the major reason for global and nation climate change. Climate change, deforestation, overgrazing, fisheries collapse, food insecurity and the rapid extinction of species are all part of a

* Tatsanawalai Utaraskul. Tel.: +662-160-1143-45#34; fax: +662-160-1146.

E-mail address: Tatsanawalai.ut@ssru.ac.th, pubasten@gmail.com

single, over-arching problem: Humanity is simply demanding more from the Earth than it can provide (Global Footprint Network, 2015). In addition, climate change is not an issue in isolation, but rather, a symptom of a broader challenge: humanity's systematic overuse of the planet's finite resources. Our natural systems can only generate a finite amount of raw materials (fish, trees, crops, etc.) and absorb a finite amount of waste (such as carbon dioxide emissions) (Wackernagel, 2014).

Many findings such as climate change modeling, urban planning, and behavioral solutions were initiated in order to mitigate CO₂ emission. Therefore, many sectors increased more awareness on the process and activities to reduce GHG. As well as in the academic sector, for higher education in Thailand. In the year 2014, many universities in Thailand were in the Green University ranking by UI Metric Green University Ranking (UI, 2014) but the ranking was focus only on the university system. The most important method to reduce GHG is to change the behavior by focus on carbon footprint. Human activities consume resources and produce waste, and as our populations grow and global consumption increases, it is essential that we measure nature's capacity to meet these demands (Global Footprint Network, 2015).

The Ecological Footprint has emerged as one of the world's leading measures of human demand on nature. Simply put, Ecological Footprint Accounting addresses whether the planet is large enough to keep up the demands of humanity. The report of Ecological Footprint Atlas 2010 showed that Thailand population generate ecological footprint consumption 2.37 gha per person (Global Footprint Network, 2010)

Many evaluation techniques have been developed in the name of carbon footprint calculator. In Thailand, Thailand Greenhouse Management Organization (TGO) developed web-base Thai carbon footprint calculator for users and focus mainly on energy consumption, transportation and food consumption. (TGO, 2014)

In higher education, De Montfort University also studied the carbon performance through a consumption-based carbon footprint. The scope 3 emissions (include upstream emission from the production, transportation of purchased goods, and downstream emissions from the use and disposal of organisation's products and services) comprised around 79% of the total university's greenhouse gas emission (Ozawa-Meida et al., 2013). From the research of carbon footprint in the university in Thailand, Faculty of Environment and Resource Studies, Mahidol University was collected the data of electric energy, water supply consumption, quantity of wastewater and garbage, and amount of fuels used. The results showed that GHGs emission from faculty Environment and Resource Studies is equal to 1,091.85 tonsCO₂e. The major source which generated most GHGs from the use of electric energy and solid waste production (Aroonsrimorakot et al., 2013).

For the more detail of carbon footprint of student behaviour also conducted in China. Average carbon footprint was 3.84 tonsCO₂e per student with 65% attributable to daily life, 20% to transportation, and 15% to academic activities such as studying (Li et al. 2015). There's still no academic research for environmental science student's carbon footprint.

1. Purpose of Research

1. To evaluate carbon footprint of environmental science students.
2. To compare the major sources of student's activity which generated GHG

3. Materials and Methods

3.1 Evaluate student's carbon footprint by using web-base Thai carbon footprint calculator

The web-base Thai carbon footprint calculator was developed for general people and very easy to evaluate by themselves. The criteria divided into 3 categories which are energy consumption, food consumption and transportation indicated by number of people in the household and the detail of each criterion are present as following.

