

An Investigation into Reusable Cutlery Solutions

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An Investigation Into Reusable Cutlery Solutions

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Abstract

The University of British Columbia's Student Union Building (SUB) and cafeteria in particular, is a large hub for student activity and traffic. Thousands of students pass through the SUB each day, generally in a rush. There are many food establishments within the SUB and managing the subsequent waste in a sustainable way is a challenge. With the new, more sustainable SUB building being built, there is a push to make every detail more sustainable. One of the most pressing issues in the current SUB is the amount of waste from disposable cutlery produced from all the food establishments. An excellent alternative is portable, reusable cutlery.

This report addresses on three specific cutlery products and assesses them based on triple bottom line assessment. This assessment focuses on the environmental, social, and economic impacts of the products. The specific products feature bamboo cutlery from "To-Go Ware Products", stainless steel cutlery available from "Lavish and Lime Vancouver", and recycled polypropylene cutlery from "Preserve Products". Research methods included locating sustainable products, then assessing their benefits and drawbacks based on contact with suppliers, and research in peer-reviewed journals.

Each product has unique benefits and drawbacks. The assessment concluded that stainless steel cutlery was the most well rounded option. Despite the fact that the stainless steel product has the poorest environmental impact in terms of production, it has the longest working life span of the three products. Polypropylene cutlery is the cheapest of the three, but it doesn't last as long as stainless steel. The bamboo cutlery has good functionality properties and has excellent environmental standards, but it is much too expensive. When accounting for the environmental, social, and economic factors, stainless steel reusable cutlery proves to be the most viable option.

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Glossary

1. Carbon Footprint/CO₂ emissions – The amount of carbon emitted due to the consumption of fossil fuels by a person, or a group of people.
2. Cottage Industry – Industry such that products are made at home rather than in a factory
3. Embodied energy – Energy it takes to transport and produce a product
4. Life-Cycle Assessment – Measurement of the environmental impacts caused by a given product or service from creation up until biodegradation, as well as lasting impacts.
5. Polyethylene Terephthalate – A form of plastic such as that used in plastic bottles
6. Triple-bottom-line Assessment – An evaluation of a product or service that takes into account social, economic, and environmental factors.
7. Virgin PET – Polyethylene Terephthalate produced from raw, unrecycled material

List of Abbreviations

1. AMS – Alma Mater Society
2. BC – British Columbia
3. CAD – Canadian Dollars
4. CO₂ – Carbon Dioxide
5. LCA – Life Cycle Assessment
6. MJ - Mega joule
7. NGO – Non-Governmental Organization
8. PET – Polyethylene Terephthalate
9. RePEaT – Recycled Polyethylene by To-Go Ware Products
10. rPET – Recycled Polyethylene Terephthalate
11. SUB – Student Union Building
12. UBC – University of British Columbia
13. WEAVE – Women’s Education for Advancement and Empowerment

1.0 – Introduction

The new UBC student union building (SUB) is facing the challenge of reducing the amount of waste output it will produce to promote a more sustainable model. More specifically, UBC wants to reduce the waste created by the common use of plastic utensils on campus. The idea is to place vending machines near the UBC food establishments, which will offer reusable cutlery, as opposed to disposable cutlery. This investigation into reusable cutlery will explore three types of reusable utensils, which could be available in UBC vending machines for student purchase. Students would be encouraged to use the reusable cutlery available and help reduce the amount of disposable cutlery waste.

The three types of cutlery materials being studied include bamboo, polypropylene plastic and stainless steel. The benefits and drawbacks of each material will be broken down in detail during this report in terms of environmental aspects, social aspects and economic aspects. The best suppliers for UBC to consider purchasing from will also be addressed. For the bamboo cutlery, To-Go Ware RePEaT utensils were investigated as a potential supplier. These utensils are 100% biodegradable and exceed environmental expectations. To-Go Ware is a leader in social impacts within the employment sector; however, the cutlery is relatively expensive. The polypropylene plastic cutlery is a material type which has a relatively positive environmental impact in production and can be reprocessed in the long term. The cutlery is relatively inexpensive at \$0.24 per piece, but carries a social stigma along with the use of plastic. The stainless steel utensils are determined to be the most functionally and aesthetically pleasing for consumers to use, but the production of stainless steel can be environmentally harmful. Stainless steel cutlery has the longest life span of the three products and is reasonably priced.

