

**An Investigation into Eco-to-Go in the New
Student Union Building (SUB)**

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APSC 262

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An Investigation into Eco-to-Go in the New Student Union Building (SUB)

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Abstract

As part of the Lighter Footprint Strategy, the AMS has requested an investigation into incorporating UBC's Eco-to-Go Program at the New SUB. The program is currently being used at the Totem and Vanier cafeterias with around 4000 participants. Users pay a \$5 deposit for a token, which can be exchanged for a clean container. Used, dirty containers can also be returned for a clean container where they will be washed. The New SUB will have eleven food outlets that will participate in this program. This report analyses the environmental, economic, and social impacts that integrating with this program might have. This report considers stakeholder interviews, academic research, and quantitative analysis in its detailed analysis of these areas. An environmental analysis considering life cycle analysis of reusable polyethylene containers, as well as paperboard and some biodegradable plastic containers yields a net positive effect. Mainly as a result of the number of containers a single reusable container can replace, the environmental impact from production is vastly reduced. An economic analysis considering the costs of purchasing the reusable containers versus the disposable containers, washing, and discounts on meals resulted in finding that the program has a negative return. Because the meal discount is equivalent in value to the savings from not purchasing the disposable containers, the program as it currently stands is not able to generate any savings. However, it is recommended that the meal-discount is eventually phased out as this will result in the program saving money. A social analysis considering the effects of implementing the program on student's convenience, health hazards, operational changes, and green initiative concluded that the program would have positive overall social impact.

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List of Abbreviations

AMS: Alma Mater Society

PP: Polypropylene

SUB: Student Union Building

1.0 Introduction

Since 2010, UBC Food Services has operated the Eco-to-Go program in several locations on campus, primarily in Totem Park and Vanier residences. This program allows students to exchange \$5 for a reusable plastic container, which can be filled, cleaned, and exchanged at different locations. Each time the container, the student receives a small discount on the purchase for helping reduce the number of disposable containers used on campus. As part of the Lighter Footprint Strategy, the AMS (Alma Mater Society) has proposed to integrate the Eco-to-Go program into the new SUB (Student Union Building). The goal of this report is to perform a triple bottom line analysis of the environmental, economic, and social requirements and predicted effects of bringing Eco-to-Go to the new SUB.



Figure 1: The Eco-to-Go Reusable Container

2.0 Environmental Impacts

The first component to the triple-bottom line analysis is the environmental analysis. The environmental analysis includes a comparison of the waste and life-cycles of the Eco-to-Go containers, as well as an analysis of washing resources.

2.1 Material waste and life-cycle

The containers used for the Eco-to-Go program, purchased from Starfrit, are mainly comprised of PP (Polypropylene) (Starfrit). The manufacturer warranties these containers for one year, and UBC Food Services has stated that the majority of containers initially distributed are still in service (two years). This allows for many opportunities to offset the use of disposable containers. The disposable containers currently used by the AMS are all either compostable or recyclable, to varying degrees. Since some of the outlets participating in the Eco-to-Go program will be owned by third parties, there is no unified container type that can be referenced. For the purposes of this analysis, we will assume that the majority of trays are made of paperboard or varying types of compostable or conventional plastics. Biodegradable plastic trays generally have a life cycle energy requirement approximately 67 - 108% of that of conventional plastics, depending on the type or material. They also create 26 - 114% of the CO₂ produced during the conventional plastic life cycle (Sakamoto, 2012). Additionally, the approximate environmental impact of paperboard trays, which are also commonly used in AMS and third party outlets, is approximately 27% of that of PP (Cascades Canada ULC, 2011). Assuming that each Eco-to-Go container is used on average 300 times, the environmental impact from its life cycle will certainly be less than the equivalent number of disposable containers. Though the ratio of materials used in disposable containers is not known, even in a best case scenario, the Eco-to-Go containers would result in only approximately 1.3% of the environmental impact as only paperboard trays.

