

An Investigation into Waste-Reducing Vending

Products: Office Supplies

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APSC 261

November 29, 2011

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Technology and Society – APSC 261

An Investigation into Waste-Reducing Vending Products: Office Supplies

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Submission Date:	Nov 29th

Abstract

This report investigates the plan to install vending machines that sell re-usable office supplies on UBC campus. The vending machines will provide students with easy access to green office supplies. Extensive primary and secondary research was performed to examine the impacts of existing office supplies on the environment as well as the implications of introducing re-usable office supplies to the campus.

This report focuses on three commonly used office supplies: staplers, batteries, and disposable pens. Research has revealed that existing office supplies used on campus have profound negative impacts on the environment. Some of the negative impacts include consumption of steel and coal, emission of air pollutants, and emissions of toxic compounds.

To better assess the feasibility of selling re-usable office supplies in vending machines, a triple-bottom-line assessment was conducted to evaluate the environmental, social, and economical aspects of each of the three office supplies. For environmental aspects, research indicated that all three office supplies help to mitigate some of the environmental problems associated with existing office supplies. From a social perspective, results from student surveys indicated that most students on campus were not aware of the existence of the three re-usable office supplies but most of the students who took the surveys have responded in favor of using these three office supplies once they have learned the benefits. For economical aspects, research has shown that all three re-usable office supplies are equally priced as the existing office supplies and in the long term, are cheaper than the existing office supplies.

The re-usable office supplies are environmentally friendly, potentially widely acceptable, and economical to implement in vending machines on UBC campus. This report strongly recommends UBC AMS to installing vending machines on campus that sell these office supplies.

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Glossary

Staple-less staplers: invented in 1910, are a means of stapling that punches out a small flap of paper and weaves it through a notch.

Non-biodegradable waste: waste that will NOT break down (or won't for many many years). Examples are plastics, metal and glass. Some dangerous chemicals and toxins are also non-biodegradable, as are plastic grocery bags, Styrofoam (polystyrene), and other similar materials but will eventually break down over time.

Primary Battery : Disposable batteries that are designed to use once and discarded

Secondary Battery: Rechargeable battery

Photochemical Oxidation: Oxidation that occurs when a substance poses an electron and combines with another substance.

Zinc - carbon Batteries: A battery is packaged in a zinc can that serves as both a container and negative terminal.

Nickel Cadmium Battery: A type of rechargeable battery using nickel oxide hydroxide and metallic cadmium as electrodes.

Nickel-Metal Hydride Battery: A type of rechargeable battery similar to the nickel-cadmium cell. NiMH battery uses a hydrogen-absorbing alloy for the negative electrode instead of cadmium.

Lithium Ion Battery: A family of rechargeable battery types in which lithium ions move from the negative electrode to the positive electrode during discharge, and back when charging.

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1.0 Introduction

Office supplies such as stapler, disposable pens, and batteries have become a serious issue to the well-being of the environment. Little research has been done to evaluate the environmental impacts of these three office supplies have and even less attention has been paid to the habit of using these office supplies. This report highlights some of the environmental, social and economic problem associated with disposable pens and staplers and presents the readers with more sustainable options.

This report investigates the option of selling re-usable office supplies in vending machines. Specifically, three types of re-usable office supplies have been chosen for this report: refillable pen, rechargeable battery and staple-free stapler. This report performs a triple-bottom line analysis to assess the environmental, economical and social aspects of each of the three products. In addition, this report will determine the feasibility of implementing these products in vending machines. This report will help UBC AMS to make informed decisions on installing vending machines that sells re-usable office supplies on UBC Campus.

2.0 Refillable Pen

While computer software has significantly replaced the need to write documents using pen and paper, the need for old-fashioned pen and paper still exists. For example, it is still necessary for people to write documents such as homework, letters, and multi-million dollar formal contracts using pen and paper. However, just like Alvin Weinberg said, “the technological solutions to social problems tend to be incomplete and metastable.”⁽⁴⁾ The environmental impact caused by the use of pen and paper has not been entirely fixed by the paperless technology. Many technicians and social engineers have been trying to develop more sustainable pulp and paper technologies. In a similar vein, many sustainable solutions have been developed to mitigate the negative environmental impacts caused by disposable pens.

The disposable pens can cause environmental problems. The United States alone discards 1,600,000,000 pens each year. (Recycling Facts, 2010, Para. 6). These disposable pens will eventually wind up in the landfills, deep under the waterways or being buried in some unforeseen areas. Since plastic materials are hard to decompose, it will take a long time for most disposable pens to completely decompose inside the landfills.

Introducing the Refillable Pen

Most types of pen can be refillable. Fountain Pen is the best solution among all since it keeps its own cartridge and refills by delivering the liquid ink through the nib. Other types of pens such as ballpoint pen, rollerball pen, markers and highlighters can also be refilled by replacing a new cartridge.

Environmental Impact

Instead of watching disposable pens stack up in the landfills, we can simply avoid it by using a refillable pen. How? One can prolong the life of a pen by using a refill cartridge. For instance, after the pen is out of ink, instead of discarding it or buying a new pen, one can simply refill the ink into the cartridge. By doing so, one refillable pen can last as long as the user keeps it. As a result, the number of discarded disposable pens will be reduced if more people use refillable pens.