2.0 – Environmental Assessment

2.1 – Introduction: Environmental Assessment

Using life cycle assessment (LCA), this analysis will primarily look at the environmental impact of manufacturing, transport, and disposal of the three products. With reference from several LCA articles, figures will focus on the embodied CO₂ and energy consumption in the products.

2.2 – Bamboo Cutlery: Environmental Assessment

In the environmental assessment of this utensil set, a number of factors were taken into consideration. These factors include the impacts of materials used, energy cost of production of the products, and a life cycle assessment of the rPET plastic that is contained within the carrying case.

For the bamboo cutlery alone, 100% is biodegradable and poses no unnatural environmental side effects during decomposition. Bamboo is also a renewable resource with an incredibly fast growth rate. It is a type of grass that reaches full maturity after 3-5 years as compared to hardwood oak, which reaches maturity after approximately 130 years (Bajzek 2009). Bamboo can capture carbon up to 75% faster than similar plants and therefore has an extremely low carbon footprint (African Business 2011). The expansion of bamboo farms and production was even considered during a UN conference in Cancun, Mexico in December of 2010 (African Business 2011).

The cutlery is made from single sheet bamboo, so it uses no glue. The only chemical additives are in the sealant, which is described as a “top grade, natural, vegan, food-safe sealant on the utensils to further ensure their durability” (To-Go Ware, 2011).

The sealant is composed of:

- Potassium Permanganate – water-soluble salt, often used as a disinfectant.
- Acetic Acid – Organic, relatively weak acid found universally in water and soil.
- Heptane – Used as oil repellent. Distilled from the resin of the Jeffery Pine and the Petroleum Nut Tree.
- Ethanol – sugar based and most commonly used form of alcohol.

(To-Go Ware, 2011)

The carrying case is made of recycled Polyethylene Terephthalate (rPET). In simpler terms, it is made up of recycled disposable water and soft-drink bottles. A number of studies have been done on whether this recycling process is in fact sustainable, such as that by Arena et Al. Their study determined that each kilogram of rPET produced used 22-35 fewer MJ of energy (almost 50%) than an equal weight of virgin PET and produced a 50% smaller carbon footprint than an equal mass of organic cotton (Arena et al., 2003). This shows that rPET is a relatively sustainable product in comparison to producing virgin PET.

With the use of renewable and recycled materials, minimal chemical additives, low production energy, and negligible embodied CO₂, the bamboo cutlery proves very ecofriendly.

2.3 – Polypropylene Plastic Cutlery: Environmental Assessment

Preserve produces polypropylene plastic cutlery from recycled sources. Their process uses 54% less water, 64% less greenhouse gases, 75% less oil, 48% less coal, 77% less natural gas and 46% less electricity than manufacturing these products from new materials (Preserve, 2010).

The manufacturing of polypropylene is a hidden environmental factor that may be overlooked. Polypropylene is produced with the use of fossil fuels, which may be viewed negatively in respect to green production materials. For the production of approximately

4500 kg of polypropylene products manufactured, 9.8 gigajoules of energy is used, 84 kg of solid waste and 345 kg of CO₂ are produced (Franklin Associates, 2006, p. 6).

While it may seem that plastic is an environmentally destructive material, this plastic specifically can be recycled and be melted down with new polypropylene to make new products (Simmons, 2005, p. 6).

2.4 – Stainless Steel Cutlery: Environmental Assessment

During stainless steel production there are a variety of metals that are required for production. Table 1 shows the total energy consumption required to produce these necessary metals which account for all energy consumption in the production of the materials (i.e. mining, manufacturing...)

