An Investigation into The AMS Food and Beverage: Optimal Modes of Campus Food Delivery

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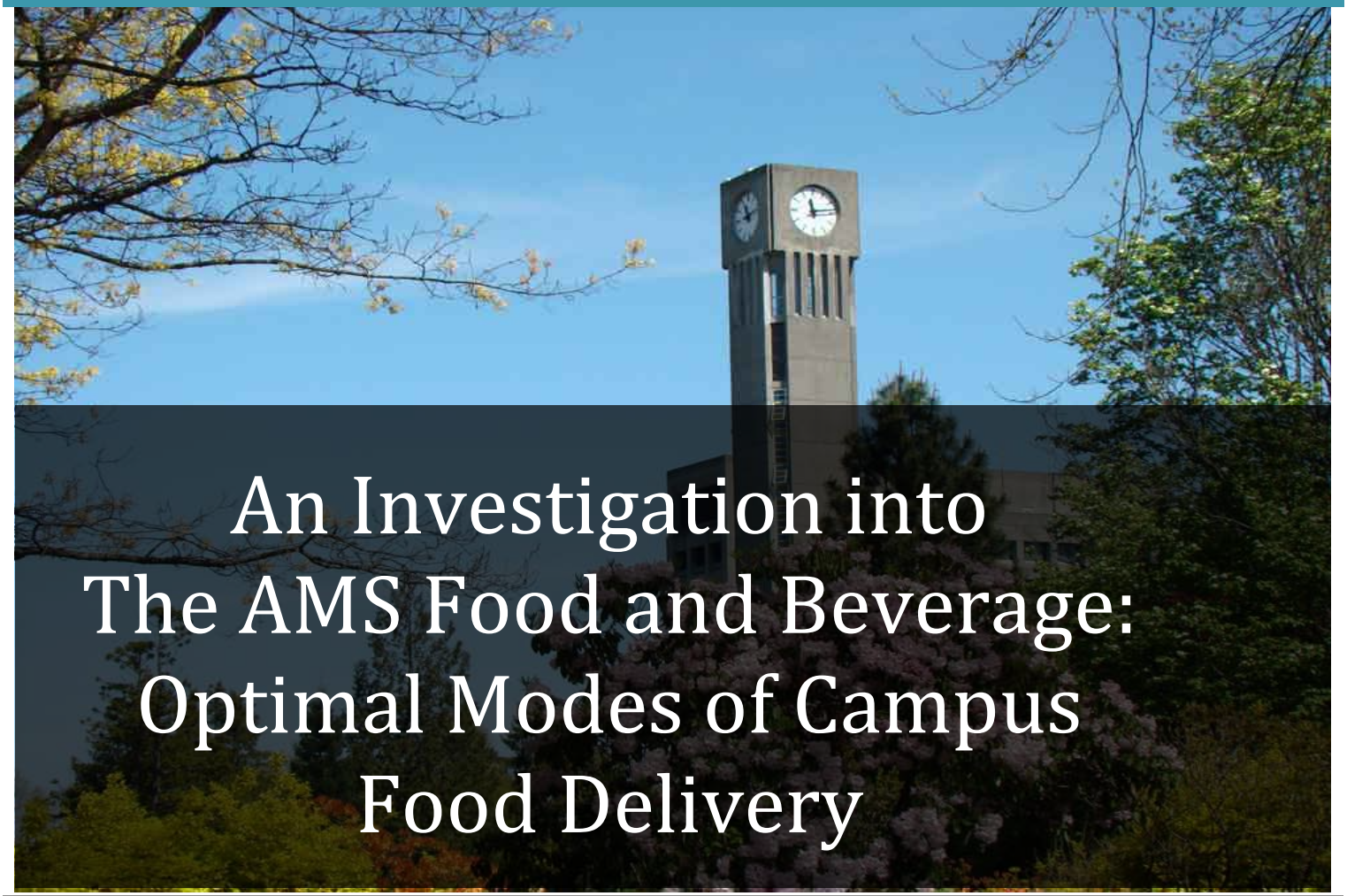
APSC 262

April 10, 2014



An Investigation into The AMS Food and Beverage: Optimal Modes of Campus Food Delivery

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April 10, 2014

Abstract

With the arrival of the New Student Union Building at UBC Vancouver, UBC Campus will experience many new features that will advance and support great student life. Included in those features are Food and Beverage delivery services provided by the Alma Mater Society. As the AMS is a large stakeholder in the New SUB project, they have brought upon some goals and requirements as part of their initiative. The AMS wishes to see the New SUB reach and withhold a platinum level LEED standing while actively being a part of the community.