Economic Impact

Refillable pens and disposable pens have the similar initial cost. However, comparing with buying a new pen, refilling ink cartridges is more cost effective. Moreover, people can buy a pack of ink cartridges with only a few dollars, which is equivalent of buying a lot of disposable pens without the possible environmental impacts. Therefore, the cost of buying refillable pens is much preferable than buying disposable pens in a long run.

Social Impact

We performed a survey on 50 students. The result showed us that 21 students could not accept the refillable pens. When asked why they made their choices, six people responded that disposable pens are convenient, five people thought disposable pens are cheap and ten people prefer disposable pens because it is readily available. In addition, eight people chose disposable pens for all of the above reasons. According to the survey, 29 out of 50 students approved refillable pens. Therefore, the majority of the students will support the idea of selling refillable pens in the vending machine. Furthermore, after the students were introduced to the benefits of using refillable pens, the number of students who chose refillable pens dramatically increased as they realized that how much they could contribute to the cause of a sustainable way of living by buying refillable pens. In short, most of the students understood the importance of sustainability. Therefore, if refillable

pens are to be sold in vending machines, more students will have opportunity to get involved in promoting sustainability.

Recommendations

I strongly recommend this product since the differences between disposable pens and refillable pens listed in the previous section are profound. Specifically, I recommend BeGreen and Parker brand. However, if one loses it every few months, there will hardly be any environmental benefit and certainly no financial benefit. On the other hand, people may find it hard to remember the refill option of a pen. In order to encourage people to accept refillable pens, we need to raise public awareness of the benefits of purchasing refillable pens by setting up posters near vending machines.

3.0 Rechargeable Batteries

Nowadays, re-usable energy is becoming paramount in building a sustainability society. As many students are using batteries in their electronic devices, replacing normal batteries with rechargeable batteries can significantly save energy. Rechargeable batteries are also known as secondary cells. They are consisted of groups of electrochemical cells such as lead-acid (this is mainly used for car batteries, so we do not discuss in this project), nickel cadmium, lithium ion and lithium ion polymer. Rechargeable batteries can reverse the chemical reaction by applying an external voltage while the chemicals in the normal batteries cannot be recharged. In this project, we have analyzed the difference between disposable batteries and rechargeable batteries.

3.1 Environment Impact

The disposable batteries, which also known as primary batteries, include zinc-carbon batteries and alkaline batteries. Both of these primary batteries are made of ammonium chloride and zinc chloride, which are highly soluble in water and mildly acidic. Due to photochemical oxidation process, these chemical compounds will become toxic. These toxic are responsible for peaks in ozone concentration as well as emission of other toxic compounds. On the other hand, rechargeable batteries have up to 28 times less impact on climate warming comparing to disposable batteries. (Energizer, 2008, Alkaline Manganese Dioxide Handbook and Application Manual, page 2)

In additional to the toxic acid, recycling wasted batteries is a major problem. According to official statistic, South Africa disposes almost 100 million waste batteries, none of which is recycled despite the fact that South Africa government has implemented a program to recycle these batteries. (Recharge Your Batteries - and care for the environment, 2010, Para 1) This failure to recycle waste batteries has led to a serious degradation of the environment. In contrast, rechargeable batteries can be reused up to one thousand times. In other words, one rechargeable battery can reduce the waste of nine

hundred and ninety-nine batteries. Thus, instead of having these waste batteries contaminate the soil, water, and animal life up to fifty years, we can reduce that contamination by twelve times by using rechargeable batteries.

There are several kinds of rechargeable batteries such as Nickel Cadmium, Nickel-Metal Hydride, Lead Acid, Lithium Ion and Lithium Ion Polymer. Each of them has its own advantages and disadvantages. From an environmental perspective, Nickel Metal Hydride is the most environmentally friendly of all the batteries since it contains no toxic material.

	NiCd	NiMH	Lead Acid	Li-Ion	Li-Ion polymer	Reusable Alkaline
Gravimetric Energy Density (Wh/kg)	45-80	60-120	30-50	110-160	100-130	80 (initial)
Internal Resistance (includes peripheral circuits) in mΩ	100 to 200 ¹ 6V pack	200 to 300 ¹ 6V pack	<100 ¹ 12V pack	150 to 250 ¹ 7.2V pack	200 to 300 ¹ 7.2V pack	200 to 2000 ¹ 6V pack
Cycle Life (to 80% of initial capacity)	1500 ²	300 to 500 ^{2,3}	200 to 300 ²	500 to 1000 ³	300 to 500	50 ³ (to 50%)
Fast Charge Time	1h typical	2-4h	8-16h	2-4h	2-4h	2-3h
Overcharge Tolerance	moderate	low	high	very low	low	moderate
Self-discharge / Month (room temperature)	20% ⁴	30% ⁴	5%	10% ⁵	~10% ⁵	0.3%
Cell Voltage (nominal)	1.25V ⁶	1.25V ⁶	2V	3.6V	3.6V	1.5V
Load Current						
- peak	20C	5C	5C ⁷	>2C	>2C	0.5C
- best result	1C	0.5C or lower	0.2C	1C or lower	1C or lower	0.2C or lower
Operating Temperature (discharge only)	-40 to 60°C	-20 to 60°C	-20 to 60°C	-20 to 60°C	0 to 60°C	0 to 65°C
Maintenance Requirement	30 to 60 days	60 to 90 days	3 to 6 months ⁹	not req.	not req.	not req.
Typical Battery Cost (US\$, reference only)	\$50 (7.2V)	\$60 (7.2V)	\$25 (6V)	\$100 (7.2V)	\$100 (7.2V)	\$5 (9V)
Cost per Cycle (US\$) ¹¹	\$0.04	\$0.12	\$0.10	\$0.14	\$0.29	\$0.10-0.50
Commercial use since	1950	1990	1970	1991	1999	1992

