

# Environmental Impacts Study of Life Cycle Assessment (LCA) XV Conference at UBC

Report from Sustainability Booth, November 2015

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## ABSTRACT

This is a project coordinated by ACLCA (American Center for Life Cycle Assessment) and UBC SEEDS (Social Ecological Economic Development Studies) Program. The authors are graduate students at UBC and volunteers working at the Sustainability Booth in LCA XV conference, which was held at UBC, from October 6th to October 8th, 2015. It was intended to assess the environmental impacts of the 2015 LCA XV conference and provide students a real world sustainability experience, skills and knowledge. The two students (authors) investigated the following five aspects: waste generated by the conference, the material of schedule sheet, the disposals, attendees' transportation modes and electricity usage. Generally, the conference was excellent in terms of reducing impacts on the environment. The analysis results will provide more information for future decision-making.

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## Executive Summary

This project is co-organized by ACLCA (American Center for Life Cycle Assessment) and UBC SEEDS (Social Ecological Economic Development Studies) Program. The authors of this report are graduate students at UBC who volunteered at the Sustainability Booth in 2015 LCA XV conference, which was held at UBC, Vancouver, Canada, from October 6<sup>th</sup> to October 8<sup>th</sup>, 2015.

The project was intended to assess the environmental impacts of the conference using LCA methods, to find out solutions or suggestions for future conference, and also, to provide students with real-world sustainability experience, skills and knowledge. This report is prepared for all the conference organizers, attendees and anyone who cares about environmental impacts.

The authors investigated the following five aspects of the conference: waste, the paper material of schedule sheet, the disposals, attendees' transportation modes and electricity usage.

The waste collected from the kitchen for the conference was weighed and compared to average municipal solid waste in Canada, US and Europe. The results suggest that the waste generated by the conference is dramatically less than those averages, i.e. 1/6 of average waste in Canada. This is because many good practices were taken, such as food donation, survey of dinner attendee numbers, use non-disposable cups, plates and cutlery, attendees bringing their own water bottles, etc. But there are still some suggestions, for example, more accurate calculation of food demand, more social actions about food, and a specific place for conference waste.

A simplified LCA was conducted to the special paper material for printing schedules. And the results show that regular office papers have less environmental impacts than the card stock material. Some attendees were interviewed as well to get their opinions on the special material for schedule printing. We suggest for future conference to use electronic schedules on cellphones and to use office papers to print schedule as a back-up.

The Green House Gas Emissions (CO<sub>2</sub>e) from the transportation of attendees were calculated. People showed significantly different transportation choice between Airport-Hotel and Hotel-UBC trip. The total CO<sub>2</sub>e emissions for one-trip dropped 69% from 29.557 kg/km to 9.2 kg/km, simply because more people chose to take public transit from hotel to UBC. Some good practices that should be taken in the future are: public transit information was distributed via emails prior to the conference; flipchart was used to share ride information at the end of conference.

Analyses of disposals and electricity usage provide informative results. More suggestions are listed in chapter 3.

In general, 2015 LCA XV conference achieved high environmental performance due to high awareness of reducing environmental impacts from the conference organizers and the attendees.

# 1 Introduction

## 1.1 Background

2015 LCA XV International Conference is the year's key Life Cycle Assessment conference in North America and it had be attended for professionals from the fields of academia, research institutes, policy makers, government and industry from 19 countries (ACLCA 2015). The conference was collaboratively hosted by ACLCA (The American Center for Life Cycle Assessment) and UBC (The University of British Columbia), represented by the Centre for Interactive Research on Sustainability (CIRS), from October 6<sup>th</sup> to October 8<sup>th</sup> 2015 at UBC, Vancouver, Canada. The conference was held in a LEED Platinum Certified building – AMS Nest (new Student Union Building).

ACLCA is a non-profit membership organization that seeks to build capacity and knowledge of Environmental LCA among industry, government and NGOs. The organization was formerly a program of The Institute for Environment Research & Education (IERE), which performs and disseminates fact-based research for the use in the development of responsible environmental policy, programs and decisions. (ACLCA 2015)

The sustainability booth of this conference is a joint project between ACLCA and UBC SEEDS (Social Ecological Economic Development Studies) Program. The program provided students with real world sustainability experience, skills and knowledge, giving them an opportunity to evaluate the environmental impact during the three days of conference.

## 1.2 Objectives

Firstly, the project aims to evaluate the environmental impacts (and potential social and financial impacts in waste analysis) of the conference based on Life Cycle Assessment (LCA). Students collected information and data during the conference such as waste food and surveys. AMS and the conference coordinators of the conference helped to collect information such as transportation, energy, and food consumption. The students analyzed the collected data at the Sustainability Booth in the conference under supervision of the conference organizer on daily base and presented a final presentation at the end of the conference. This final report consolidates all the information and evaluation that had been done.

