UBC Social Ecological Economic Development Studies (SEEDS) Student Report

An Investigation into Sustainable Water Consumption

(Bottled Water versus WaterFillz Units)

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University of British Columbia

APSC261

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APSC 261

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Date Submitted: Nov.29th, 2010

Abstract

This report aims to perform an analysis on the environmental, economical, and social impacts of selling over-the-counter bottled waters versus implementing filtered water dispensing units such as WaterFillz. The WaterFillz unit will be evaluated against the current method of selling bottled water in order to determine whether WaterFillz can be a suitable candidate for replacing bottled water in terms of water distribution in the New SUB. When the energy consumption of delivering 1L of water to consumer is compared, we have found that the WaterFillz unit consumes much less energy over time when considering the manufacturing, distribution, and disposable impacts on the environment. However AMS loses out on potential revenue if the WaterFillz unit is used to distribute water the UBC students, faculty and staff. This may be able to be recovered via renting out ad spaces on the WaterFillz units. From the social perspective, the WaterFillz unit can make significant social impacts on the way water is consumed in the New SUB and at UBC. It helps raise awareness of waste issues regarding disposable plastic and encourage people to be conscious of other sustainability problems. By surveying a small sample population within the Faculty of Applied Science, we have also identified that 80% of our participants are willing to drink tap water, however only 52% drink tap water at UBC. More participants would drink tap water at UBC if the water fountains were filtered, maintained and accessible. By implementing the WaterFillz units, UBC and the New SUB are taking steps to move toward a more sustainable way of water consumption.

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List of Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
AMS	Alma Mater Society
HIV	Human Immunodeficiency Virus
PET	Polyethylene Terephtalate
SUB	Student Union Building
UV	Ultra Violet

Glossary

Activated Charcoal -- Activated Charcoal is a form of carbon that has been processed to make it extremely porous and thus to have a very large surface area available for adsorption or chemical reactions.

Pathogenic Microorganisms -- Pathogenic microorganisms includes viruses, bacteria, fungi and protozoa. These may be found outside the body on the skin surface and the mucosal surface or inside the body in the blood, tissues or EM.

Polyethylene Terephtalate – A thermoplastic polymer used mainly for the production of synthetic fibres and plastic bottles. When used in textiles, it is simply known as polyester.

Ultra Violet Light -- Ultra Violet Light is electromagnetic radiation with a wavelength shorter than that of visible light, but longer than X-rays, in the range 10 nm to 400 nm, and energies from 3eV to 124 eV.

List of Illustrations

1.0 Introduction

As a human, it is suggested by nutritionists that we consume roughly 2 litres of water a day. For students, staff, and faculty members at the University of British Columbia, a portion of the daily water intake will be consumed while at UBC. The UBC Student Union Building is the most high traffic area at UBC, housing all of AMS food and beverage outlets with hundreds of students purchasing bottled water every day. As the New SUB is being built, it is important that we evaluate the current methods of providing drinking water to UBC students, staff and faculty members and determine whether it is a sustainable and socially conscious practice.

The goal of this report is to conduct a triple-bottom-line assessment of sustainable water consumption methods for the New SUB at UBC. First we will evaluate one of the more popular methods of giving access to drinking water via selling bottled waters. We will evaluate the real cost of a bottle of water throughout its life time and determine its financial cost, eco-footprint and social impact. These 3 criteria will also be used to assess the WaterFillz water dispensing units currently employed as a pilot project in the SUB. A comparison of these two water distribution methods will be done to determine the more sustainable candidate for the New SUB. Furthermore, this report will also evaluate a third common water distribution method which is consuming water straight from the tap. A water consumption survey will be sampled form a small UBC student population to analyze common drinking patterns and their causes. A final suggestion will be made after determining the most sustainable candidate out of the three water distribution methods.

2.0 Bottled Water

2.1 Bottled Water Consumption

Bottled water use has increased by vast amounts over the past few years. For instance, in 2007, over 200 billion litres of water were sold, mostly in North America and Europe [1]. Bottled water sales alone have increased 70% since 2001. Not only is bottled water use growing rapidly in developed nations, it is also growing in developed nations, such as China where bottled water use has doubled between 1999 and 2004 [2]. There are many reasons consumption of bottled water has grown at these rates, but a large reason why people buy bottled water for are convenience and perceived health benefits.

2.2 Environmental Impacts of Bottled Water Production

There are many direct and indirect social and environmental costs related to the production and consumption of bottled water. These costs arise from every stage. These include production of bottles, treatment/extraction of water, bottling, packaging, transportation, refrigeration and disposal.