Part of the AMS initiative included revamping the current F&B delivery state. Currently, the AMS does F&B delivery on campus using standard vehicles, which means emissions and dependent on the time of day, traffic congestion. This report details viable alternatives and their pros and cons. As the AMS initiative also included the sustainability factor, this report takes that into heavy consideration while conducting research regarding the alternatives.

As F&B delivery is high in demand for on campus students, this report details three specific variations of electric bicycles, as a very feasible alternative. Students living on campus were surveyed asking for their preference on various topics and keeping sustainability in mind, this report has found that one model in particular was favored over others in all aspects. A Triple Bottom Line analysis was also conducted for all alternatives discussed and the TBL assessment correlates with the results acquired from the survey positively. With the development of the New SUB, new ideals for sustainability are required, and this report portrays realistic suggestions for the Alma Mater Society at UBC Vancouver.

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List of Abbreviations

AMS:	Alma Mater Society
F&B:	Food and Beverage
LEED:	Leadership in Energy and Environmental Design
SUB:	Student Union Building
TBL:	Triple Bottom Line
UBC:	University of British Columbia

1.0 Introduction

Since 1915, the Alma Mater Society has been founded upon enhancing student life at UBC Vancouver. The most recent example of which would be the recent development of the New Student Union Building. The New SUB will incorporate key components put forth by the AMS including new businesses and vendors, while maintaining sustainability. The new vendors include food and beverage delivery set up through the AMS. With the integration of new F&B options, the AMS plans to introduce a revamped, more sustainable delivery method . The focus of this report is on determining which method of transport would be most appropriate for delivery throughout UBC.

As there are a variety of transportation methods available for use, this report comments on three specific models and their characteristics. The models include the Parklane Electric Bicycle, Edgerunner Cargo Bicycle, and a Self-built Electric Cargo Bicycle. Our report includes feedback from UBC students who live in residence and order food for delivery. The results were used to find campus residents' view on sustainability regarding delivery methods as well as preferred delivery methods.

Food and Beverage delivery suggestions were made for AMS as to allow them to decide on the optimal choice for delivery throughout campus. One of the main objectives of the New SUB project is to be certified LEED platinum while providing and supporting student life. This report along with survey results goes into detail about a few viable F&B delivery options that would definitely aid in being certified LEED platinum. Additionally, the AMS had an objective to acquire a Triple Bottom Line analysis on the most realistic delivery methods on UBC campus; the TBL analysis method was used to assess the social, economic and environmental impact of our suggestions for the AMS. As sustainability becomes a more heavily discussed topic, our report and survey results provide many suggestions that would benefit sustainability at UBC Vancouver.

2.0 Technical Specifications

In the following paragraphs brief descriptions for the investigated modes of transportation are presented. This part of the report outlines features such as the top speed of the model, weight capacity of the model, cost , and motor power. Other specifications such as the material used in the frame, type of battery and battery recharging time are also included.

2.1 Parklane Electric

Figure 1 shows the picture of the tricycle Parklane Electric. The dimensions of the platform at the back are 19 1/2'' x 17 3/4'' which is smaller than our required dimensions of 4' x 4'. This model was chosen to be investigated because it is designed for heavy duty, which can handle almost all types of weather conditions. It can carry approximately 45 kilograms of load, and with the weight of a 12' inch pizza being about 1 kilogram the Parklane Electric can carry around 45 pizza deliveries. The specifications for the Parklane Electric are summarized in Table 2. All the information provided in the table was obtained from the manufacturer website.

Figure 1. Parklane Electric
Source: JV Bike, 2002 < www.jvbike.com >

Table 1. Parklane Electric Technical Specifications

Top Speed without pedaling	32 km/h per charge
Hauling Capacity	45 kg
Motor Power	500 Watt
Battery Type	36 V 9.6A Hr Li-Ion Battery
Battery Recharging time	4 hours
Material Used in Frame	Oversize Single Main Tube
Starting Price	$ 2,145.00 CAD

2.2 Edgerunner Cargo Bike

Figure 2 shows the sample of Edgerunner Cargo Bike. It is a purpose-built longtail cargo bike with a 26-inch front wheel and 20-inch rear wheel. All of the tail-end frame geometry is designed to the Xtracycle Longtail Standard, which provides a wide array of snap-in accessories for carrying heavy load and specialized cargo. This model was chosen to be investigated for its features of a greener and more cost effective transportation alternative to motor vehicles. Two battery options are provided for the bike. As mentioned earlier, the weight of 100 pizza deliveries is about 100kg, which is lower than the hauling capacity of this model. Table 3 presents a summary of the technical specifications of the Edgerunner Cargo Bike.