Secondly, this study aims to explore solutions to organize sustainable conferences by adopting policies that incorporate sustainable practices into the management, operations and reporting. Also, this study aims to provide ACLCA a guideline with sufficient information to be evaluated for the best decision of potential sustainable actions or priorities with the organization of future conferences.

At last, as mentioned by SEED, this study is also helpful to bring knowledge and experience of Lifecycle to several UBC faculties and departments, such as reducing energy, materials, improving social wellbeing, encouraging sustainable event practices.

## **1.3 Methodology**

### **1.3.1 Life-Cycle Assessment**

Life-Cycle Assessment (LCA) addresses the potential environmental impacts of products and services, both embodied and consumed, from extraction to disposal (ISO14040 2006). LCA can help products design and decision-making in organizations. It provides the opportunity to increase the environmental performance of products and increases marketing value.

In this study, LCA was used to analyze the special schedule sheet material and transportation modes of the conference attendees.

### **1.3.2 Survey**

Interview is a direct way to collect people's opinions. A little survey with three questions was done regarding attendee's opinions on the card stock schedule sheet and few questions at the moment of the register on the first day to collect information about transport used, and if they brought their own water bottle.

### **1.3.3 Data Collection**

Some other methods were used to collect information to analyze the impact of the conference as well.

In the waste analysis, the volume of waste was recorded by observation, i.e. ½ bin, 1 bin, etc. Then the waste was weighed at the end of the day to get the weight.

In the disposals analysis, every attendee noted down if they brought their own water bottle. It was analyzed also the operational of the conference and material chose such as ceramic cups and plates. The energy performance of the washing machine in the kitchen was determined by downloaded product technical sheet.

In the transportation modes analysis, every attendee was asked to specify his or her transportation modes on the sign-up sheet.

## 2 Results

### 2.1 Waste Analysis

The UBC and conference organizer provided three kinds of bins to sort the waste generated by the three-day conference: compost, recycle and garbage.

The management of the waste started in the design phase of the conference such as calculating the quantity of the food, deciding what cutlery to use, etc. The objective of waste management is reducing the solid waste that goes directly to the landfills, affecting our environment. In Canada, the landfills are designed and located in a manner to minimize impacts both social and natural environment (Canada 2014). The best solution to minimize the environmental affect is to mitigate the waste that goes to the landfills.

#### 2.1.1 Goal and Scope

The objective of this analysis is two-folded.

1. Evaluate the waste generated during the conference and what is the main cause for each waste category (compost, recycle and garbage);
2. Investigate what had been done to mitigate waste and how to improve for next conference.

For example, for compost waste, what have been done with the untouched food that could be donated to feed people? For Recycle and Garbage, what are the materials used to operate the conference?

In terms of scope, we calculated and weighed the quantity of waste at the conference venue and we compared the conference waste to some baselines. There is no detailed LCA but some social and financial issues were observed and discussed.

#### 2.1.2 Data Collection and Analysis

The waste was counted at each break of the conference. In total there were five breaks each day: breakfast, morning coffee break, lunch, afternoon coffee break, dinner. The quantities of waste in the bins were collected in each break. Table 1 demonstrates the data collected for each day and each break cumulatively. At the end of the day the waste was weighed (see section 2.1.3 limitations).

**Table 1 Daily collection of the waste (cumulatively)**

DAY	BREAK	COMPOST	RECYCLE	GARBAGE
October 6 <sup>th</sup>	Breakfast	0.2 Bin	0.25 Bin	0.33 Bin
	Coffee Break	0.33 Bin	0.33 Bin	0.33 Bin
	Lunch	0.5 Bin	0.67 Bin	0.5 Bin
	Coffee Break	0.67 Bin	1 Bin	0.5 Bin

	End of the day/ Dinner	1 Bin	1.25 Bin	1 Bin
	<b>Total Oct. 6<sup>th</sup></b>	<b>1 bin 38.28kg</b>	<b>1.25 bin 5.88 kg</b>	<b>1 bin 12.80 kg</b>
<b>October 7<sup>th</sup></b>	Breakfast	0.25 Bin	0.2 Bin	0
	Coffee Break	0.33 Bin	0.33 Bin	0.33 Bin
	Lunch	0.5 Bin	0.33 Bin	0.5 Bin
	Coffee Break	0.67 Bin	0.67 Bin	0.5 Bin
	End of the day/ Dinner	2.05 Bin	1 Bin	0.5 Bin
	<b>Total Oct. 7<sup>th</sup></b>	<b>2.05 bin 72.96 kg</b>	<b>1 bin 4.70 kg</b>	<b>0.50 bin 6.40 kg</b>
<b>October 8<sup>th</sup></b>	Breakfast	0.5 Bin	0	0.25 Bin
	Coffee Break	0.67 Bin	0.17 Bin	0.33 Bin
	Lunch	0.8 Bin	0.5 Bin	0.5 Bin
	Coffee Break	1 Bin	0.5 Bin	0.5 Bin
	End of the day/ Dinner	-	-	-
	<b>Total Oct. 8<sup>th</sup></b>	<b>1 Bin 35.6 Kg</b>	<b>0.5 Bin 2.35 Kg</b>	<b>0.5 Bin 6.4 Kg</b>

Table 2 demonstrates the sum of all three kinds of waste and the amount per day (average), per person. It was considered 199 attendees to divide the waste.