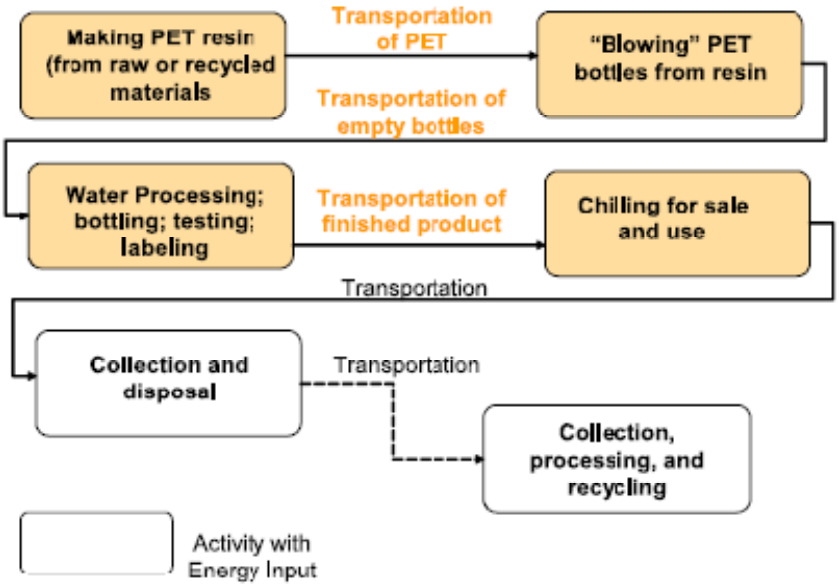

Figure 1: Bottled Water Manufacturing Process [1]

First, we will focus on the production of the water bottles themselves. Most water bottles are made of a plastic called polyethylene terephtalate (PET). One of the main ingredients that go into the production of PET is crude oil and about 3 million tons of PET is used annually on a global scale [1]. To produce this amount of PET, roughly 50 million barrels of oil are used. This comes from the fact that it takes about 100 000 megajoules (MJ) of energy per ton (100MJ/kg) of PET and a barrel of oil contains roughly 6000 MJ of energy [1]. Interesting to note is that once the water is drunk out of those bottles, most of them are simply thrown away and end up in a landfill, taking over a millennium to biodegrade. In fact, 86% of plastic bottles in the US go to a landfill [2]. It should also be noted that almost 40 percent of the PET bottles that were deposited for recycling in the United States in 2004 were actually exported, sometimes to as far away as China, adding to the ecological footprint [2].

The treatment of bottled water is actually a very small component of the energy footprint of bottled water, even with the most extensive treatment. For instance, UV treatment of water only requires 10 kilowatt-hours (kWh) of electricity per million litres (0.0001MJ/L). Up to 7000kWh/million litres (0.07MJ/L) of electricity may be used to treat water by desalination. This would be in addition to the approximately 3000kWh (0.03MJ/L) used embodied in municipal water for treatment and distribution.

The energy required to transport the treated and bottled water varies greatly depending on where the water source is and where it is being shipped to, but the energy required for transportation may not be an insignificant amount of the water is being shipped from the other side of the world, especially if being shipped by air freight. Also, since water is not light, weighing 1kg/L, energy requirements can be quite high. Table 1 sourced from Gleick [1] shows the energy required for various forms of transportation.

Cargo Ship/Ocean ($MJ\ t^{-1}\ km^{-1}$)	Air Cargo ($MJ\ t^{-1}\ km^{-1}$)	Rail ($MJ\ t^{-1}\ km^{-1}$)	Heavy Truck ($MJ\ t^{-1}\ km^{-1}$)	Medium Truck ($MJ\ t^{-1}\ km^{-1}$)
.37	15.9	.23	3.5	6.8

Table 1 Energy Required for Water Transportation

Once the bottled water is shipped, it must now be refrigerated, waiting for sale. First the water is cooled from room temperature, around 20°C to 3°C and maintained at 3°C until it is sold. Assuming the water is refrigerated for 1 week the heat capacity of water is 4.2kJ/kgK, an average refrigerator uses about 8.65kWh/week to cool on average 17 cubic feet, about 0.4MJ/L of electricity is consumed to keep the water refrigerated for sale.