Figure 2. Edgerunner Cargo Bike
Source: ebikes, 2012 < www.ebikes.ca >

Table 2. Edgerunner Cargo Bike Technical Specifications

Top Speed without pedaling	32 km/h (battery option 1); 39 km/h (battery option 2)
Hauling Capacity	181 kg
Motor Power	700 Watt
Battery Type	36V 14.5Ah LiMn (option 1); 48V 10Ah LiMn (option 2)
Battery Recharging time	approximately 4 hr
Material Used in Frame	steel
Starting Price	$3,300 CAD

2.3 Self-built Electric Cargo Bike

Figure 3 shows the ideal model a self-built electric cargo bike. The idea is to build the most cost effective electric bike that most satisfies the needs of this project. The bike can either be an used or brand new bicycle, but for the purpose of cost effective, an used bike is much preferred. The motor that generates power could be purchased in bike stores or on internet for price around $200 to $300 CAD. The cargo trailer that carries the pizza deliveries could either be self-built as a project for engineering students or be purchased in bike stores or on internet for around $100 to $200 CAD depending on the quality. The expected price for a self-built Electric Cargo Bike is under

Figure 3. Self-build Electric Cargo Bike
Source: Mountain Bike Review, 2010 < www.forums.mtbr.com >

3.0 Survey Results

The students who live on campus were asked to answer questions involving the convenience of current AMS food delivery system, overall satisfactory for the delivery system, and after introducing them the three models suggested in Section 3.0, students were asked to rank their most favorable mode of food delivery. Survey questions are presented in Appendix A: Survey Questions

From the first question, our survey results from 30 students who live on campus show that 20% of students order a food delivery less than 10 times a week, and 8 of them said they usually cook for themselves. Another 30% of survey students order a food delivery about 10 times a week, which usually includes lunch, dinner, and late night supper. The other 50% of students order a food delivery more than 10 times a week. This result shows that there is a high demand for food delivery on campus.

From the second question, our survey results show that almost 60% of them agree to see a more sustainable mode of food delivery on campus, while 35% of students have no opinions, and the other 5% of students are satisfied with the current mode of food delivery system. This result shows that, in general, students at UBC are aware of the issues with sustainability and are willing to be in a more sustainable environment.

From the last question, our survey results show that the Parklane Electric model is the least favorable model with only 10% of students voted for it, and 45% of students preferred Edgerunner Cargo Bike for its 180 kg hauling capacity, and the other 45% of students preferred Self-Built Electric Cargo Bikes for its low cost investment.

4.0 Triple Bottom Line Analysis

The Triple Bottom Line is an accounting framework that incorporates three aspects: social, environmental and financial. It helps to define and measure the sustainability of the project according to it's social, environmental, and economic impact on the society.

For this project, using the Triple Bottom Line approach, we have assessed the electric bicycle, electric cars, and walking to deliver the food across campus. To assess the social impact, we considered the efficiency in labor such as the physical fatigue that one may face with respect to the amount they are getting paid. Comparing the carbon emission by each method of delivery system assesses the environmental impacts. To determine the economic impacts, we assessed the capital cost of the implementation of each method of delivery as well as maintenance cost.

4.1 Social Impacts

The main social aspect of the triple bottom line analysis was comprised of comparing walking versus electric bikes and vehicles. Considering deliveries may be of large amounts, up to 100 medium sized pizzas, deliveries on foot did not seem reasonable. Apart from the mass factor, distance is also an issue. Deliveries may span from the New SUB to Totem Park Residence, which is approximately 2 kilometers; in this span, deliveries may get cold and damaged by weather, along with the physical and mental fatigue of the employee delivering. The compensation for an employee delivering on foot would logically be greater than that of a simpler delivery method, in this case an electric vehicle or bike.