3.2 Economic Impact

In this project, we will analyze the cost and gain from both consumer side and AMS side. The cost to manufacture a rechargeable battery is almost the same as a disposable battery. As consumers, students can save their money by purchasing rechargeable batteries. A rechargeable battery can be reused for one thousand times while the disposable can be used for only once. Although students have a slightly higher initial

cost of buying the rechargeable batteries, in the long term, they are actually saving money as they can recharge these batteries instead of buying a new one. (Linden, 2002, chapter 22).

Furthermore, when implementing a sustainability vending machine project, AMS can sale chargers with rechargeable batteries as a package since a rechargeable battery need a charger to apply an external voltage during the recharging process. Selling the charger with the rechargeable battery in vending machine is convenient for students to recharge batteries and provide incentives to buy rechargeable batteries.

From the economic point of view, Nickel Cadmium rechargeable batteries have low will cost less in the long term. What I mean is that Nickel Cadmium rechargeable batteries has the shortest charge time. Thus, they will cost less as customer recharge it for several times.

3.3 Social Impact

From the survey we did (attached in appendix) we are able to conclude that majority of students are still using disposable batteries. However, this survey also shows that most disposable battery user would like to use rechargeable battery after we introduce the benefits. Therefore, by advocating more people to buy rechargeable batteries, industries will use less resource and our society can be more sustainability.

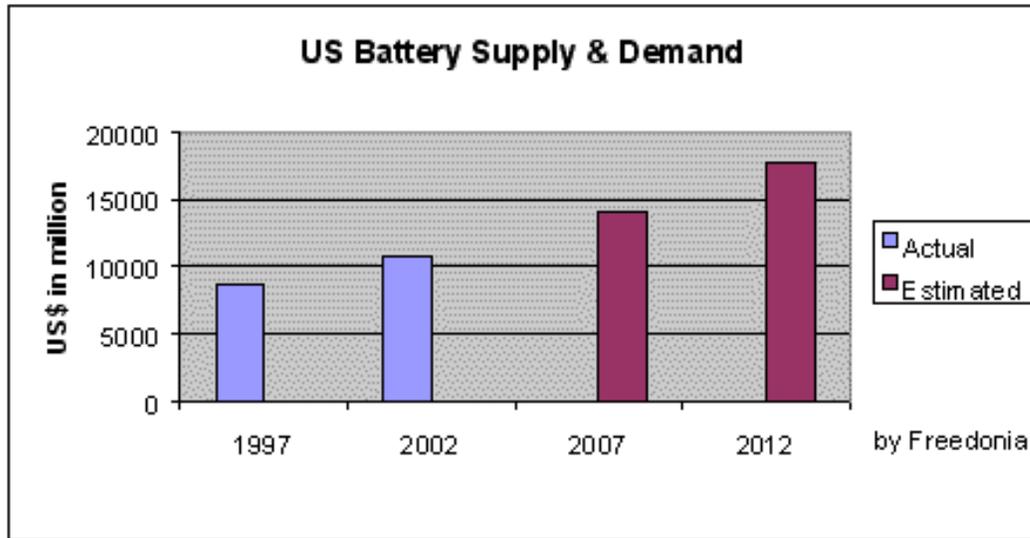


Figure 15

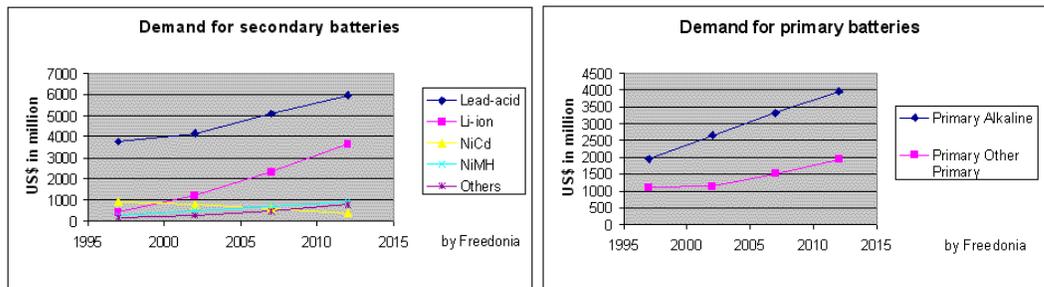


Figure 16a

16b

3.4 Recommendation

In this report, after analyze all kind of batteries, we recommend Nickel Metal Hydride rechargeable batteries. Although they have high expense in reducing cycle life, they can benefit the environment in the long term and build sustainability society.

4.0 Staplers

The vending machines can make great contribution to the cause of sustainability by promoting re-usable office supplies. One such product that this report will be focusing on is the staple-less stapler. Staple-less stapler binds paper by punching a v-shaped cut in the paper and then folds the point of the V up. In this section, we will evaluate staple-free staplers using triple-bottom-line assessment.