**Table 2 Summary Waste of LCA XV Conference**

Total Waste (Bin)	Total Waste (Kg)	Average (kg)	Attendees	Waste (kg) per Person per Day
8.8	185.38	61.79	199	0.31

Figure 1 demonstrates the division of the waste per day in kilograms. Figure 2 compares the conference waste to reference Municipal Solid Waste (MSW) according to US EPA, Environment Canada and Organisation for Economic Co-operation and Development (OECD).



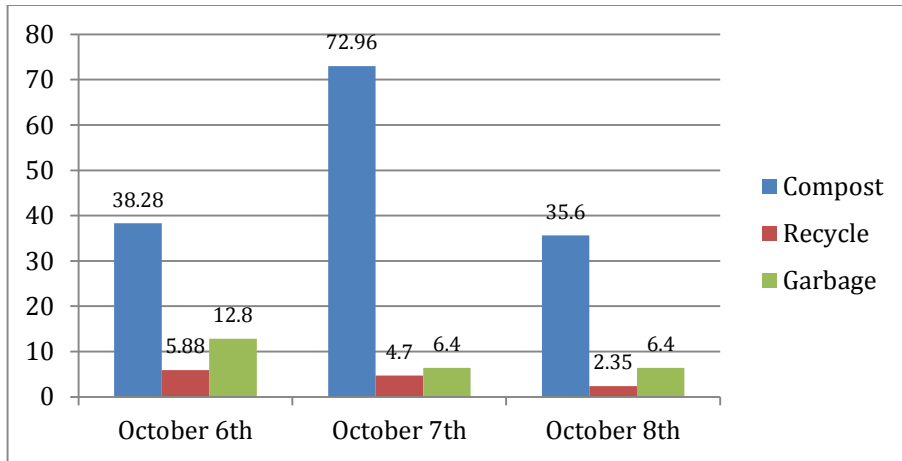


Figure 1 Division of the waste per day (kg)

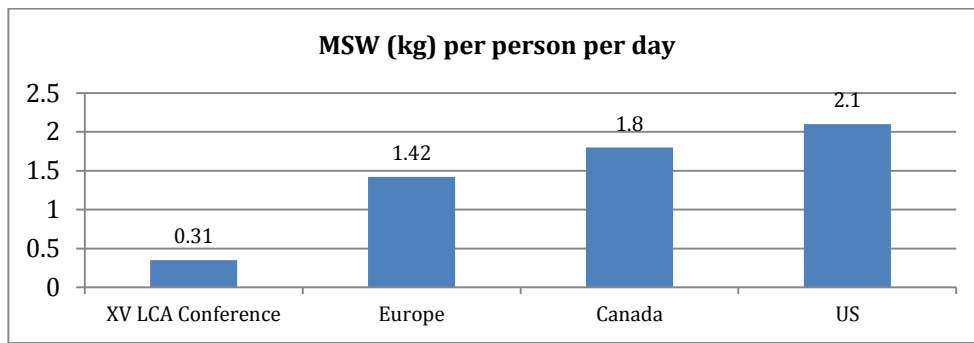


Figure 2 MSW (kg) Comparison per person per day (US EPA, Environment Canada, OECD)

Figure 1 shows that October 7<sup>th</sup> generated almost double waste of October 6<sup>th</sup>/October 8<sup>th</sup>, which we believe was caused for two reasons:

**1. Improper calculation of food demand (Environmental and Financial Impacts)**

In October 7<sup>th</sup> a social dinner was offered to the attendees at Sage Bistro on UBC campus. The organizer of the conference had done a survey to confirm the number of attendees who were interested in this event. This action was very important to avoid waste. On the other hand, there are some services offered to calculate the closest quantity of food per person. According to the organizer, such calculation was done for the dinner but we couldn't get to know how they calculated. In fact, there were approximately 1.25 bin of compost waste out of the dinner, which contributes to the dramatically high volume of compost on October 7<sup>th</sup>. The calculation of food demand need to be improved, for example, consider that some people would not show up although they signed up.

**2. Donation of untouched food (Environmental and Social Impact)**

If you look at the waste during the day and the evening on October 7<sup>th</sup> (Table 1), you will find the huge difference – 0.65 bin from four breaks during the day and 1.38 bin from the dinner only. That was because the untouched food of the conference in the day was donated to the students, decreasing the

compost waste considerably. But the waste food generated in October 7<sup>th</sup> evening was not donated. In fact, the food could have fed approximately 80 people, according to the responsible in SAGE restaurant.