The energy used to produce bottled water is summed up in Table 2. Note that it requires anywhere from 5.6 to 10.2MJ of energy to produce a single litre of bottled water, depending largely on the distance travelled and the method of transportation. This is in comparison to tap water that requires only about 0.005MJ of energy per litre to treat and distribute [1]. Considering that approximately 35000 bottles of water are sold over-the-counter annually by UBC, and assuming the bottled water is actually produced in the Metro Vancouver area, requiring the minimum amount of energy (5.6MJ/litre) and if each bottle is about half a litre, 16 barrels of oil are used by UBC students alone. This number will actually be a little higher in reality as sales of bottled water from vending machines, which isn't included in the figure given, on campus is unknown.

	Energy Required (MJ per litre)
Manufacture plastic bottle	4.0
Treatment at bottling plant	0.0001-0.2
Fill, label and seal bottle	0.01
Transportation	1.4-5.8
Cooling	0.2-0.4
Total	5.6-10.2

Table 2 Total Energy Required for Bottled Water Lifecycle

2.3 Economic and Social Impacts of Bottled Water

Not only are there environmental impacts from the use of bottled water there are also economic and social ones as well. At as much as $2.50 per litre, bottled water is about 10000 times more expensive than tap water [3]. Even at this elevated price, people are still willing to drink bottled water. At UBC alone, approximately 35000 bottles of bottled water were sold. At about $2 per bottle that equals approximately $70 000 per year in revenue that the AMS brings in. This money is then used to provide services to students. If we were to reduce or even eliminate the sales of bottled water here at UBC, this would mean that a significant source of revenue for the AMS would be severely reduced or even eliminated, potentially reducing services available for students. In addition, we must also consider the costs of the Waterfillz units which have an initial purchase cost of around $9000 dollars in addition to its operating and maintenance costs, which are explained in more detail later in this report, that will not be directly recuperated through the use of the machines.

Also interesting to note that most bottled water is of good quality. However, testing has found that about one fourth of the tested bottled water brands contained microbiological or chemical contaminants in at least some samples at levels sufficiently high to violate enforceable state standards (California) or warning levels [4]. Also of the waters tested by Olson, one fifth of the brands tested exceeded state bottled water microbial guidelines in at least some samples. Generally, most bottled water is of acceptable quality, but should not be considered to be sterile.

3.0 WaterFillz

3.1 Operating Process

Incoming city water enters the Sediment Filter, a 50-5 micron pre-filter. From there, the mineralized pure water travels to the Activated Charcoal Filter and then enters the Refrigeration Unit. Finally, the water travels through the Ultra-Violet Light to eradicate micro-organisms remained in the water [5].

3.2 Environmental Impact of the WaterFillz unit

3.2.1 Energy Consumption

The energy consumption during manufacture process is estimated by calculating the energy used for steel production, according to the data provided by METALs advisor [6]. Since the WaterFillz unit is mainly made of steel and weighted 92 kg, based on the specification sheet in Appendix A, we calculated the energy consumption for producing 92kg steel:

Electricity Consumption

Operating Unit	Product Basis	kWh Consumption Per Metric Ton of Product	kWh Consumption Per Net Ton of Product
Sinter Plant	Sinter	44	40
Coke Plant	Coke	38.5	35
Blast Furnaces	Hot Metal	27.5	25
Basic Oxy. Furnace	Raw Steel	33	30
Continuous Casting	Slabs / Billets	27.5-44	25-40
Blooming Mill	Blooms	33-44	30-40
Slabbing Mill	Slabs	35.2-49.5	32-45
Reversing Plate Mill	Plates	110-132	100-120
Bar Mill	Bars	132-165	120-150
Hot-Strip Mill	Sheet / Strip	121-143	110-130
Cold-Reduction Mill	Sheet / Strip	126.5-148.5	115-135

Figure 2 Electricity Consumption per ton of product for various integrated mill operations [6]

Net electricity consumption of sheet steel: 120 kWh/ton
Energy consumed for 92 kg steel = 120 kWh/ton *92 kg /1000 = 11.02 kWh

The UV light bulb and the refrigeration unit are two major power consuming parts in the WaterFillz unit. The UV light bulb continuously consumes the power at 12 Watts. There are two Refrigeration units in the body, and each consumes power intermittently at 34 Watts [7]. Therefore, we choose 46 Watts as the average power consumption for the WaterFillz unit. The energy consumption of one year period is therefore calculated as below:

Annual electricity consumption during operation = 46 Watts * 24 hours* 365 = 403 kWh

3.2.2 Eliminate the use of Bottled Water

The WaterFillz unit is certainly an alternative to the bottled water. People can access to fresh clean water by filling up their cups, cans or bottles. There is no need to buy a bottle each time when someone needs to drink. The WaterFillz unit will change way how people drink water, and therefore, reduce the amount of bottles used to contain water.