4.1 Environmental Impact

Just as its name implies, this kind of staplers do not use staples. Usually, staples are made of steel. Given the amount of staples used each year, a colossal amount of steel is used in making staples every year. According to a research from the University of Aberdeen, if each of the UK's estimated ten million office workers used one less staple a day, 120,000 kg (or 120 tonnes) of steel would be saved every year. (University of Aberdeen, 2010, p.1). In most developed countries, it takes 0.7 tonne of coal to make one tonne of steel while in developing countries; it might take more than one tonne of coal to make one tonne of steel. This process of burning coal to make steel releases a large amount of flue-gas that contains harmful compounds such as SO_x, NO_x, and CO₂, which cause acid rain. (World Coal Association, 2010, Para. 4). In addition, steel will need further processes before it can be made into staples, which will consume energy. By using staple-less staplers, it will completely eliminate the need of steel and coal for making staples and thereby, reducing pollution levels in the environment. Furthermore, since there is no staple needed, it is easier to recycle the paper, as there is no need to remove staples.

4.2 Economical Impact

Based on the information on some big stores such as amazon, staples, and etc. The price of traditional staplers ranges from \$3 to more than \$20. On the other hand, the price of staple-free staplers is about \$5 to \$8. Although the price of staple-free staplers cannot match that of the cheapest traditional staplers, they are still much cheaper than the more expensive traditional staplers. Therefore, staple-free staplers can be very competitive. Moreover, traditional staplers have to use staples and so long as people are using them, they must buy new staples. However, once people buy a staple-free stapler, they will not have to spend any additional money on buying staples. In conclusion, staple-free stapler is a product that is good for sustainability, reasonably priced, and potential to gain wide acceptance. If products like staple-free staplers were sold in vending machines, they would make a great contribution to sustainability.

4.3 Social Impact

The staple-less stapler is a new kind of stapler. Its unique appearance, and functionality could attract people's attention. According to our survey, only 26% of interviewees have heard of staple-less staplers prior to doing the survey. However, after learning about the staple-less staplers and its benefits, 54% of the interviewees are willing to buy this kind of staplers. Compare with a traditional stapler, a staple-less stapler has a relatively small size. It is about L2" x W2" x H1" and weigh no more than 70 grams, which makes it very convenient to carry around. (Grass Roots, 2011, p.1). Since a staple-less stapler does not need any staples, people do not need to worry if the staple runs out of staples when they use it. Although staple-free stapler cannot hold more than 5 pages, it still has broad applications, such as binding assignments, memos, and emails printouts. (Staple Free Stapler, 2009, Para. 2) The most important social impact of staple-free staplers is that by using them, people are actively engaged in promoting a healthy, and sustainable way of living.

5.0 Vending Machine

We have conducted triple bottom line analysis on several products in the previous sections. However, we cannot overlook the fact that vending machine itself has considerable impacts on social, environmental and economic aspects. Therefore, our group has also conducted a triple bottom line analysis on vending machine itself.

5.1 Economic Impact

In terms of economic aspect, vending machines have many advantages. The one-time purchase cost of vending machine ranges from \$2000 to \$3000. (Vending machine unlimited, 2011). However, low maintenance cost is what makes the vending machine profitable. A vending machine can operate all year long with minimum maintenance. In fact, a typical vending machine only needs a few hours to replenish its stock. Another benefit is that the products sold in vending machines require no advertisement; the vending machine itself is the best advertisement for the products, which in this case, promote sustainability. In addition, vending machine can easily be relocated. Vending machines can be moved to a new place without much effort. Therefore, in a long run, vending machines can make considerable amount of profit.

5.2 Environmental Impact

Our group has also researched on the environmental impact of the vending machine. There has been lots of concern on the energy consumption of a vending machine. Researchers have conducted many studies on the energy consumption of a vending machine. According to their researches, in one week, a vending machine can consume 38 kWh of electricity. On a monthly basis, that accumulates to be 163 kWh of electricity. (Platts, 2004, page 2) Therefore, a vending machine indeed consumes a lot of energy. However, it is important to note that the US has set a new standard on energy

consumption of vending machine and (source #15) therefore, the newer model of vending machines are likely to consume a lot less energy. Moreover, the analysis is based on vending machines with refrigeration system. If a vending machine only sells office supply, it will consume very little energy since the refrigeration system is not needed. Also, another benefit is that the vending machine itself should not generate any waste. (source #16)

5.3 Social Impact

The vending machines can have various social impacts. Our group has conducted a survey on a sample of 50 students. They are given the option to either approve or disapprove the idea of having a vending machine that sells office supply on campus. More than 70% of them support the idea. We also ask them why do they want to buy office supply from a vending machine. According to the survey, it's evident that many students believe that It would save their time if there's vending machine to buy office supply from. Another benefit is that having vending machines that sells office supply can help students in certain situation. For example, if a student forgot to bring pen for the exam, having a vending machine in a place near the exam location such as the Student Reaction Center would be very convenient for them.

After concluding the triple bottom line analysis, it's evident that vending machine itself has mostly positive impacts on economic, environmental and social aspects.