Although electric or hybrid vehicles are environmentally friendly, they still produce greater emissions than electric bicycles. As well, they also can cause congestion during peak traffic times, which could cause potential traffic flow problems for students as well as delay deliveries. Although during non peak hours deliveries may be faster, the delivery cost for the AMS would be higher as fuel and battery charge fees must be allocated for as well. Additionally, not everyone may be classified to operate the vehicle, which may lead to further employee problems. Hence, although more realistic than on-foot deliveries, because of the dense layout and population of UBC Campus, electric vehicles are not the most preferred mode of delivery.

Electric bicycles serve as a medium between vehicles and walking deliveries. They are an in between as they are quicker than walking and much more reasonable than vehicles. Many factors can attribute to this, such as being able to maneuver existing UBC Campus roads with a bicycle easier than a vehicle as well not interrupting traffic flow at peak times getting from one place to another. Logically, since this is an easier method of transport for the employee

and cheaper for the AMS, electric bicycles could potentially have the best overall compensation for both parties.

4.2 Environmental Impacts

The main focus on the environmental assessment for this project was the CO2 emission from each of the transportation as well as carbon footprint it leaves during the production. Due to no emission of CO2 during the travel, the CO2 emission number are based on the CO2 emitted from the production stage and electricity generating stage combined together.

Figure 1 – Electric Car's Carbon Emission

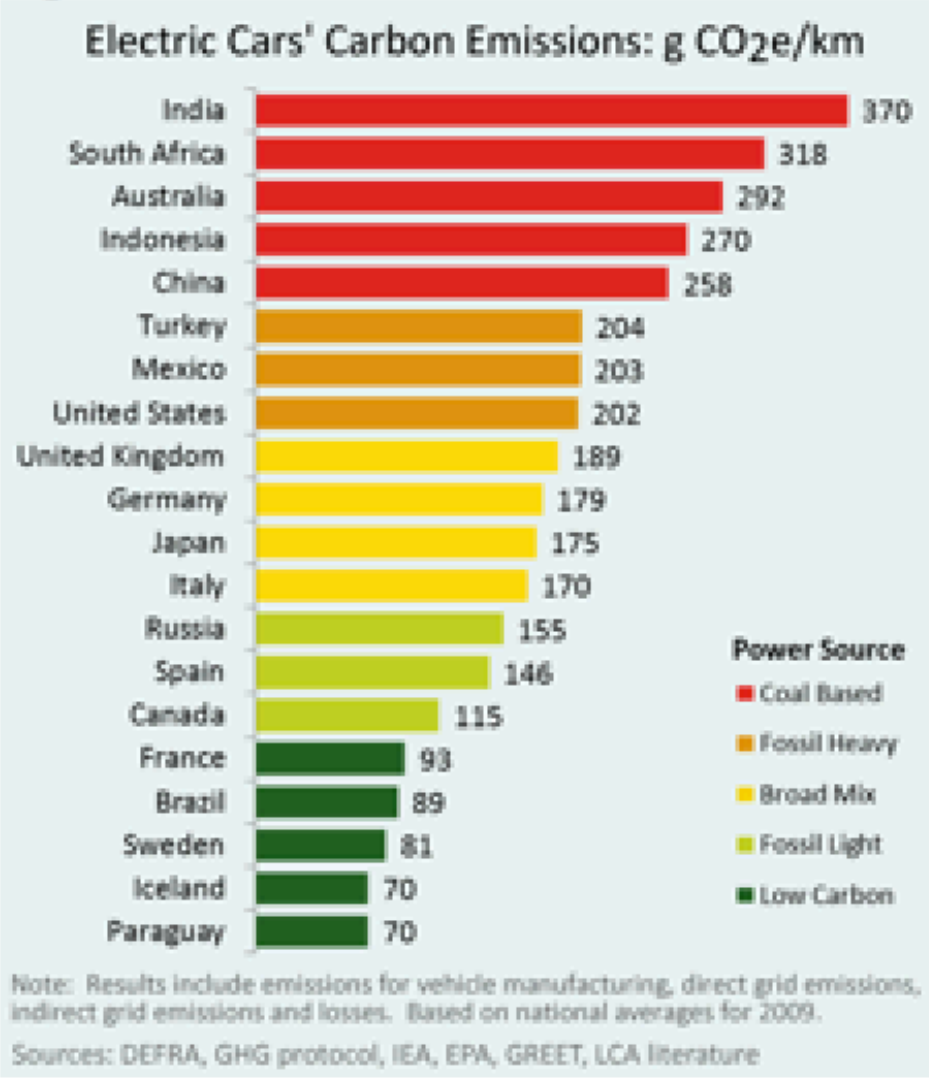

Figure 4: Electric Car's Carbon Emission

Table 3: of CO2 Emissions in grams per mile or kilometer

Mode of Transportation	Emission (gCO_2/mile)	Emission (gCO_2/km)
Electric Cars	71.46	115
Electric Bicycles	2.6	4.18
Walking	0	0