- A. Energy consumption per day:
 - a. Energy consumption in daily life

1. Type and duration of light appliances/ bulb
(Fig.1 incandescence/ fluorescence/ compact fluorescence/LED)
2. Type of air condition (more than 24,000 BTU or less)
3. Type of Television (Cathode Ray Tube (CRT TV)/ LCD TV/ LED TV)
4. Type of computer (PC/ notebook)
5. Number of rice cooking
6. Number of microwave
7. Number of stove
8. Number of iron
9. Number of heating water machine
10. Number of washing machine
11. Number of kettle
12. Number of mobile charger
13. Type of refrigerator (1 door/ 2 doors)



Fig. 1. Type of light bulbs

B. Daily food consumption

1. Amount of carbohydrate consumption (plate/day)
2. Amount of meat consumption (time/week)
3. Vegetable (piece/week)
4. Fruit (piece/week)
5. Type of drink per day (soft drink/ coffee/ tea/ milk/ fruit juice)

3.2 Methodology

Provide class activities in Impact of Climate Change subject based on carbon footprint definition and classification for 35 environmental sciences students (2nd year) and described the methodology to evaluate carbon footprint in TGO's website (Fig. 2).

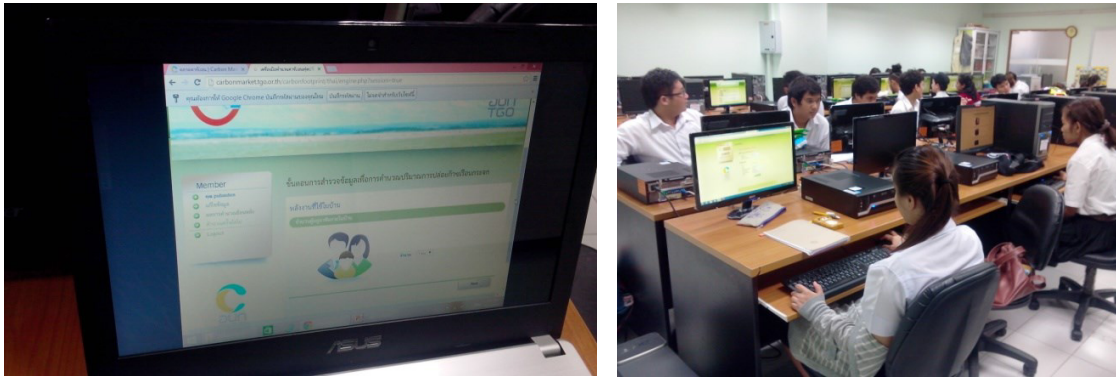


Fig. 2. (a) Web-base Thai carbon footprint calculator; (b) students evaluated their carbon footprints

4. Results and Discussion

4.1 Carbon footprints of Environmental Science Students

From the Web-base Thai carbon footprint calculator, the results of average carbon footprint of environmental science students in the 2nd year of Suan Sunandha Rajabhat University represented in Table 1 and Fig. 3.

Table 1. Carbon footprint of Environmental Science Students based on gender.

Category	Gender	Carbon footprint (TonCO ₂ e)	
		Min	Max
All cagories	Male	0.84	4.99
	Female	0.39	8.25
	All	0.39	8.25
Appliance	Male	0.59	3.31
	Female	0.10	5.37
Travel/transportation	Male	0.05	2.63
	Female	0.00	1.74
Food consumption	Male	0.18	1.56
	Female	0.13	1.14

From Table 1. Carbon footprint from male students were between 0.84 -4.99 TonCO₂e whereas female students generated carbon footprints between 0.39 – 8.25 TonCO₂e. For electronics appliances, males generated carbon footprint between 0.59 – 3.31 TonCO₂e whereas female students generated carbon footprints between 0.10 – 5.37 TonCO₂e. For transportation or travel, male generated carbon footprint between 0.05 – 2.63 TonCO₂e while female students generated carbon footprints between 0.00 – 1.74 TonCO₂e. The last category is food consumption, male generated carbon footprint between 0.18 – 1.56 TonCO₂e whereas female students generated carbon footprints between 0.13 – 1.14 TonCO₂e.