These numbers also ignore that PP is designated recyclability type 5 (Waste Online, 2013), and thus can further reduce the waste compared to disposable containers, which can still require long periods of time to decompose.

2.2 Washing water, energy and chemical use

The resources required to wash each container is another environmental concern for the Eco-to-Go containers. Since each dishwasher will be owned individually by each outlet, there is no standard with which these impacts can be derived. The consumption will therefore be estimated at 15 - 22 litres and 1 - 2 kWh per load (Stamminger, 2010). Assuming 300 washes per lifetime, and ~30 containers per load, each container ends up using approximately 150 to 220 litres of water and 10 - 20 kWh of electricity for a lifetime of washes. Because paper product trays use approximately 26 times more water to produce than plastic, around two litres per unit (Lilenfield, 2007), and with a large portion of trays being made of paperboard, up to 380 litres of water could be saved per Eco-to-Go container used. Dish detergents can also have adverse effects on the environment, but because each outlet is likely to use detergents already available to them, the effects are unpredictable. A large environmental factor is phosphates contained in detergents, but there are low phosphate detergents available which could improve these effects.

3.0 Economic Impacts

The second component of the triple-bottom line analysis is the economic analysis. The economic analysis for the Eco-to-Go program includes a material cost comparison over the life of the project, analysis of the costs associated with washing containers, and the operational costs.

3.1 Material cost savings and life-cycle

The disposable containers currently used by AMS outlets are either recyclable or compostable, but only designed for a single use. That means that for each meal, a container must be disposed of. The AMS provided the number of transactions and number of discounts for each AMS outlet at the SUB. We used these numbers to build an estimate of the cost comparison between the current disposable system and the Eco-to-Go system.

Table 1: Discount and Transaction Data Provided by the AMS

Jan - Dec 2012	Number of Discounts	Number of Food/Coffee Transactions	Percentage of Transactions that Received a Discount
Blue Chip	57426	527626	10.88%
Moon Noodle	733	11904	6.16%
Honour Roll Sushi	16	280382	0.01%
Pie R Squared	0	397787	0.00%
Bernoulli's Bagels	1682	254371	0.66%
Burger Bar	32	155942	0.02%
Gallery Restaurant	225	59192	0.38%
Total:	60114	1687204	3.56%

The totals in Table 1 account for purchases of both food and beverages. For the purposes of this report, we will make two assumptions: 1. That all of the discounts at the Blue Chip are for coffee (since the menu does not include any meal items), and 2. That 90% of the purchases from other retailers are for meal items (The only non-meal items at these locations are beverages and so we assumed that 10% of the transactions accounted for these purchases). Using these assumptions results in 2554 meal discounts for 1101599 meal purchases. This new rate of 0.23% is much lower than the one using the total number of discounts of 3.56% but we feel it provides a much better estimate of the numbers. Although data was not provided by the AMS, for our analysis we assumed each container cost the AMS \$0.15. Using these assumptions we calculated that disposable containers cost the AMS \$109905 over the length of the year. The reusable Eco-to-Go containers, meanwhile, would cost \$2.50 per container. While students pay \$5 to enter the program and get a container, the \$5 is only a deposit and is

returned upon leaving the program. The lifetime for the disposable containers is only a single use while the lifetime for the Eco-to-Go containers is assumed to be around 300 washes. Over the lifetime of the Eco-to-Go container, the cost per use would be only \$0.0083. Calculations are found in the appendix.

3.2 Washing costs

The costs of purchasing do not account for the entire cost of implementing the system. Another significant cost component is in the washing process. The two significant costs in washing are the labour and the equipment. AMS employees are paid \$15 per hour and we estimate the container washing process handle a 30-container batch in 3 minutes. In reality, for low washing requirements, the time spent washing will not interfere with the employee's regular duties. Therefore, we assumed the impact of the cost would be lessened for a when only a small number of the AMS's customers are using the program. This assumption will only hold true as long as the number of users in the program are small. As soon as a significant number of purchases are made with the container, washing will become an onerous task and therefore cost that will not be able to be ignored. Therefore, if 20% or more customers use the container we will assume the washing cost can no longer be reduced. Calculations are found in the appendix.