Donation of untouched food has huge great impacts on natural and social environment. There are already many organizations that can manage the distribution of the food in the city. For example, the Quest Food Exchange that receive food donation to distribute to the people who need. At UBC, where many events take place, some students are trying to create an initiative which schedules when and where to pick up untouched food and manages its distribution.

Figure 2 shows that the waste at the conference per person per day is 0.31kg, which is much less than the average waste in Europe and North America. This probably resulted from the following reasons:

1. All the attendees are experts in LCA and thus highly conscious about reducing waste.
2. The people in the kitchen were aware that two students were looking at the waste regularly, so they carefully sorted out the waste. Sometimes they ate the leftover food too.
3. Most leftover food was donated to the main kitchen in the building.
4. We could not get access to the waste generated during the initial food processing in the main kitchen, because the kitchen prepares food to all events in the building. It was impossible to collect the information specific for one unique event. However, we were told that the waste in the main kitchen is very small, because they worked to minimize it purposely.
5. The number 0.31 kg per person per day did not include waste people generated elsewhere.

### 2.1.3 Limitations

The most important challenge was collecting the waste data. The conference was during all day, and three different teams were working in the kitchen, increasing difficulty in communication. Some information and orientation was given to one team but was not transferred to the next one. On the first day it was not possible to weigh the waste because the team that worked at night collected the waste before we weight them. To calculate the weight of the first day waste we used the proportion from the second day.

Also, at the barbecue dinner on the first day, we did not have access to the waste of the bottles. The drinks served in glass bottles were not considered in our analysis. But we took into account the weight of the disposable plates by multiplying the unit weight of the material by the number of the attendees.

## 2.2 Schedule Sheet Material Analysis



Figure 3 Conference Schedule Handout

Unlike other conferences, a special type of paper was used to print the conference schedule handouts in LCA XV conference (Figure 3). It is hard and thick card stock, larger than A3.

There is no doubt that there are reasons behind the choice of new paper material. It was believed that people would better keep the schedule sheet throughout the whole conference and thus use less material in total. Moreover, it is much clearer with all day information showed on one page. Advantages and disadvantages of the special material and ordinary paper are compared in Table 3.

The authors found this unusual choice interesting and therefore conducted a little survey and LCA for this paper material.

Table 3 Advantages and Disadvantages Comparison between Different Paper Materials

Card Stock Schedule Sheets	Advantages	Disadvantages
	<ul style="list-style-type: none"> <li>• Durable</li> <li>• One piece</li> </ul>	<ul style="list-style-type: none"> <li>• Too big</li> <li>• Too thick</li> <li>• More Expensive</li> </ul>
Ordinary Office Paper Schedule Sheets	Disadvantages	Advantages
	<ul style="list-style-type: none"> <li>• Easy to lose or tear</li> <li>• 4 pieces</li> </ul>	<ul style="list-style-type: none"> <li>• Easy to carry</li> <li>• Cheaper</li> </ul>

### 2.2.1 Goal and Scope

The objectives of this analysis are

1. understand if attendees liked the schedule sheet and their suggestions;
2. investigate if using card stock to print schedules has less environmental impacts than using normal office papers.

For objective 1, a little survey was done. For objective 2, a simplified LCA was done.

This analysis was prepared mainly for conference organizers in order to provide some reference for future decision-making, but it is also for those attendees who are interested in the material itself or in other attendees' opinions.

The LCA data of this analysis was based on a LCA study of papers produced in North America done by American Forest & Paper Association (AFPA n.d.). The system boundary is from raw material extraction to final disposal of paper products (cradle-to-grave). Transport is also included. The data is from 2006-2007.

The Functional Unit for this study is providing schedules for 210 people for 3 days. The conference organizer printed 210 copies of card stock schedule sheets and only a few left (absences). Assume that to replace one card stock sheet, we need 4 pieces of normal office papers to print the three-day schedule. And on the second and third day, 20% of attendees will ask for another copy of schedule because the first copy is either damaged or lost. The numbers of different papers are

- # of Card Stocks = 210
- # of Office Papers =  $210 * 4 * (1 + 0.2 * 2) = 1,176$

James Salazar helped calculate the weight of the two comparatives:

- Card Stocks = 13.7kg
- Office Papers = 6.4kg

### 2.2.2 Data Collection and Analysis

#### 1. Survey

33 people were chosen randomly at the registration desk to answer three questions regarding the card stock schedule sheet. Below are the results.