Table 1: LCA Results for Stainless Steel Production (Norgate, Jahanshahi and Rankin)

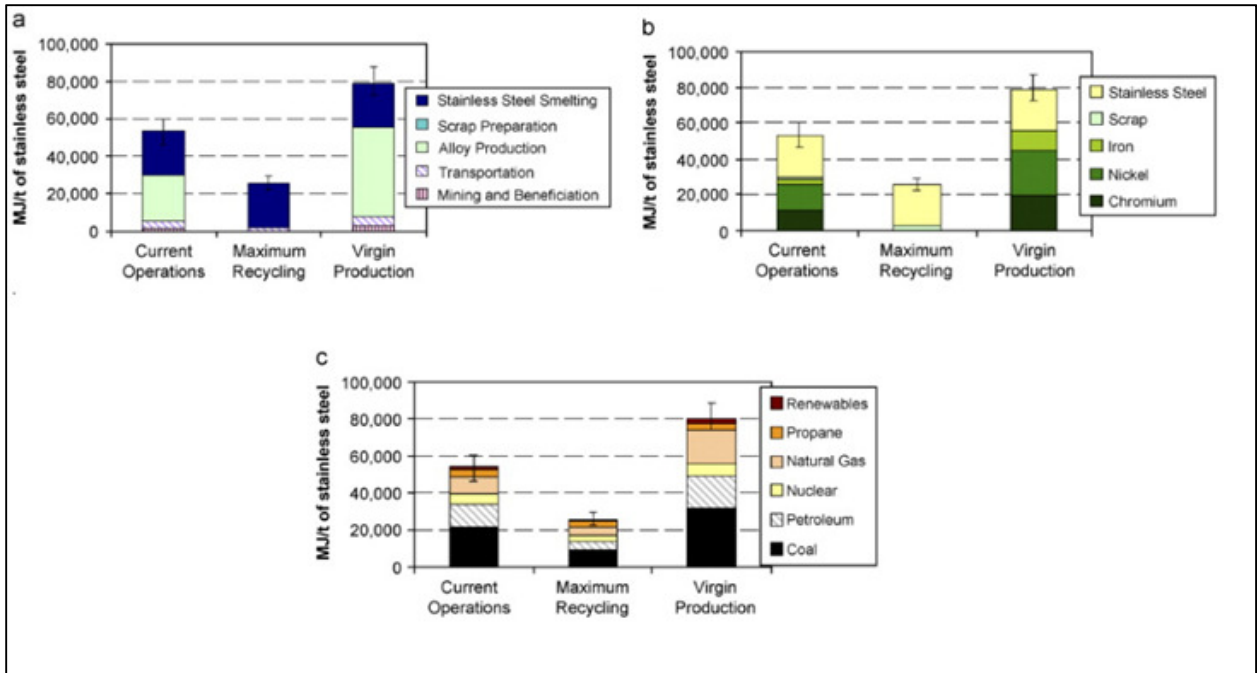
Environmental impact	Feedstock materials for stainless steel production				304 Stainless steel	
	Iron	Nickel	Ferrochrome	Ferronickel	From nickel	From ferronickel
Total energy (MJ/kg)	22	114	56	110	49	75
Gaseous emissions						
CO ₂ (kg/kg)	2.0	11.1	5.1	8.9	4.8	6.6
CO (g/kg)	1.9	2.9	5.4	5.6	3.4	4.7
N ₂ O (g/kg)	0.02	0.05	0.06	0.07	0.04	0.06
CH ₄ (g/kg)	2.6	16.6	6.2	18.4	6.0	10.8
NO _x (g/kg)	12.6	44.6	29.6	70.6	24.8	44.1
NMVOC** (g/kg)	0.20	2.7	0.17	1.6	0.4	0.8
SO ₂ (kg/kg)	0.007	0.107	0.018	0.026	0.022	0.020
GWP (kg CO ₂ e/kg)	2.1	11.4	5.3	9.3	4.9	6.8
AP (kg SO ₂ e/kg)	0.015	0.138	0.039	0.075	0.039	0.051

** Non-Methane Volatile Organic Compounds

For every kg of stainless steel manufacture, it will produce approximately 4.8-6.6kg of CO₂ and 49-75MJ of energy.