Because the industrial washers are being purchased regardless of if the Eco-to-Go program gets the go-ahead or not, the equipment costs can be ignored as they will not be useful in a comparison.

3.3 Operational costs

The switch to the reusable containers will require space for storage as well as inventory management to ensure that a sufficient number of containers are always available for users. While the space requirements are not a very quantifiable cost, they will take away from space that would otherwise be used for storing other items at the food outlets. The inventory will need to be managed so that either throughout the day or at the end of each day the manager will need to keep track of inventory levels at each food outlet to ensure sufficient levels are maintained. While these costs will be incurred, similar costs are also required for the disposable containers the SUB currently uses and so we can assume the differences are negligible.

Because the program gives a \$0.15 incentive for each purchase made using a reusable container, this must also be considered when comparing options. Calculations are found in the appendix.

4.0 Social Impacts

The last component of the triple bottom line analysis is the social analysis. This analysis will include the people reaction the new program, the food safety and user health and operational changes. At the end of this discussion we have a clear picture of the social impacts of implanting the Eco-To-Go program in the new SUB

4.1 Real and perceived inconveniences to using the Eco-to-Go container

The effect of using the Eco-to-Go program on people's convenience is a very important factor of our social analysis. Students find compostable food containers very convenient because they don't have to clean or return them. They only need to throw them in any garbage container. On the other hand, the containers of the Eco-to-Go program need to be returned back to specific locations after students are done using it. Although this might seem like a drawback for the program, the effort of going to garbage can to throw the compostable food container is almost equal to the effort of returning the Eco-to-Go container. Moreover, students can choose between washing the containers themselves or replacing the dirty containers by clean ones at any of the participants food outlets.. In addition, the reusable containers provide convenience to the students due the fact that they are microwavable. About 90% of UBC students are willing to switch to the reusable containers provided that students will get around 15 cents discount on their meals (Merry, Pau, Bontempo & Mazurek, 2012).

4.2 Food safety and user health

The safety of food and user health is another factor of our social analysis of the Eco-to-Go program in the new SUB. The fact that students can wash their own food containers then reuse them at any food outlet in the new SUB brings a large health hazard. Some container might not be cleaned probably or they might be contaminated, which might lead to sickness or food poisoning. In order solve this issue, food outlets at the new SUB must have trained personnel to identify such risks and deal with it . In addition, all container washed in the in new SUB need to be washed at 70 degrees and sanitized at 83 degrees to ensure the safety of the students(Perry,2012).

4.3 Operational changes

Another important factor of our social analysis is the operational changes to the people working on the new SUB. Food servers in the new SUB need to be able to identify food hazard from dirty container and they will be responsible in case something goes wrong. the extra factor of responsibility is tremendous to be handled by food servers. We think the AMS need to provide those workers with the necessary knowledge to identify such risks. In addition, the task of washing these containers is going to be added to the job description of the people working in the new SUB. However, the estimated time of washing a food container is 6 seconds which means an additional 1.4 hours of workload per 1000 containers. This number is very small to make a huge difference on the behavior of work done.

4.4 Green Infnitive

The last factor we are taking into our social analysis is the increase in awareness of sustainable solution. Implementing the Eco-to-Go program will increase the awareness of the suitability

issues the world is having. Students will get involved into making the campus a better place by making sustainable individual decision on and off campus. As shown in figure 2 below, around 90% of UBC students think that implementing the program will increase the awareness of the suitability issues which could lead to larger involvement (Merry, Pau, Bontempo & Mazurek, 2012).