#### Q1. Is the material good for schedule sheets?

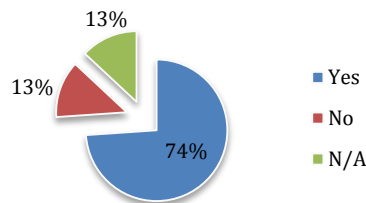


Figure 4 Answers to the question: Is the material good for schedule sheets?

Generally, respondents think card stock is an appropriate material to print schedule for a conference.

#### Q2. Is the size convenient?

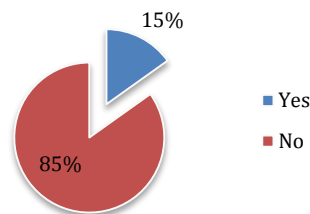


Figure 5 Answers to the question: Is the size convenient?

Although the attendees were satisfied with the material used for the sheet, most respondents complained about the inconvenient size of the schedule sheet, saying it is too big to carry and too thick to fold.

### Q3. Is the organization of information clear?

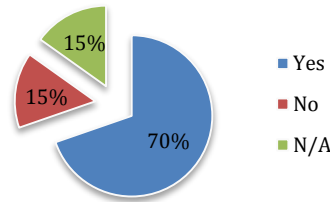


Figure 6 Answers the question: Is the organization of information clear?

70% of respondents are satisfied with the information presented – the letters are easily readable. However, some interviewees suggested that it would be better if one-day schedule were on the same side (the second day schedule was separated on both sides).

#### 2. LCA

Due to time limit (three days) and limited information about the card stock material, the authors couldn't develop a thorough new LCA for the paper materials. As mentioned before, the LCA data was extracted from an existing LCA done by American Forest & Paper Association.

Normal office paper was referred to "Ream of Office Paper" in the report, while the card stock was referred to "Catalog". After adjusted by weight, the environmental impacts of using office paper and card stock to print schedule for this conference are listed in Table 4.

Table 4 Environmental Impacts of Different Paper Materials

Impact Category	Unit	Office Paper	Card Stock
Global Warming	kg CO <sub>2</sub> eq.	12.65	49.62
Acidification	H <sup>+</sup> moles eq.	4.26	16.95
Respiratory effects	kg PM <sub>2.5</sub> eq.	0.02	0.07
Eutrophication	kg N eq.	0.02	0.09
Ozone depletion	kg CFC-11 eq.	0.0000008	0.000003
Smog	kg NO <sub>x</sub> eq.	0.03	0.21
Fossil fuel depletion	MJ surplus	8.99	39.98

According to the results, although using card stocks to print conference schedule will significantly decrease the amount of paper needed, it is still more harmful for the environment. Therefore, it should be carefully considered what material should be used to print schedule in next conference.

### **2.2.3 Limitations**

The real production processes of the card stock schedule sheets were unknown. The data was from previous LCA in 2006-2007. As techniques increase, environmental impacts for both kinds of paper materials are likely to decrease, but the drop degrees are unknown. Therefore, given that the environmental impacts of card stock schedule sheets are generally 4 times more than those of office papers, it is fairly to say that the card stocks are still more environmentally harmful than office papers nowadays in 2015.

## **2.3 Disposals Analysis**

Events in general generate a big amount of waste: compost, recycle or garbage. For special event, organizer needs to be carefully with the amount of waste going to disposal and identifies practical ways to reduce it, because it is the most effective way to cut waste and provide environmental benefits. (Northeast Recycling Council 2015)

According to Northeast Recycling Council (2015), strategies to reduce waste include:

1. Limit or eliminate trash disposal for vendors. Could be charged a penalty to all suppliers who do not comply;
2. Encourage to supply drinks in containers that can be recycle or reuse
3. Limit the number of printed materials, and use printed material by two-sided and on recycle-content paper
4. Consider requiring the use of compostable plates, cups, flatware, and trash bags.
5. Encourage and facilitate vendor efforts to donate leftover items, such as food or durable products (see section 2.1.2).

### **2.3.1 Goal and Scope**

For this kind of conference, one of the most disposal wastes is cups and plates to serve the food and drinks. This analysis provided some overall observations on methods that aimed to successfully reduce disposal waste (the waste amount was very small according to waste analysis). The objective of this analysis is to identify the actions adopted by the conference that minimized the disposal waste.

### **2.3.2 Data Collection and Analysis**

Figure 7 below shows some materials used in the conference that helped to minimize the impact of the waste of the conference.



Figure 7 Some material used in the conference

Specific strategies to mitigate the disposal waste such as:

1. “Bring your own water bottle”

The organizer encouraged all attendees to bring their own water bottle that could be used during the conference. On the first day morning, the attendees were asked to notify if they brought their own bottle. 172 of the 199 attendees answered the question. Figure 8 demonstrates the result of the survey.

Another interesting fact was that some attendees who did not bring their own bottle was using the same disposal cup throughout all day, minimizing the waste of disposable cups. The communication and high awareness contributed a lot to less waste.