6.0 Conclusion

In this project, our group has conducted triple bottom line analysis on three types of re-usable office supplies: staple-free stapler, refillable pen, and rechargeable battery. From the environmental point of view, our research showed that all three office supplies have some advantages in solving environmental problems associated with existing office supplies. In the economical term, research has shown that all three re-usable office supplies are equally priced as the existing office supplies and in the long term, are cheaper than the existing office supplies. From a social perspective, results from student surveys indicated that most students on campus were not aware of the existence of the three re-usable office supplies but most of the students who took the surveys are willing to make changes to save the environment. They will become in favor of using these three office supplies once they have learned the benefits. Therefore, our group strongly recommends three products to be stocked in the vending machines.

References

- Doan, A. (2008) GREEN CELL Universal Battery Sold in Vending Machines. Retrieved Nov 24, 2011 from <http://inhabitat.com/green-cell-universal-battery-sold-in-vending-machines/>
- Energizer. (2008). Alkaline Manganese Dioxide Handbook and Application Manual. Retrieved Nov 26, 2011, from http://data.energizer.com/PDFs/alkaline_appman.pdf
- Environment Canada. (2010). Batteries. Retrieved Nov 26, 2011, from <http://www.ec.gc.ca/mercure-mercury/default.asp?lang=En&n=8E1CA841-1>
- Grass Roots. (2011). Cubed Staple Free Stapler. Retrieved Nov 26, 2011, from http://www.grassrootsstore.com/Cubed_Staple_Free_Stapler_p/12554.htm
- Henley, J. (2005, September 9) Bic over the moon as sales top 100bn. From: <http://www.guardian.co.uk/world/2005/sep/09/france.jonhenley>
- Home > Products > Find ENERGY STAR Products > Vending Machines.* (n.d.). Retrieved October 15, 2011, from Vending Machines : http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=VMC
- Linden, D. Reddy, T. (2002). Handbook Of Batteries 3rd Edition.
- Lee, D. (2003). Consumers' Experiences, Opinions, Attitudes, Satisfaction, Dissatisfaction, and Complaining Behaviour with Vending Machines. *Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behaviour*, 16, 1-15.

- Monley, B. (2011, July). Vending Machine Collection Dispensers in Libraries. *APLIS*, 24(3), 133-138.
- Maag, C. (2011). Vending Machines Going Cashless. Retrieved Nov 24, 2011 from <http://www.credit.com/blog/2011/03/vending-machines-going-cashless/>
- Muller, R. (2008). Rechargeable batteries have marginal impact on environment. Retrieved Nov 24, 2011 from <http://mybroadband.co.za/news/hardware/2707-rechargeable-batteries-have-marginal-impact-on-environment.html>
- Perry, D. (2011). HP Patents Ink Cartridge Vending Machines. Retrieved from <http://www.tomsguide.com/us/hp-printer-ink-cartridge-refill,news-12306.html>
- Platts. (2004). Office Equipment and Other Plug Loads: Vending Machine Energy Savings Retrieved Nov 26, 2011, from http://www.reliant.com/en_US/Platts/PDF/P_PA_50.pdf
- Rogers, H. (2005). *Gone Tomorrow: The Hidden Life Of Garbage*, Chapter 1.
- Recharge Your Batteries, (2008). Retrieved Nov 26, 2011, from <http://mybroadband.co.za/news/hardware/2707-rechargeable-batteries-have-marginal-impact-on-environment.html>
- Rusdiansyah, A. (2005, October). An Integrated Model of the Periodic Delivery Problems for Vending Machine Supply Chains. *Journal of Food Engineering*, 70(3), 421-434.
- Vezzoli, C. (2006). EcoDesign: What's Happening? . *Journal of Cleaner Production*, 14(15-16), 1319-1325.

- Recycling Facts, (2010). From <http://www.recycling-revolution.com/recycling-benefits.html>
- Brandt, D. (2010, March). Vending Appeal. *Industrial Engineer*, 42(3), 52-53.
- Schieltz, M. (2011). Types of Vending Machines. Retrieved Nov 24, 2011 from http://www.ehow.com/list_5788095_types-vending-machines.html
- Segrave, K. (2002). Vending machines : an American social history, page 299-277.
- Staple Free Stapler. (2009). Staple Free Stapler. Retrieved Nov 26, 2011, from <http://www.staplefreestaplers.com/>
- US sets new energy standards for vending machines, 2009. Retrieved Nov 24, 2011 from <http://www.energyefficiencynews.com/policy/i/2365/>
- University of Aberdeen. (2010). Staples versus paperclips. Retrieved Nov 26, 2011, from <http://www.abdn.ac.uk/estates/environment/resources/documents/Staplesversuspaperclips.pdf>
- US sets new energy standards for vending machines, 2009. From <http://www.energyefficiencynews.com/policy/i/2365/>
- Vending machine unlimited. (2011). Retrieved Nov 26, 2011, from <http://www.vendingmachinesunlimited.com/>
- World Coal Association. (2010). Coal & Steel Statistics. Retrieved Nov 26, 2011, from <http://www.worldcoal.org/resources/coal-statistics/coal-steel-statistics/>
- Weinberg, A. *Nuclear Reactions: Science and Trans-Science*. Buffalo, NY: American Institute of Physics, 1992. Print.

Appendix

Some Brands to Recommend

Refillable Pen: BeGreen, Paker

Staple-Free Staplers: Eco

Types of Battery to Recommend

Rechargeable Battery: Nickel-Metal Hydride

Survey Results

Are you aware of the office supply vending machine in Koerner library on campus at UBC?