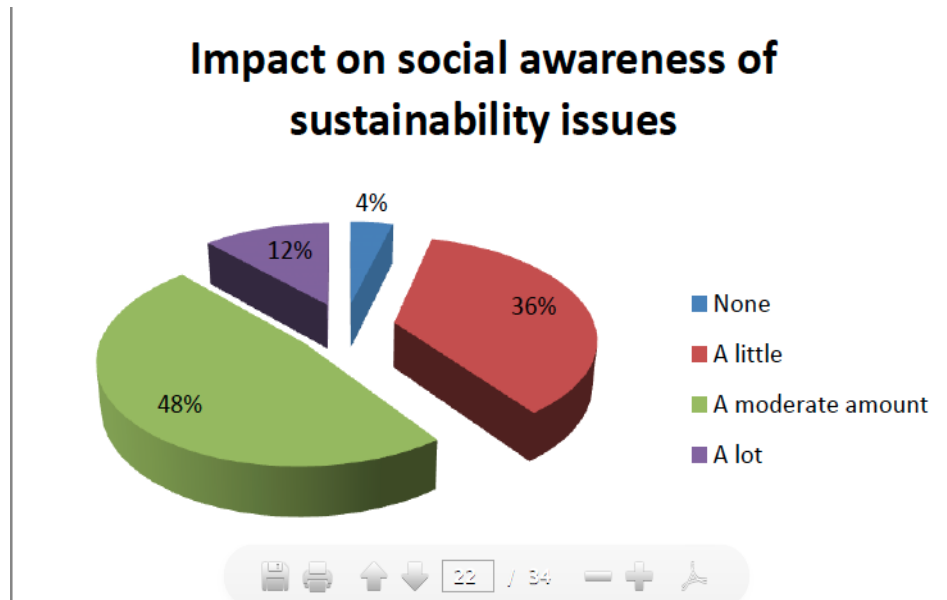


Figure 2: Impact of Eco-to-Go program on awareness of sustainability issues

5.0 Conclusions and Recommendations

The overall environmental effect from the Eco-to-Go program reduces the impacts from production of many more disposable containers, as in the case of paperboard trays, reduced the total water consumed. A combination of the effects (emissions, energy, etc.) have been approximated to 1 - 2% of the impact that using disposable containers would have. The costs associated with running the Eco-to-Go program will depend upon what percentage of customers at the New SUB use the container. Using the numbers calculated above, the additional cost if 10% of users use the program is \$1,606/year. If 100% of customers use the Eco-to-Go container, the estimated cost is \$36,720/year. The figure below demonstrates the cost as a function of the percentage of users of the program. Calculations are found in the appendix.