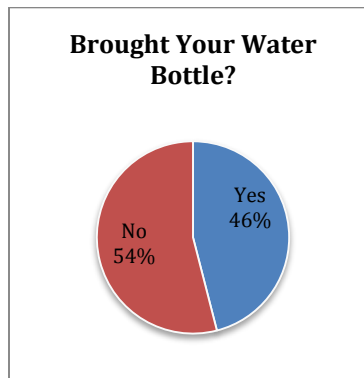


Figure 8 How many attendees brought their own water bottles?

2. Use non-disposable cups and plates

For the breakfast, coffee break and lunch, the conference opted to use ceramic cups and plates, which did not generate disposal waste at all. Table 5 demonstrates the comparison between disposable and not disposable cups/plates.

**Table 5 Advantages and Disadvantages of Disposable Vs. Non-Disposable**

<b>Non-disposable</b>	<b>Advantages</b> <ul style="list-style-type: none"> <li>• Reduce waste</li> <li>• Reusable</li> </ul>	<b>Disadvantages</b> <ul style="list-style-type: none"> <li>• Need water and energy to clean</li> </ul>
<b>Disposable</b>	<b>Disadvantages</b> <ul style="list-style-type: none"> <li>• Higher volume of waste</li> </ul>	<b>Advantages</b> <ul style="list-style-type: none"> <li>• No need to wash</li> </ul>

Although non-disposable cutlery can reduce waste, they require a lot of water and energy to wash, which may increase environmental impacts. So, we did a further observation to the dishwasher. There is a high-technology washing machine with “Energy Star” label in the kitchen, which indicates it is energy-efficient (Figure 9). Table 6 below demonstrates the technical information of the machine and the results of water and energy consumption of the machine based on usage information provided by the kitchen people.



**Figure 9 Pictures of the Wash Machine used at the conference**

**Table 6 Wash Machine consumption**

Wash Machine			
Water Consume		Energy Consumption	
L/h	499.62	kW (Heating system = 25 + Operation Machine = 5)	
Time/wash (min)	1.5	Time/wash (min)	30
Qt/day (7/break)	35	Qt/day (7/break)	1.5
Time/day	52.5	Time/day	35
Consume/day	437.17	Consume/day	52.5
<b>L/ Conference</b>	<b>1311.50</b>	<b>KW/ Conference</b>	<b>78.75</b>

3. Compostable disposable cutlery at the barbecue event

There was a barbecue dinner at the roof garden on the first day. In this case the conference chose to use disposable plates and cups. However, the cups and plates were decomposable and sustainable, so it only increased compostable waste, without recycle or garbage waste.



### 2.3.3 Limitations

When calculating the energy and water consumption of the wash machine we used the Dishwater Machine Specification from the supplier because we did not have a specific meter to measure actual consumption.

## 2.4 Transportation Modes Analysis

The attendees in this conference are experts or practitioners in LCA area. They are very conscious about environment protection and green behaviors. Moreover, the conference organizers sent emails to every attendee prior to the conference to inform them with public transit options in Vancouver. Therefore, we were curious to see if the attendees have chosen greener transportation mode give the background.

### 2.4.1 Goal and Scope

The objective of this study is to relate the attendees' transportation modes to environmental impacts. This is not a rigid LCA. Only Global Warming Potential (CO<sub>2</sub> equivalent) was set as the analysis target, since it is the largest environmental effect from transportation. This study is trying to provide every attendee with informative results and hopefully influence their future transportation choices.

The LCA data was derived from a previous study where Carbon footprint emission factors (EF) were adjusted for transportation to UBC (Dolf and Teehan 2014). The emission data took into account vehicle manufacturing, maintenance, fuel use, end-of-life, and share of road/rail/air infrastructure. But Dolf's report does not have EF for rail system. Skytrain is the rapid transit metropolitan rail system in Vancouver. The emission factor of skytrain is referred to emission of light rail with average occupancy in a report from U.S. Department of Transportation (Hodges 2010).

This study analyzes transportation from airport to Hotel and from Hotel to UBC, not including flights from original place to Vancouver due to inadequate information.

### 2.4.2 Data Collection and Analysis

When every attendee signed up at the registration desk, they noted down their transportation modes. Then the numbers of each kind of mode were calculated (Table 7) and the CO<sub>2</sub> equivalent were calculated using existing LCA data.