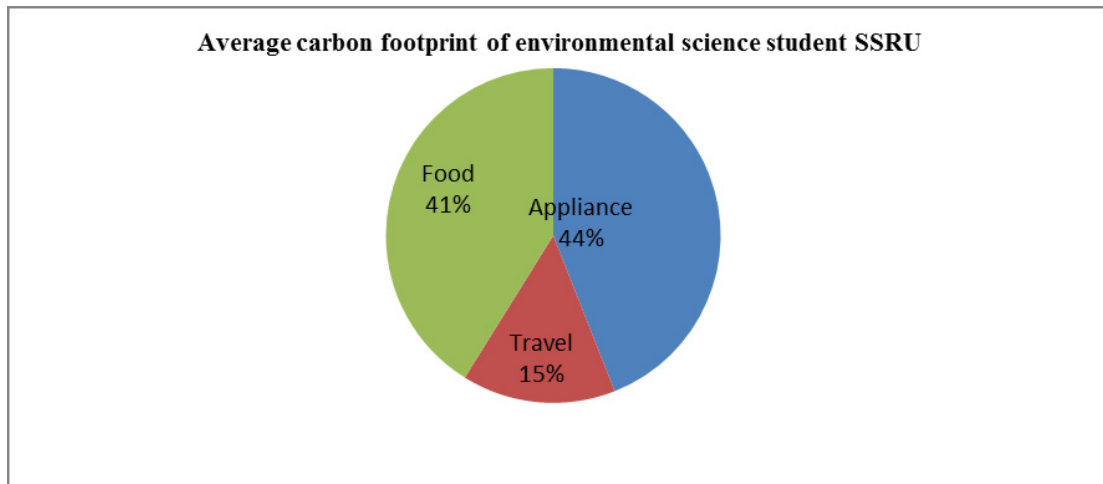


Fig. 3. Average carbon footprint divided into 3 categories

The results revealed that major activities that generate CO₂ emission of environmental science were related with electronics appliances which are 44% follow by food consumption 41% and travel 15%.

5. Conclusion

The results revealed that students generate greenhouse gas emissions between 0.39 – 8.25 tCO₂e/yr. An average GHG emission is approximately 2.16 t CO₂e/yr. The mainly student's activities generated greenhouse gas were using electric appliance 1.05 tCO₂e/yr follow by food consumption 0.7 tCO₂e/yr and transportation 0.4 tCO₂e/yr, respectively. The greenhouse gas emission from transportation was less than other activities according to the student's lifestyle. Mostly, students in SSRU stay nearby the university area and travel by public transportation.

Acknowledgement

This research was supported by Suan Sunandha Rajabhat University. Special thanks also extended to the environmental science students of SSRU who helped and support this research.

References

- Aroonsrimorakot, S., Yuwaree, C., Arunlertaree, C., Hutajaroen, R., and Buadit, T. (2013). Carbon Footprint of Faculty of Environment and Resource Studies, Madidol University, Salaya Campus, Thailand. *APCBEE Procedia* (5). 175-180.
- Global Footprint Network. (2010). *Ecological Footprint Atlas 2010*. http://www.footprintnetwork.org/en/index.php/GFN/page/ecological_footprint_atlas_2010
- Global Footprint Network. (2015). *Carbon footprint overview*. http://www.footprintnetwork.org/en/index.php/GFN/page/footprint_basics_overview/.
- Li, X., Tan, H., and Rackes, A. (2015). Carbon footprint analysis of student behavior for a sustainable university campus in China. *Journal of Cleaner Production* (in press). 1-12.
- Mathis Wackernagel. 2014. *Why waiting for climate consensus could waste your future: the role of sustainability policy in advancing national self-interest*. http://www.footprintnetwork.org/images/uploads/Climate_Action_National_Competitiveness.pdf
- Ozawa-Meida, L., Brockway, P., Letten, K., Davices, J., and Fleming, P. (2013). Measuring carbon performance in a UK University through a consumption-based carbon footprint: De Montfort University case study. *Journal of Cleaner Production* (56). 185-198.
- Thailand Greenhouse Gas Management Organisation. 2014. *Web-base Thai Carbon Footprint Calculator*. <http://carbonmarket.tgo.or.th/carbonfootprint/thai/engine.php>