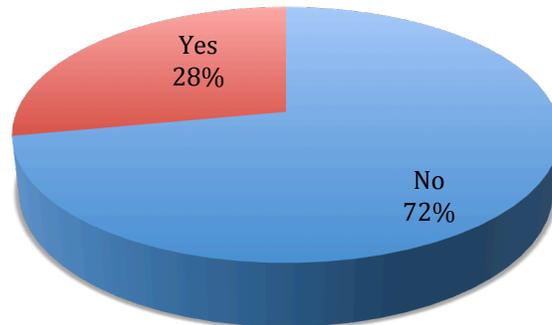


Figure 1

Do you prefer refillable or disposable pens?

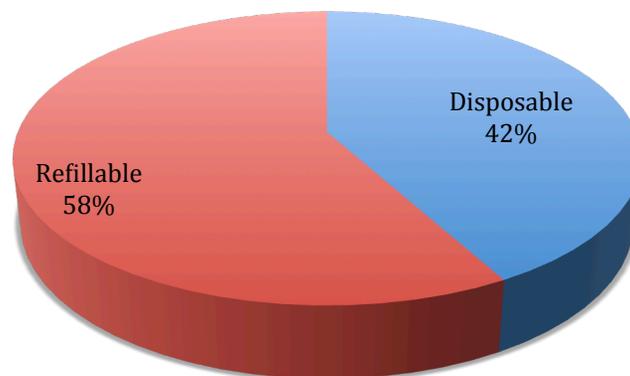


Figure 2

Why would you choose disposable pen?

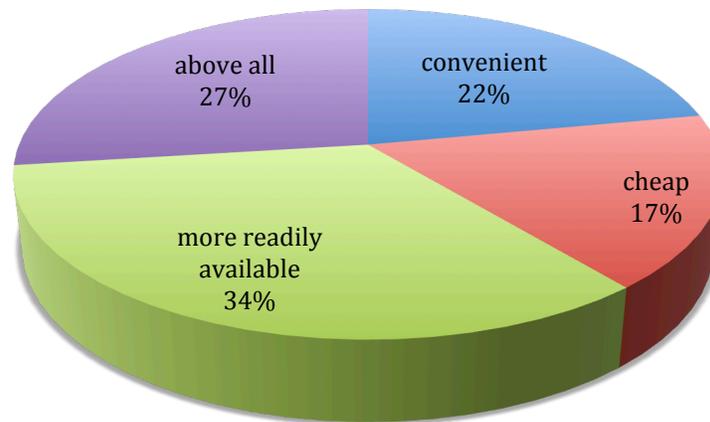


Figure 3

Why do you choose refillable Pens?