Table 7 Impacts of Transportation Calculation

AIRPORT - HOTEL						HOTEL - UBC					
TAXI/ CAR	SKY- TRAIN	BUS	BIKE	WALK	NA	TAXI/ CAR	SKY- TRAIN	BUS	BIKE	WALK	NA
98	39	27	0	1	53	18	3	83	2	38	35
59.4%	23.6%	16.4%	0%	0.6%	/	12.5%	2.1%	57.6%	1.4%	26.4%	/
CO <sub>2</sub> e EF (kg/Passenger km)											
0.23 <sup>1</sup>	0.101 <sup>2</sup>	0.114 <sup>3</sup>	0.013 <sup>4</sup>	0	/	0.23	0.101	0.057 <sup>5</sup>	0.013	0	/
CO <sub>2</sub> e (kg/km)											
22.54	3.939	3.078	0	0	/	4.14	0.303	4.731	0.026	0	/
Total = 29.557						Total = 9.2					
Notes:											
1, 3, 4 are from Dolf and Teehan 2014, for North America average.											
5 is from Dolf and Teehan 2014, adjusted with consideration of more occupancy on the bus to UBC											
2 is from U.S. Department of Transportation, 2010											

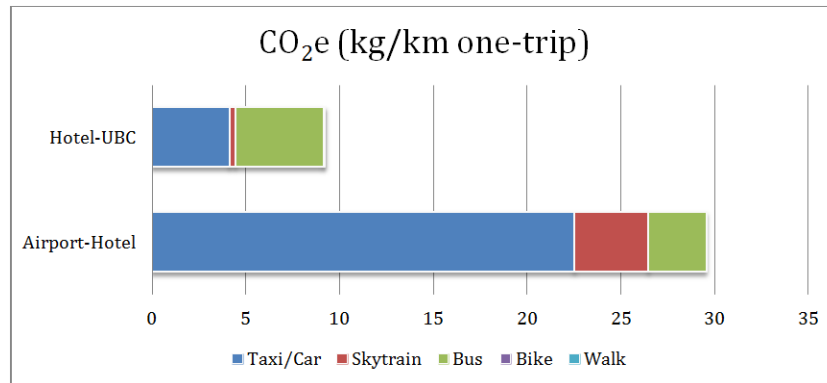


Figure 10 CO<sub>2</sub>e From Attendees' Transportation To The Conference

From Table 7 we can see that transportation modes were significantly different from airport to hotel and from hotel to UBC. From airport to hotel, nearly 60% of people chose to take taxi or car, while from hotel to UBC, 60% of people took public transit (skytrain or bus or both), and the second largest proportion is walk (26.4%). Apparently, when people arrive at a new place, they are reluctant to explore public transit, and find taxi the most convenient. But these LCA experts are willing to take buses or skytrain for shorter distance. It is astonishing that only 12.5% of attendees took taxi or car from hotel to UBC, which means almost 90% of attendees chose greener transportation mode.

Just because of the change in transportation mode selection, the total CO<sub>2</sub>e emissions in one-trip dropped 69% from 29.557 kg/km to 9.2 kg/km. Personal green choice is not minor; it makes huge difference to the environment! We strongly recommend attendees choose greener transportation mode in the future.

Also, the organizer of the event divulged all the public transit information to all attendees before the conference, which we believe that motivated the use of it.

### 2.4.3 Limitations

The CO<sub>2e</sub> emission factors used are from two LCA studies. Thus they are not consistent in terms of functional unit, system boundaries, etc. However, the authors compared the two sets of data and found them very close. Therefore, the inconsistency should have negligible effect on the results.

## 2.5 Electricity Usage

Electricity is the major energy used in the conference venue. The main conference area – Great Hall is naturally ventilated, plus that the gas meter in the building monitors gas for all space heating and hot water, etc. So we do not calculate the gas used for the conference. Water is only used in kitchen and washrooms. The water consumption in the kitchen mainly comes from the dishwasher (see section 2.3.2). Washrooms were used by both conference attendees and UBC students. There is no way to separate the usage and make credible assumption, therefore, we decided not to look into water usage.

### 2.5.1 Goal and Scope

We will only provide informative data for you in this part, but not do any analysis and comparison, because:

1. The data is not exactly right. Although the building is full of sensors, it does not provide electricity usage per room. So electricity usage of this conference was calculated based on footage proportion. This is the only way but the result is highly inaccurate.
2. There is no reference baseline about how much electricity should be used in a conference. Even there is, given the different country and building, the comparison makes little sense.

We calculated the electricity usage for the conference in the Nest building from October 6<sup>th</sup> to October 8<sup>th</sup> (dinner at the Sage Bistro restaurant is not included). Figure 11 is the Level-2 floor plan in the Nest building where the conference was held. Table 8 shows approximately use time periods of different places. Different colors represent different periods.