Even though the electric cars and the electric bicycles do not emit CO2 during their travel, the electricity it consumes and the manufacturing process has CO2 emission. The CO2 emission including production stage is 2.6g/mile or 4.18g/km for electric bicycle. However, the electric cars have much bigger carbon footprint of 71.46g/mile or 115g/km. Between electric cars and electric bicycles, the electric bicycle is no doubt a more environmentally friendly mode of transportation with more than 30 times less CO2 emission. Humans do not have any significant CO2 emission. Just looking at the environmental impact, delivering the food across campus has the least amount of environmental impact.

4.3 Economic Impacts

The economics assessment covered the capital cost of the methods of transportation as well as the maintenance of the transportation. There will be two prices on the electric bicycles due to their availability in different forms. The electric bicycle made from different companies can be directly bought or an electric battery can be bought and installed onto an existing bicycle.

Table 4: Capital Cost of Each Mode of Transportation

Mode of Transportation	# of vehicle	Capital Cost (Each Vehicle)	Capital Cost (Total)
Electric Cars	5	$25,000 ~ $91,000	$125,000 ~ $455,000
Electric Bicycles + Trailer	5	$1,400 ~ $2,100 + $150 ~ $300	$7,000 ~ $10,500 + $750 ~ $1500
Electric Batteries + Trailer	5	$250 - $450 + $150 ~ $300	$1,250 ~ $2,250+ $750 ~ $1500
Walking	-	-	-

Table 5: Maintenance Cost of Each Mode of Transportation

Mode of Transportation	Cost of Maintenance
Electric Cars	$15,000 every 100,000 miles
Electric Bicycles	$ 200 every 15,000 miles
Walking	-

As the table shows, the capital cost for the electric car will be significantly more expensive than the electric bicycles. The cheapest electric car, 2013 Smart Fortwo Electric Drive, cost around $25,000. However, one of the best electric bicycle in the world, EVELO Aurora, will cost around $2,100. Since many students on campus use bicycle, the cheapest way to have electric bicycle is to install the electric battery for those of whom who are willing to bring their bicycle in or even get a used bike for free. I know for a fact that my bike got taken away by UBC because I did not unlock it at the end of the year when living at the residences. Also, the trade off can be made where students get a free electric battery if they decide to work as a deliveryman for over 1 year. Each electric motor will only cost around $200 to $300. To store the food we need to consider the trailer that can be attached to the bicycle, which will cost around $200.

Typically, the electric bicycles will not have any major expenses in maintenance other than replacing the electric battery, which need to be done after around minimum of 500 charges, which will probably provide around 10,000 - 17,000 miles of distance. The electric cars will also have to go through maintenance every 100,000 miles costing around $15,000.

5.0 Conclusion

Using the Triple Bottom Line approach, the electric bicycle resulted in the best option between, electric bicycle, electric cars, and walking. The electric bicycle keeps the social integrity of the employee that deliver the food compared to walking when getting paid minimum wage, even though it leave little more carbon footprint. When we compare the capital costs for electric cars and electric bicycle, the difference is tremendous and it It also does not make sense to use the electric cars on campus due to many traffic limitation.

We recommend using electric bicycle to deliver the food across UBC campus. It seems very logical to implement the electric bicycle from figure 3. as the mode of transportation for the AMS delivery system. Having a phenomenally low CO2 emission of 2.6g/mile and also having only $11,500 as the capital investment with no significant social issues, it is no doubt the best choice between the three, electric bicycle, electric cars and walking.

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Appendices

Appendix A: Survey Questions

1. As a student living on campus how often do you order a food delivery?

- Less than 10 times a week
- Around 10 times a week
- More than 10 times a week

2. The AMS F&B is looking for a new mode of transport for food delivery on campus, what is your opinion on this project ?

- I would like to see a more sustainable mode of food delivery on campus.
- I am satisfied with the current situation.
- I have no opinion.

3. Out of the three suggested models, which mode of food delivery would you like to see being used on campus ? and why ?

- Parklane Electric
- Edgerunner Cargo Bike
- Self-built Electric Cargo Bike