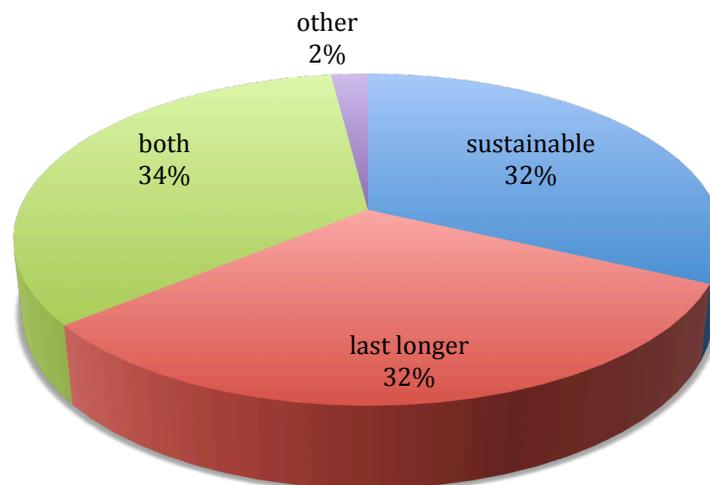


Figure 4

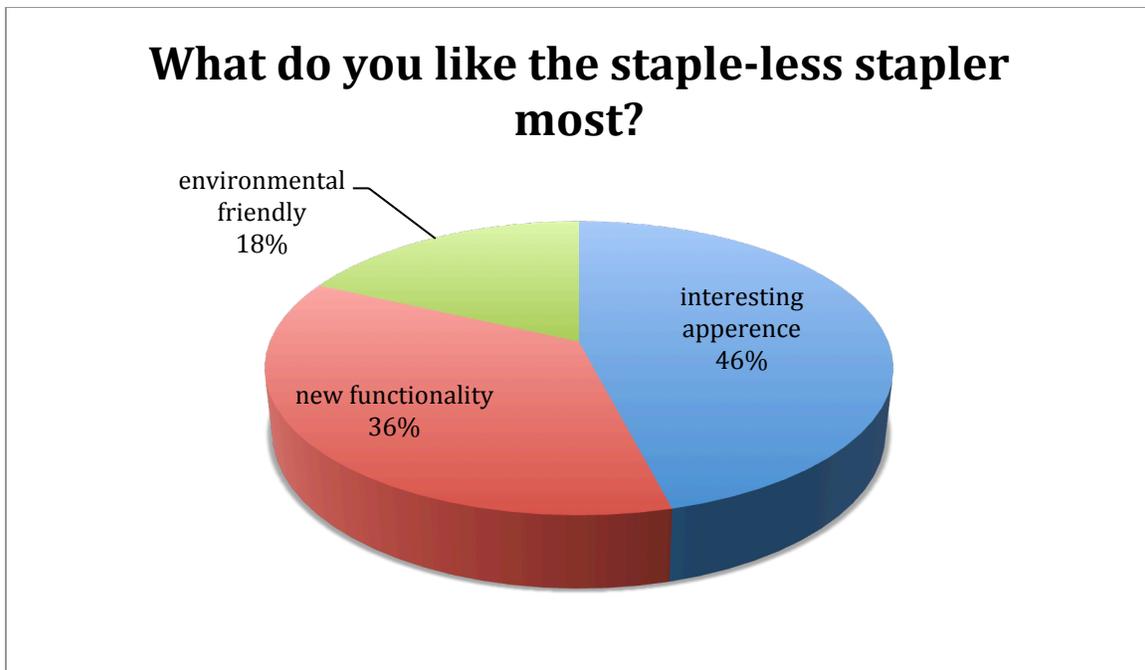


Figure 5

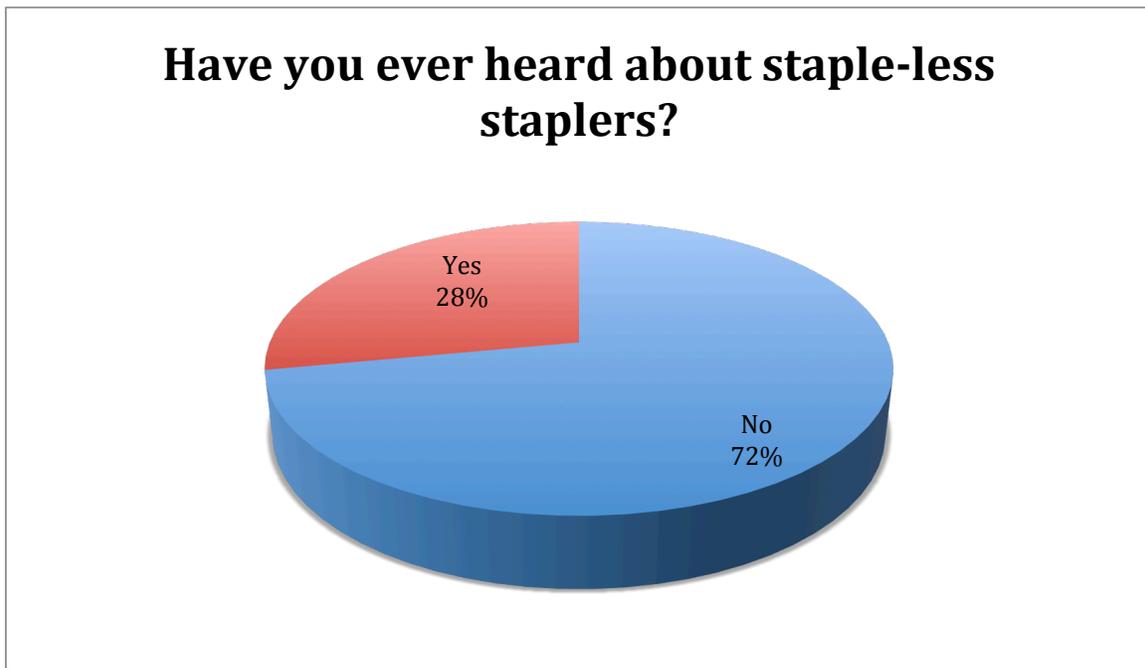


Figure 6

After we introduce the stapler, are you willing to buy it?

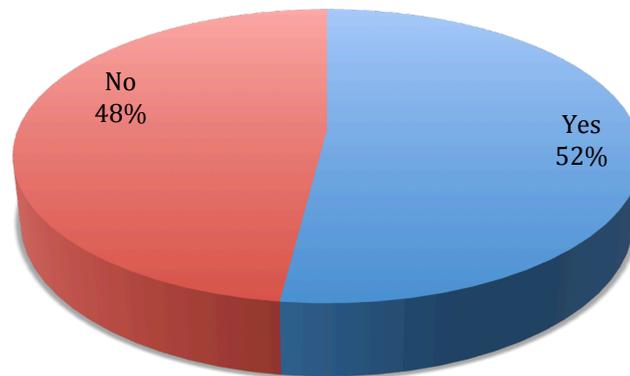


Figure 7

Do you prefer use disposable batteries or rechargeable batteries?

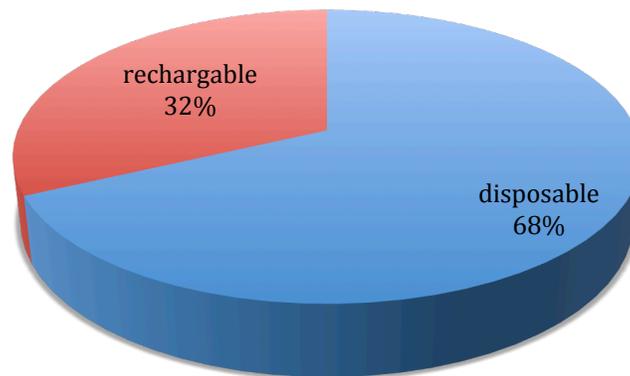


Figure 8

why do you prefer disposable batteries?