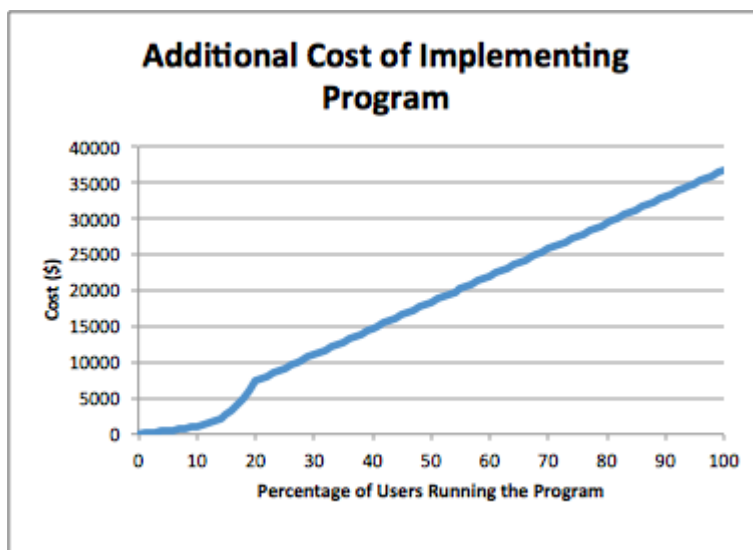


Figure 3: Additional Cost of Implementing the Eco-to-Go Program

The most significant additional cost to the program is the discount given to customers for using a reusable container. Because this discount is equivalent in value to the savings from not purchasing the disposable containers, the program as it currently stands is not able to generate any savings. Therefore, we recommend that the discount be phased out and eventually eliminated once the program proves itself and gains a sufficient popularity. If no discount existed and 10% of customers used the program, the program would actually generate \$14,917 in savings compared to the current implementation with disposable containers.

Implementing the reusable food containers in the New SUB will increase people's convenience because those containers are microwavable. In addition, the health hazard of using reusable food containers can be eliminated if the containers are washed and sanitized in high temperature. Another social impact is the operational changes in running the food outlets. We figured that the amount of time needed to wash 1000 containers is 1.4 hours, which is a very small number that can be neglected. Lastly, implementing the Eco-To-Go program in the new SUB will increase social awareness of sustainability issues. This increase in awareness will lead to more students making better sustainable decisions. All and all, accepting reusable food containers in the SUB will have a great social outcome.

Overall, the program is recommended for implementation with the New SUB

References

- Cascades Canada ULC. (2011). *Life Cycle Analysis of Various Food Trays*. Retrieved from http://www.cascades.com/client_file/upload/pdf/acv/ACV_Emballages_Survol_Technique_EN.pdf
- Lilenfield, R. (2007). Review of Life Cycle Data Relating to Disposable, Compostable, Biodegradable, and Reusable Grocery Bags. *The ULS Report*. Retrieved from http://www.deq.state.mi.us/documents/deq-ess-p2-recycling-PaperPlasticSummary_2.pdf
- Merry, K., Pau, R., Bontempo, A., & Mazurek, K. (2012). *An investigation into reusable container food outlets*. Unpublished raw data, University of British Columbia, Vancouver, BC, Available from UBC SEEDS. Retrieved from http://sustain.ubc.ca/sites/sustain.ubc.ca/files/seedslibrary/APSC261_2.ReusableContainer_submittedbyFaizal.docx.pdf
- Perry, C. (2012, June 26). *Reusable container programs in food service could it work*. Retrieved from <http://leafme.ca/reusable-container-programs-in-food-service-could-it-work/>
- Sakamoto, Y. (2012). Life cycle assessment of biodegradable plastics. *Journal of Shanghai Jiaotong University (Science)*, 17(3), 327-329. Retrieved from <http://link.springer.com.ezproxy.library.ubc.ca/content/pdf/10.1007%2Fs12204-012-1279-8>
- Stamminger, R., Badura, R., Broil, G., Dörr, S. & Elschenbroich, A. (2010). A European Comparison of Cleaning Dishes by Hand. *University of Bonn*. Retrieved from http://www.landtechnik-alt.uni-bonn.de/ifl_research/ht_1/EEDAL_03_ManualDishwashing.pdf
- Starfrit. (n.d.). *Lock & Lock 1 | Rectangular container*. Retrieved from http://www.atlanticpromotionsinc.com/products/2-starfrit/30-lock_and_lock_storage/82-I_and_I_classic_rectangular/439-0946060060000-lock_and_lock_1_rectangular_container.html
- Waste Online. (2013). *Plastics Recycling Information Sheet*. Retrieved from <http://dl.dropbox.com/u/21130258/resources/InformationSheets/Plastics.htm>
- UBC Food Services. (n.d.). *Initiatives*. Retrieved from <http://www.food.ubc.ca/sustainability/sustainability-initiatives>
- UBC Alma Mater Society. (n.d.) *Blue Chip Menu*. Retrieved from <http://www.ams.ubc.ca/wp-content/uploads/2013/03/Blue-Chip-Menu-2013-Final.pdf>

Appendices

Environmental Impact Calculations

The following calculations were used to compare some of the environmental effects of the Eco-to-Go containers, compared to some other materials which could also be used in disposable containers. Sample calculations are done using assumptions listed, and data sourced from various sources.