3.2.3 No Waste Water

Because of the design feature of the WaterFillz unit, it only supplies water when the user pushes a bottom. Therefore, the amount of water supplied by the WaterFillz unit will be the same as the demand. There will be no waste of the clean water that has been processed.

3.3 Economic Impact of the WaterFillz unit

In order to calculate the Life Cycle financial costs of the WaterFillz unit, we need to consider all aspects from the purchase of the unit until the disposal of the unit. Since the cold water in Vancouver is free of charge, the cost of water consumption will be zero.

The detailed cost analysis is performed as follow:

- Cost of Purchase: $8995 [8]
- Parts: UV light bulb good for 9000 hours(or 12.5 months) [5] approximately $30 each
- Expected Lifespan: 10 years

- Electricity Rates:

Basic Charge (cents/day)	Step1 (cents/kWh)	Step2 (cents/kWh)
13.41	6.27	8.78

Table 3 Residential Conservation Rate

Roughly 9 cent/kWh, according to BC Hydro's Electricity Rate [9]. (Basic charge is always required no matter of the WaterFillz unit)

The Total life time(estimated 10 years) expenditure of the WaterFillz unit is:
8995+30*10+0.09*403*10=9657.7 dollars
The annual cost will be: 9657.7/10=965.8 dollars

The above calculations are based on the assumption of 10 years operating period since the WaterFillz unit is a relatively new product and have not had enough time for lifespan evaluation. The cost of for transportation is neglected since the company is located in Great Vancouver area. Meanwhile, the cost of disposal is also not involved since the steel material can mainly be recycled. In the perspective of AMS, the actual cost for the WaterFillz will just be the factors we considered above.

3.4 Social Impact of the WaterFillz unit

3.4.1 Health

The WaterFillz unit provides a healthy drinking water source. The contaminants that may have dislodged from the city water pipes are removed in the Sediment Filter. Because the city's water purification plant may be far away from the local water supply, it is possible that the water contains contaminants while travelling through the aged pipe lines. Chlorine and other heavy metal minerals that can be harmful are further removed from the water by the Charcoal Filter. It is a known fact that city adds Chlorine for protect water from bacteria. At the final step, the remaining micro-organisms are removed by the UV light. It is safe to conclude that the water supplied by the WaterFillz unit is clean and healthy.

3.4.2 Public Awareness

The use of the WaterFillz unit will raise public awareness of water bottle usage. It is a virtual feature that indicates an option to consume water other than purchasing bottled water. The WaterFillz unit brings people awareness of water consumption in a daily basis. In order to get water from the WaterFillz unit, people have to bring their own bottle every day. As people have their own bottle in hands, there is a less chance that people will go and buy another bottled water. While the users are filling up the water using the WaterFillz unit, they will start to think about the environmental responsibility they have. The idea of reducing bottled water usage is therefore implemented.

4.0 Tap Water Alternatives

4.1 Vancouver Tap Water Quality

4.1.1 Social Impacts

At UBC, although there are a great numbers of water fountains as well as WaterFillz located at the Student Union Building, the number of students choosing to drink bottled water is increasing. Various factors such as perceived risk of drinking tap water, taste, smell, convenience, and accessibility have significant influence in making the choice.

According to *"The Greater Vancouver Water District Quality Control Annual Report"*, Metro Vancouver (supplier of drinking water to UBC) follows a series of guidelines and regulations to perform daily tests on the source water coming from Capilano, Seymour, and Coquitlam sources [10]. These tests monitor the percentage of various factors such as turbidity levels, Giardia, Cryptosporidium, Coliform, Herbicides, Pesticides, Volatile Organic Compounds, Radioactivity, and Uranium. They perform these daily monitoring in order to find out the quality of source water, the degree of contamination, and the treatment level required.

The disinfection process of the water has two stages:
1) Destroy disease-causing or pathogenic microorganisms by using strong oxidizing agents, chlorine or ozone
2) Improve the quality of the delivered water to meet the bacteriological requirements of the British Columbia Drinking Water Protection Regulation

Hence, based on the results of these daily tests, Metro Vancouver states:
"It is safe for healthy people to drink water directly from the tap, since all cities in the lower mainland receive safe and treated water which is subject to monitoring and testing. For people with compromised immune systems (such as organ transplant recipients, chemotherapy patients or those suffering from HIV or AIDS) or infants under 3 months of age, the provincial medical health office recommends boiling the water for 5 minutes."