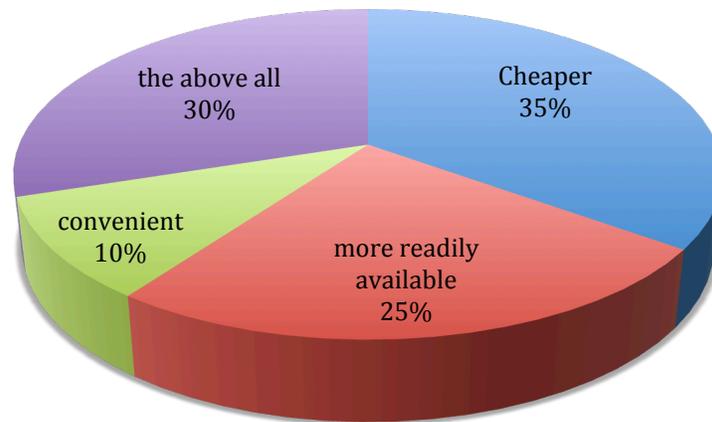


Figure 9

why do you prefer rechargeable batteries?

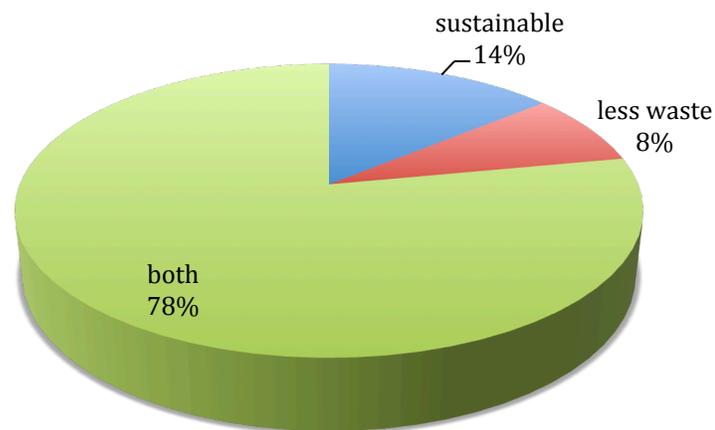


Figure 10

How did you deal with waste batteries?

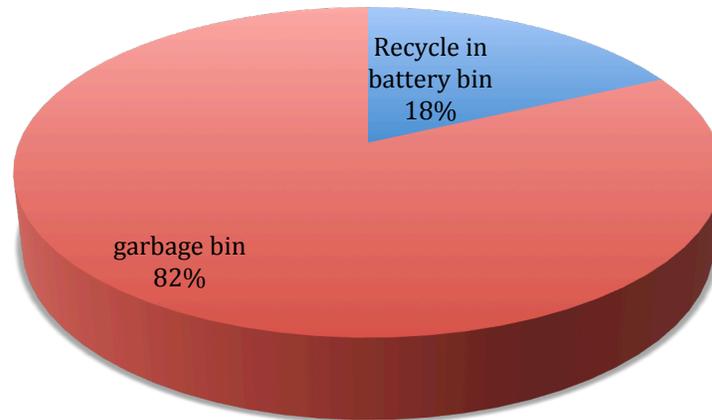


Figure 11

Will you buy rechargeable batteries after you realize it cost less than disposable batteries and it will be available in ubc vending machines?

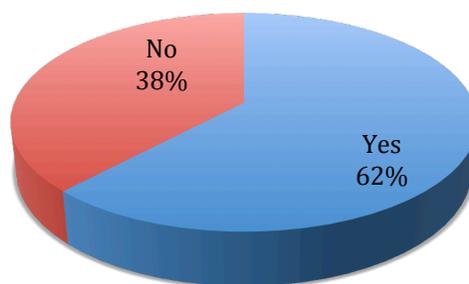


Figure 12

Why do you buy pens and other office supply from vending machines ?
A. convenient and saves time 80% **B cheaper price 2%** **C others 18%**

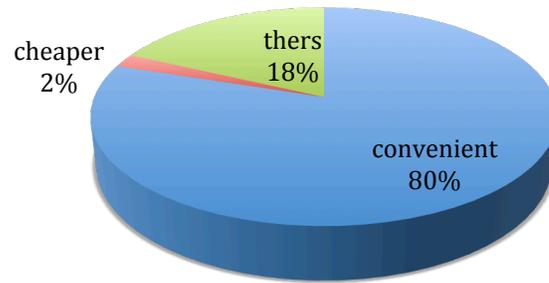


Figure 13

Do you want vending machines which sells office supply on campus ?

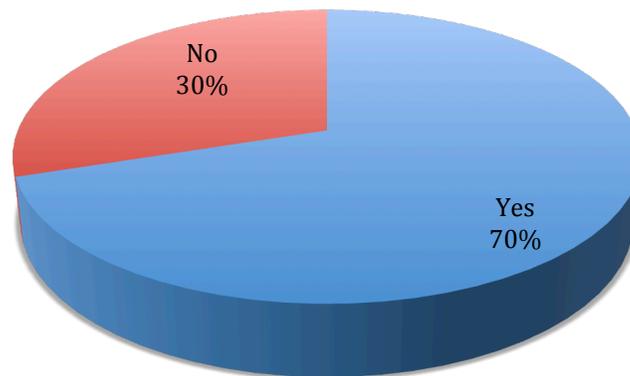


Figure 14