With current operations, recycling stainless steel (primarily composed of iron, nickel, and chromium) cuts down production energy by almost by 50% as opposed to manufacturing virgin stainless steel (Johnson, Reck and Wang). Figure 1 shows the required energy for production between current recycling, maximum recycling, and virgin (new) production of stainless steel.

Figure 1: Stainless Steel Recycling Energy Consumption (Johnson, Reck and Wang)



In terms of this product’s carbon footprint, recycling cuts upwards of 45% of CO₂ emissions depending on the specific composition of the stainless steel (Johnson, Reck and Wang). Recycling stainless steel has proved to be an efficient process; however the current supply of scrap does not currently reach the production demand (Johnson, Reck and Wang).

Transportation from China to Canada also has higher embodied energy and CO₂ compared to manufacturing the product in North America.

2.5 – Conclusion

Below in Table 2, we compared all three products in terms of their: production carbon footprint, embodied production energy, and embodied transportation carbon.

Table 2: Product Environmental Figure Comparison

Product Material	Bamboo	Polypropylene Plastic	Stainless Steel
Embodied Production CO ₂ (kg/kg material)	N/A	0.1	4.8-6.6
Embodied Production Energy (MJ/kg material)	42	2.2	49-75
Embodied Transportation CO ₂ Rating	High	Low	High

There are several discrepancies in this table that are not obvious upon first inspection.

- The bamboo product’s embodied production CO₂ is negligible because of the bamboo plant’s carbon offset
- The bamboo product’s embodied production energy is primarily produced from the cutlery case made of rPET
- Both the bamboo and stainless steel products originate from China, which has a high embodied CO₂ level from transportation to Canada
- The polypropylene plastic product originates from the United States which has a significantly less embodied CO₂ level from transportation compared to the two other products

In conclusion, the polypropylene and bamboo products both have positive environmental assessments in contrast to the energy consuming stainless steel product. Bamboo, being made from a renewable material with carbon offset makes the product admirably sustainable. In the future, it would be appropriate to search for alternative solutions for the bamboo cutlery case instead of rPET, which requires significant production energy. The polypropylene product requires little production energy/CO₂ and has relatively small embodied energy from transportation. The stainless steel product requires the most production energy/CO₂ and embodied energy from transportation.

3.0 – Social Assessment

3.1 – Introduction

The purpose of this analysis is to provide consumers at UBC with an alternative, sustainable solution for disposable cutlery when eating at the new SUB. There are many areas of social impacts that come along with each of bamboo, polypropylene, and metal cutlery. These impacts affect employees, producers and consumers. It is important that the companies and products we do business with promote sustainable living as well as fair employment practices.

3.2 – Bamboo Cutlery: Social Assessment

The RePEaT bamboo utensil was determined to be a socially positive product on both sides of the discussion. To-Go Ware is a very open company that provides information regarding their background and employee working conditions online. They are supporters of two different non-governmental organizations (NGOs). One of which supports women in refugee camps along the Thai-Burma border (WEAVE), and the other promotes the recycling of plastic bags in the slums of New Delhi (CONSERVE). The following is a statement from the To-Go Ware website:

All of our partners are regularly monitored for human rights and environmental abuses by an independent third party monitor, in addition to a supplemental audit we've added with some additional standards we feel are important... [Our bamboo is] sourced and made in China by a small cottage industry factory. The forest the bamboo is sourced from has been personally visited by our third party certifier and their audits assure us that the sourcing and harvesting is sustainable and that they employ fair labor practices.

(To-Go Ware 2011)

This shows their commitment to fair working conditions for their employees as well as the employees of their partners. The use of cottage industries rather than industrial factories provides additional sources of employment for agricultural workers as well as the unemployed in China when crops are out of season.