5.0 UBC Sustainable Water Consumption Survey

The results of the study "Risk Perceptions of Arsenic in Tap Water and Consumption of Bottled Water" by P. Jakus, D. Shaw, T. Nguyen and M. Walker that examines whether purchases of bottled water are associated with the perceived risk of tap water, shows the factors such as taste, smell, and clarity of drinking water are of greater concern than risks associated with health in deciding to buy bottled water [11].

Therefore, we created a survey to see the factors associated to this trend. In the survey, we ask the students if they drink bottled or tap water, their reasons for choosing one over the other, their preferences, and their suggestions [12].

5.1 Survey Result

Almost 90 people (24% female & 75% male) took the survey; they were mainly in the age range of 18-35 years old and from the faculty of Applied Science. The result shows that 23% of the participants do not drink tap water at all due to various reasons such as health, smell and taste of tap water; 77% of the participants drink tap water because it is cheaper than bottled water, it is more sustainable than bottled water, and It is more readily available than bottle water. Furthermore, the result indicates that 65% of students prefer drinking filtered tap water (WaterFillz) and would drink tap water from the fountains available at UBC if the fountains were easily accessible and were kept clean. Also, the survey signifies that 50% of the students did not know that bottled water can be between 500 to 10,000 times more expensive than tap water.

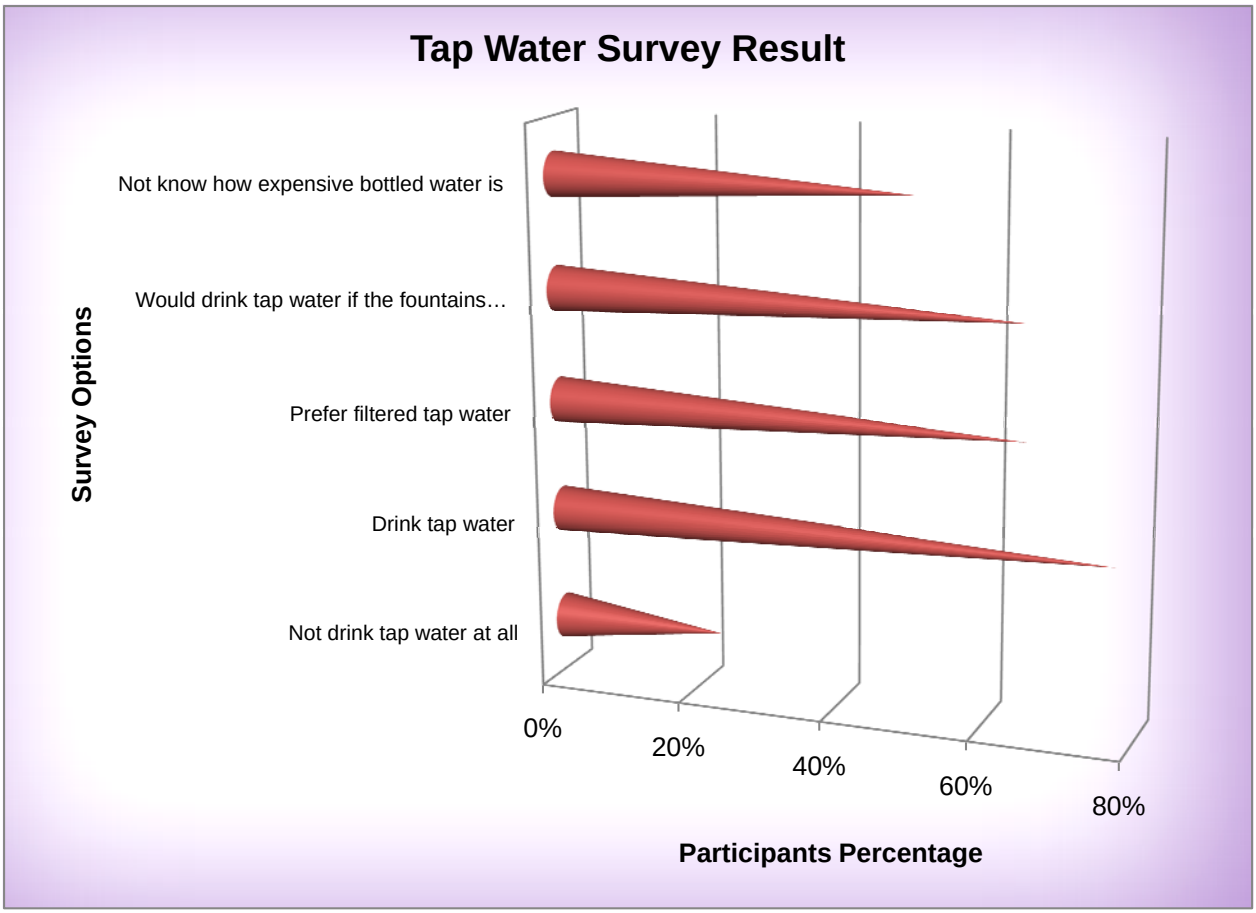

Figure 3 Tap Water Survey Result

The participant's comments can be found in Appendix C.