Impacts of Biodegradable Plastics

p: Percentage of energy of conventional plastic used in biodegradable plastic life cycle

E_{bs} : Energy use of stage of a biodegradable plastic (23000, 34100, 36800, 37100 MJ/t)

E_{cs} : Energy use of stage of a biodegradable plastic (39700, 50500, 53200, 53300 MJ/t)

$$p = \frac{\sum_s E_{bs}}{\sum_s E_{cs}} \times 100\%$$

$$p = 66.80\%$$

Environmental Impacts of PP vs Paperboard

S_{pi} : Relative environmental impact scores of PP (62, 29, 88, 84, 90, 71)

S_{mi} : Relative environmental impact scores of molded pulp (7, 10, 34, 27, 10, 26)

I_m : Assumed relative impact of molded pulp compared to PP

$$I_m = \frac{\sum_i S_{mi}}{\sum_i S_{pi}}$$

$$I_m = 27\%$$

Water Use in Paper vs Plastic Production

p: Percentage of water used in paper production, compared to plastic

w_{pa} : Water used in paper container production (145,729 m³)

w_{pl} : Water used in plastic container production (5,527 m³)

$$p = \frac{w_{pa}}{w_{pl}} \times 100\%$$

$$p = 2637\%$$

Water Use in Washing

n: Number of containers per dishwasher load (assumed ~30)

l: Lifetime of container in number of washes/uses (300)

w_l : Water used per machine load (15 - 22l)

w_c : Water used per container over lifetime

$$w_c = l \times w_l \div n$$

$$w_c = 150 - 220l$$

Cost Calculations

The following calculations break down the economic analysis done comparing the Eco-to-Go container to using solely the disposable containers the SUB currently uses. Sample calculations are done using assumptions listed beside each variable

Purchase Cost

C_e : Total cost per year

p: Percentage of customers using the Eco-to-Go program (10%)

u: Total customers per year (1101599)

c_e : Purchase cost of each Eco-to-Go container (\$2.50)

l: Lifetime of container in number of washes/uses (300)

$$C_e = p \times u \times c_e \div l$$

$$C_e = \$918$$

Cost of Washing

C_w : Total cost of washing Eco-to-Go Containers

p: Percentage of customers using the Eco-to-Go program (10%)

u: Total customers per year (1101599)

r: AMS employee wage per hour (\$15/h)

t: Time required to washing a single container in hours (3 minutes / 30 containers)

$$C_w = p \times u \times r / 60 \times t \times (p^2 / 0.04) \quad \text{for } p < 0.2$$

$$C_w = p \times u \times r / 60 \times t \quad \text{for } p \geq 0.2$$

$$C_w = \$688.50$$

Cost of Disposable Food Containers

C_d : Total cost of purchasing disposable containers

p: Percentage of customers using the Eco-to-Go program (10%)

u: Total customers per year (1101599)

c_d : Purchase cost of each disposable container (\$0.15)

$$C_d = p \times u \times c_d$$

$$C_d = \$16524$$

Cost of Discount

C_i : Total cost of discounts given to customers using the Eco-to-Go container

p: Percentage of customers using the Eco-to-Go program (10%)

u: Total customers per year (1101599)

d: Discount given per purchase (\$0.15)

$$C_i = p \times u \times d$$

$$C_i = \$16524$$

Total Cost Comparison

$$C = C_e + C_d + C_w + C_i$$

$$C = \$18130.50$$

Miscellaneous Calculations

Estimation of Number of Washes in a Container Lifetime

$$N = (2\text{years}) \times (3/5 \text{ of a year}) \times (5\text{days/week}) \times (52\text{weeks/year}) = 312 \text{ cycles}$$