Social impacts that the products might have on students and consumers at UBC who use this product were also considered. It is expected that students will find the set to be visually appealing and unique as the sets come in a variety (9) different colours. In terms of portability, the set comes with a carabineer that enables the case to be clipped to any backpack or bag.

Figure 2: Bamboo Cutlery Product



3.3 – Polypropylene Plastic Cutlery: Social Assessment

In the general population, Polypropylene cutlery is viewed as environmentally destructive. With the Preserve’s reusable and recyclable cutlery, awareness can be spread about this cutlery, which is 100% made from recycled plastic and is 100% recyclable. This cutlery is durable and is not as ductile as other plastic cutlery which is generally frustrating to eat with. The cutlery comes in 3 colors so there is once again a sense of style and choice for people to choose from. Since the cutlery is 100% recyclable, the new SUB building should have a sign above recycling claiming that the cutlery is recyclable so it does not just end up in the garbage, even at the end of the product’s lifetime.

Figure 3: Polypropylene Plastic Cutlery Product



3.4 – Stainless Steel Cutlery: Social Assessment

The durable, stainless steel set of cutlery consists of the following cutlery for virtually any meal: one fork, one spoon, and a pair of chopsticks. In terms of the aesthetics, the cutlery has a clean stainless steel look with a portable stainless steel case available in a variety of colors.

Metal cutlery is generally considered more aesthetically and functionally pleasing to consumers as opposed to disposable plastic cutlery for example. The University of Oxford conducted a study to evaluate consumer's perception of food based on the material of cutlery. The results show that the majority of consumers consider stainless steel cutlery to have a higher sense of quality than metallic coated plastic cutlery (Piqueras-Fizman). Based on personal experience and common knowledge, it is generally easier to eat food with stronger steel cutlery than plastic or wood products.

This specific cutlery set and most similar products in the same economic range are manufactured in Mainland China. The work practices in this region are commonly controversial relative to Canadian standards. Because this product is not manufactured in

Canada, it does not benefit our economy to the level that a Canadian made product would, and may involve controversial employment practices.

Figure 4: Stainless Steel Cutlery Product



3.5 - Conclusion

While each one of these products promotes sustainable living, it would be ideal to market information regarding the sustainable advantages to using reusable cutlery upon purchase. Students may view the plastic cutlery as a less environmentally friendly product, because of reputation, which would be contrary to the mission of promoting sustainable living within the SUB. In terms of functionality and reusability, the stainless steel cutlery stands above bamboo and polypropylene. To-Go Ware seems to promote good employee care and appears to be a company worth supporting. Overall, it seems as though stainless steel and bamboo cutlery are both socially beneficial as a sustainable solution.

4.0 – Economic Assessment

4.1 – Introduction

A strong deciding factor in whether a product is chosen by a company or in this case an academic establishment is the economic cost of the product. In assessing economic cost, manufacturers and suppliers of the products were contacted and approximate wholesale prices as well as shipping prices were considered. A common problem with more sustainable products is that they cost significantly more to produce, and this increased cost of production is reflected in the consumer price of the product. This situation is exactly what happened with the studied cutlery. While the bamboo cutlery appears to be the most sustainable, it is also by far the most expensive. On the other hand, the plastic cutlery appears to be the most inexpensive and hence would probably appeal to students who typically run on a narrow budget.

4.2 – Bamboo Cutlery: Economic Assessment

The RePEaT bamboo cutlery set currently costs \$12.95 per set direct from the manufacturer (To-Go Ware 2011). Shipping the packs costs approximately \$0.78 per cutlery set. This brings the total cost of one set of cutlery to \$15.41 including tax. This data is summarized in Table 3. While this appears to be much more expensive than plastic or metal, it must be considered that this set includes a knife, fork, spoon, chopsticks, and carrying case. The carrying case will prevent the student from losing or misplacing their cutlery resulting in a longer product lifetime. The economic cost is definitely the most destructive factor in the consideration of this product for the SUB vending machines

4.3 – Polypropylene Plastic Cutlery: Economic Assessment

The polypropylene plastic cutlery is sold on a per item basis. The prices per item of cutlery are \$0.24 per fork, spoon, or knife on average.