6.0 Conclusion

As summarized in this report, producing bottled water has enormous environmental cost all along each of the life cycle steps including manufacturing, transportation, distribution and disposal. An environmentally conscious choice would be using the WaterFillz unit as its environmental cost for manufacturing is relatively fixed and increases minimally as more water is distributed. WaterFillz also promotes the use of reusable containers and hence creates much less waste plastic bottles when compared to bottled water.

Financially, AMS loses revenue up to $70,000 per year for not selling bottled water over the counter while WaterFillz units would generate no revenue. AMS could still explore other revenue generation schemes for the WaterFillz units including using it for advertising space. However the upfront cost of $9000 is relatively high and it'll take time for that cost to be recovered and start generating profits for the AMS. In the short term, it could mean a cut in the budget for AMS related services.

By choosing the WaterFillz units, the AMS can help raise awareness regarding disposable plastic waste and reusable containers. The WaterFillz unit can be used to re-educate people and help change people's habit of buying bottled water. The potential ad space on the WaterFillz units can also be used for more social awareness campaigns.

By evaluating the three different bottom lines, our team has concluded that the WaterFillz unit is a suitable replacement for over-the-counter bottled waters. As our survey has identified, 80% of participants already drink tap water. Hence a combination of existing tap water and WaterFillz can be used to satisfy the New SUB users. Tap water can serve to people who are already comfortable with drinking water straight from the tap. For those that are concerned with tap water, WaterFillz would be ideal for people who only drink filtered water. Ultimately, the use of disposable plastic bottled water should be phased out and replaced either by tap water or by filtered water fountain units such as WaterFillz.

References

[1] P.H. Gleick, et.al, Energy Implications of Bottled Water, [Online Document], 2009 February 19, [cited 2010 Oct 20], Available HTTP: http://iopscience.iop.org/1748-9326/4/1/014009/pdf/1748-9326_4_014009.pdf

[2] E. Arnold and J. Larsen, "Bottled Water: Pouring Resources Down the Drain", [Online Document], 2006 February 2, [cited 2010 October 29], Available HTTP: http://www.earth-policy.org/index.php?/plan_b_updates/2006/update51

[3] J. Owen, Bottled Water Isn't Healthier Than Tap, Report Reveals, [Online Document], 2006 February 24, [cited 2010 Oct 20], Available HTTP: http://news.nationalgeographic.com/news/2006/02/0224_060224_bottled_water.html

[4] E. Olson, Bottled Water: Pure Drink or Pure Hype?, [Online Document], 2009 April, [cited 2010 Nov 19], Available HTTP: http://www.nrdc.org/water/drinking/bw/bwinx.asp

[5] WaterFillz Home Page, [Online], [cited 2010 Nov 25], Available HTTP: www.waterfillz.com/

[6] METALS Advisor, [Online], [cited 2010 Nov 25], Available HTTP: www.energysolutionscenter.org/heattreat/metalsadvisor/iron_and_steel/overview/energy_consumption.htm

[7] D. Klaassen, Survey on WaterFillz, [Online], 2010 Nov 5, [cited 2010 Nov 25], Available e-mail: Appendix D Message: Survey on WaterFillz

[8] Green Benefits, WaterFillz, [Online], [cited 2010 Nov 25], Available HTTP: http://bgreenbenefits.com/products/3-waterfillz.aspx

[9] BC Hydro, Electricity Rate, [Online], 2010 Apr. 1, [cited 2010 Nov 25], Available HTTP: www.bchydro.com/youraccount/content/electricity_rates.jsp

[10] "The Greater Vancouver Water District Quality Control Annual Report", [Online Document], 2009 www.metrovancouver.org/about/publications/Publications/QualityControlAnnualReport2009-Volume1&2.pdf

[11] P. Jakus, D. Shaw, T. Nguyen and M. Walker, Risk Perceptions of Arsenic in Tap Water and Consumption of Bottled Water, Agricultural and Applied Economics Association, July 26-29,2009, Available HTTP: www.ageconsearch.umn.edu.

[12] S. Talatala, The Effect of Tap Water Perception on the Consumption of Bottled Water, [Online Document], May 12 2008, Available HTTP: www.nature.berkeley.edu

Appendix A – WaterFillz Technical Documentation

The WaterFillz™ Potable Water Dispensing Kiosk

Manufactured in Canada by The SafeStar Products Company (1) 604-535-2030 www.safestar.ca Rev. 26/02/2010

Specifications

Dimensions	Physical	914mm (W) x 610mm (D) x 1829mm (H) 36" (W) x 24" (D) x 72" (H)
Weight	Net Dry	92 kg (202 lb)
Power	Voltage	120v/60Hz VAC Supplied with grounded plug for standard receptacle.
Power Consumption	Continuous	12 w (Ultra Violet Bulb in UV Sterilizer 24/7/365)
	Intermittent	34 w (Refrigeration Unit)
	Maximum	46 w (Combination of UV + Refrigeration)
Water Supply	Municipal Only	Copper or PEX standard 3/8" supply line with shut off valve. Maximum pressure at shut off 825KPa (120psi)
Water Connection	Internal	Supplied with 1.2m (4') x 3/8" braided food grade potable water line c/w 3/8" compression fitting.
Water Output	Potable	Working water pressure 55KPa - 105KPa (8psi - 15psi) Typical water output volume = 3.8 litres (1 us gal) per minute at average 7°C (45°F). Refrigeration tank volume = 23 litres (6 us gal). Optional in-series refrigeration tanks expand refrigeration volume by 23 litres (6 us gal) each.
Drain	Connections	Drain from dispensing area required for spillage. Potable braided plastic 3/8" x 2.5 metre (8') hose supplied. Automatic drain pump and drain-less system optional.
Operating Conditions	Indoor Use Only	Equipment is not considered waterproof for outdoor use.

Appendix B – UBC Water Consumption Survey

University of British Columbia - Sustainable Water Consumption Survey

A water consumption survey aimed at analyzing the consumption of bottled water and tap water at UBC.

What is your gender?

- ◉ Female
- ○ Male

What is your ethnicity?

- ○ African American
- ○ Caucasian
- ○ Asian
- ○ Persian
- ○ Aboriginal
- ○ Latin American
- ○ European
- ○ Other:

What is your age group?

- ○ 18-20 years
- ○ 21-24 years
- ○ 25-30 years
- ○ 31-35 years
- ○ Over 35 years

Which faculty are you currently studying in?

- ☐ Applied Science
- ☐ Arts
- ☐ Commerce
- ☐ Dentistry
- ☐ Education
- ☐ Forestry
- ☐ Land and Food Systems
- ☐ Law
- ☐ Medicine
- ☐ Pharmaceutical Science
- ☐ Science
- ☐ Other: _____

Do you drink tap water? At school, at home or at work.

- ☐ Yes
- ☐ No

Do you prefer filtered tap water over regular tap water? Filtered tap water sources such as WaterFillz in the SUB or Brita water filters

- ☐ Yes
- ☐ No
- ☐ Makes no difference

Why do you drink tap water?

- ☐ It is cheaper than bottled water
- ☐ It is more sustainable than bottled water
- ☐ It tastes better than bottled water
- ☐ It is healthier than bottled water
- ☐ It is more readily available than bottle water

- ☐ I don't drink tap water
- ☐ Other: _____

Do you drink bottled water?

- ☐ Yes
- ☐ No

Why do you drink bottled water?

- ☐ It is cheaper than tap water
- ☐ It is more sustainable than tap water
- ☐ It tastes better than tap water
- ☐ It is healthier than tap water
- ☐ It is more readily available than tap water
- ☐ I don't drink bottled water
- ☐ Other: _____

Do you drink tap water from the water fountains available at UBC?

- ☐ Yes
- ☐ No

You would drink tap water from the fountains available at UBC if ...

- ☐ The water was filtered
- ☐ The fountains were kept clean
- ☐ The fountains were easily accessible
- ☐ I would not drink tap water at all
- ☐ Other: _____

Would you bring your own empty bottle to campus if you were satisfied with the quality of the tap water?

- ☐ Yes
- ☐ No

How many 500 mL bottles do you consume a day?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ More than 4

Did you know that bottled water can be between 500 to 10,000 times more expensive than tap water?