(Preserve Products 2011)

Preserve sells cases of 24 pieces (8 forks, 8 knives, 8 spoons per case) for \$5.50 plus \$0.34 tax. Each set of cutlery (1 knife, 1 fork, and 1 spoon) costs approximately \$0.73.

On top of the product cost, the shipment cost must also be considered. For a shipment of 50 cases, the shipping cost is approximately \$45.00 conservatively from a common courier service. This means that each “set” of cutlery would cost \$0.12 in shipping, which brings the overall product price up to \$0.85 per set.

This is over 16 times less expensive than the price of the bamboo cutlery. While this appears to be very inexpensive, it must be considered that the set does not come with a carrying case, which could result in a shorter product lifetime. It is suggested that if this cutlery were implemented, more research should be done in determining whether a case should be obtained for this particular set of cutlery.

4.4 – Stainless Steel Cutlery: Economic Assessment

The Stainless steel cutlery is relatively cheaper compared to cutlery made of bamboo, but is still more expensive than the polypropylene plastic cutlery offered by Preserve Products. Global Sources is one of several ‘business to business’ (B2B) media companies that provide supplier information to volume buyer customers. Global Sources markets a supplier that sells the identical product sold from Lavish & Lime retailers at a fraction of the price. Depending on the quantity of an order, the price will vary from \$1.50 to \$3.00 per unit, which is considerably less than buying from a retail company (Volusion). Global sources did not offer a price quote on shipping costs so a general courier cost calculator estimate was used in place of confirmed shipping costs. This value was approximately \$0.85 per “set” of cutlery, including a fork, spoon, chopsticks, and case, which brings the overall cost up to anywhere between \$2.41 and \$4.10.

With these approximate unit prices, UBC has the ability to distribute stainless steel cutlery at a more than affordable price. Relative to current food prices in Vancouver, consumers could buy portable, stainless steel cutlery for the price of half a meal.

4.5 – Conclusion

Table 3 summarizes the data calculated in this section and shows the approximate overall cost per set in Canadian dollars

Table 3: All Product Price Comparison

OVERALL COST PER SET (CAD)				
	Price	Tax	Shipping	Total
Bamboo	12.95	1.68	0.78	15.41
Plastic	0.73	0.05	0.12	0.90
Steel	1.50 – 3.00	0.20 - 0.39	0.71	2.41 – 4.10

After assessing each of the products for overall cost to UBC, it was established that the plastic would be significantly cheaper than both the bamboo or steel products, although it may not last as long. The bamboo To-Go-Ware set is very expensive and would probably not appeal to students on a low budget. The steel cutlery set on the other hand, is reasonably priced and would probably last much longer than both other types of cutlery due to its carrying case, and durable materials. Overall, while the plastic cutlery is significantly cheaper, the steel would probably be the best option because it would have a longer product lifetime.

5.0 Final Conclusion

In conclusion, it has been determined that none of these three types of cutlery would be a suitable product in a sustainable product vending machine, although the best of the three is the stainless steel cutlery. The Bamboo cutlery from To-Go Ware is incredibly environmentally friendly as it is a renewable resource, and comes from a producer that promotes fair employment practices. Unfortunately, the product is too expensive and may not appeal to students in terms of performance. The plastic polypropylene cutlery from Preserve Products is an effectively recyclable material which can be recycled again and is also incredibly inexpensive to purchase. On the other hand, the plastic material may not be as user-friendly and may not be perceived as a sustainable product. The metal cutlery is definitely the least environmentally friendly in terms of production, although the products are relatively inexpensive and will last longer than the bamboo or plastic cutlery, perhaps resulting in a lower long-run environmental impact. The metal cutlery is also the most aesthetically and functionally pleasing. It is suggested that more research be done to locate a company that produces metal cutlery at a similar price to the cutlery in this report, but also does so with certified sustainable and fair employment practices in mind.

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