- ☐ Yes
- ☐ No

Please feel free to write any comments in regards to consumption of tap water at UBC campus.

Appendix C – Survey Comments

“I would drink more UBC tap water if the water fountains: were easier to find, had good tasting water, and made it easy to fill a water container.”

“Most of the water fountains are old/ugly/dirty and (whether true or not) most people think that the pipes in a lot of the old buildings are not very healthy to drink from anymore.”

“I tend to only drink from the water fountains in Irving K Barber, because they're new, clean, and cold. And they don't taste too much like chlorine.”

“The flush before you drink signs are a little worrying.”

“Some water fountains are UBC are old and the water has a strong chlorine taste to it. They also do not offer chilled tap water. Even in newer water fountains like the ones in Irving leave my bottle with a strong smell of chlorine after it has been sitting for a short while.”

“In Portland they have constantly flowing water fountains everywhere that just "recirculate" which are convenient. If there were similar things but they were "taps" that just spouted water downward so you could at any time fill up your bottle it would be nice (they have these things on water fountains but you have to activate them; public ones that just flow and recirculate the water seem like a no brainer).”

“All fountains should have the spouts to fill a water bottle, like the ones in the SUB.”

“All buildings on campus should have at least on proper water fountain (this does not include ones connect to bathroom sinks, such as the case in EOSC-Main).”

“A simple solution would be to put gooseneck faucets on the current water fountains.”

“There needs to be more access to tap water around campus that is from a nice looking normal

clean fountain. We will drink it.”

“I usually drink filtered water at home but at UBC I only drink bottled water since the water fountains are not filtered. I don't think that tap water by itself is clean enough to be drunk and there have been problems with contaminated tap water in Canada.”

“I think it's really important to provide easy access to cold filtered tap water at UBC. I would love to see WaterFillz units all over the campus!”

Appendix D – Email Conversation with WaterFillz

From: Donna Klaassen <donna@safestar.ca>
To: colinchen88@gmail.com
Date: Fri, Nov 5, 2010 at 5:27 PM
Subject: FW: Survey on WaterFillz

Hello Colin:

Paul Wilson asked that I contact you directly. I work with Paul and I have attached the responses to other members of your team below. I have also attached two presentations about the Ban the Bottle movement and our machine that will answer some of your questions, and perhaps generate more! Please feel free to contact me should others arise or you need further information.

With regards to the questions you asked Paul - I will try to answer to the best of my ability as follows:

1. Some information about the material used to manufacture the WaterFillz unit, and the methods suggested for disposal

The exterior of the unit is made from 100% stainless steel front & sides, back and top are made from galvanized steel - steel is highly recyclable. Stainless steel is 100% recyclable. An average stainless steel object is composed of about 60% recycled material of which approximately 40% originates from end-of-life products and about 60% comes from manufacturing processes. Galvanized Steel is 98% recyclable.
In fact, there is a secondary market that basically recycles usable scrap for many stainless steel markets.
Internal workings include some plastics, but due to the nature of their use and non-exposure to sunlight, they will not likely fail or need replacement as they are not exposed to the usual elements (ultraviolet light breaks down plastic) and remain functioning for many years.

The key factor to consider about the system as it relates to sustainability is the obvious reduction in plastic bottle use and production / delivery thereof, and that our system literally operates on less than 46 watts at its peak consumption (when it is refrigerating).

The UV Light bulb runs on 12 watts of power and is running 24/7/365. The refrigeration unit will kick in and out just like your refrigerator at home and when it is on, it adds 34 watts of power for a running total of 46 watts at peak.

Our event kiosk runs on 80 watts of power as it has two refrigeration units. For pictures of this unit, please refer to our website.

2. The expected life time of each WaterFillz unit, i.e. how long each unit can be used under maintenance.

We do not have this fact proven but I believe that the unit has been designed in such a way that allows for low and infrequent maintenance and uses high quality products that allow for long life and high traffic.

The unit is still in its birthing stages - we have them operative for just over two years now. Because of the durable nature of the products we have chosen to manufacture our units from and their simplicity, the units are expected to last a long time. We specifically chose not to have back lit, plastic coated, dispensing gizmos which are featured options that most cold drink vending machines that consume immense amounts of electricity to operate an use (take a close look at the next pop machine you use - how many watts of power do you think one of the dispensing arms and back lighting must be using? Depending on the machine we have seen anywhere from 900 - 3500 watts of power!

Again, Colin, if you have any questions please don't hesitate to contact me directly. Please read below for my comments to Jimson.

Donna Klaassen