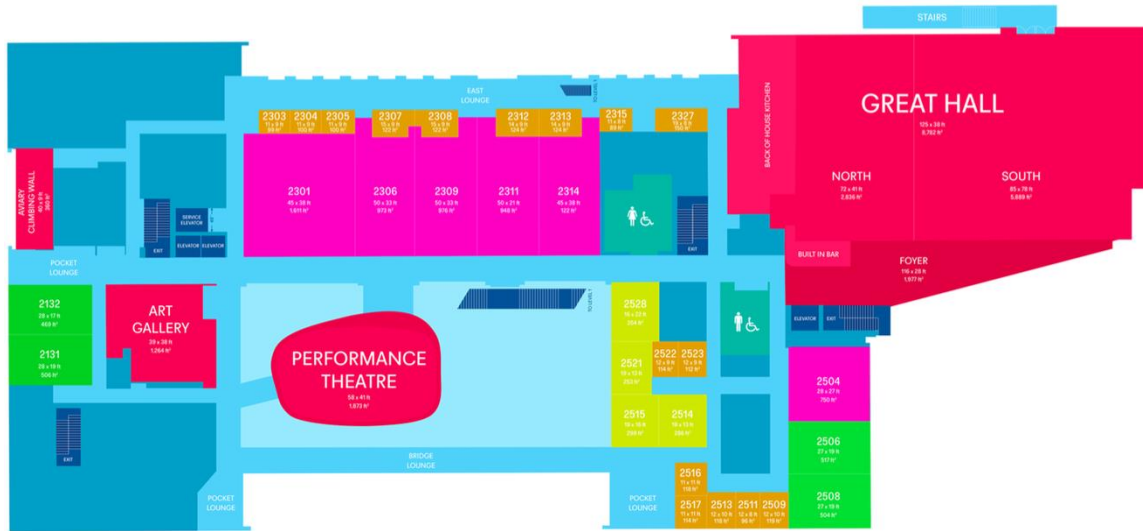


Figure 11 Conference Floor Plan at Nest Building

Table 8 Room use in Nest Building

Places	Oct. 6	Oct. 7	Oct. 8
R2306 (meeting room)	7:00am-6:00pm	7:00am-6:00pm	7:00am-3:00pm
R2309 (meeting room)	7:00am-6:00pm	7:00am-6:00pm	7:00am-3:00pm
R2311 (meeting room)	7:00am-6:00pm	7:00am-6:00pm	7:00am-3:00pm
R2301 (meeting room)	7:00am-6:00pm	7:00am-6:00pm	7:00am-3:00pm
R2528 (office room)	7:00am-6:00pm	7:00am-6:00pm	7:00am-3:00pm
R2401A (kitchen)	7:00am-9:00pm	7:00am-5:00pm	7:00am-5:00pm
R2401 (kitchen)	7:00am-9:00pm	7:00am-5:00pm	7:00am-5:00pm
R2314 (meeting room)	12:30pm-1:30pm AND 5:00pm-6:00pm	7:30pm-8:30pm AND 12:00pm-1:30pm	/
Great Hall	7:00am-6:00pm	7:00am-6:00pm	7:00am-6:00pm
Great Hall Foyer	7:00am-6:00pm	7:00am-6:00pm	7:00am-6:00pm
Men's and Women's washrooms near the Great hall	7:00am-6:00pm	7:00am-6:00pm	7:00am-6:00pm
Roof Top Terrace at Nest	5:30pm-8:00pm	/	/

### 2.5.2 Data Collection and Analysis

As mentioned above, the calculation based on footage proportion is invalid itself, therefore, there is no point to calculate exactly according to Table 8. To simplify, we calculate the electricity usage from 7:00am to 6:00pm, on October 6<sup>th</sup> to October 8<sup>th</sup>, in R2306, R2309, R2311, R2301, R2528, R2401A, R2401, R2314, Great Hall, Great Hall Foyer, and Men's and Women's washrooms.

The conference area is 18,648 square foot in total, while the gross floor area of the building is 250,000 square foot. The electricity data was extracted from building sensor. The electricity usage in the conference is shown in Table 9.

Table 9 Building Electricity Usage

October 6 <sup>th</sup>	October 7 <sup>th</sup>	October 8 <sup>th</sup>	Total
6,543 kWh	6,156 kWh	6,184 kWh	18,883 kWh

Approximately, the electricity used for the three-day conference is  $18,883 \times 18,648 / 250,000 = \mathbf{1408 \text{ kWh}}$ .

### 2.5.3 Limitations

The Nest building functions as Student Union Building and has a lot of functions, i.e. food outlets, meeting rooms, activity rooms, lecture hall, shops, elevators, washrooms, roof garden, etc. Apparently the electricity usage is not evenly distributed, therefore, the calculation is not accurate.

### 3 Suggestions

In general, the conference demonstrated excellent results in terms of reducing impacts on the environment and management of the event. The decisions made by the organizer, as well as the high awareness of the attendees, contributed to those results.

We suggest continuing some good practices. In addition, we suggest some actions that could further be evaluated.

#### 3.1 Waste Management

##### a) Good Practices

- *Attendees bring their own water bottle.*

This action helped to minimize the recycle waste. If we consider that each attendee uses one disposable cup per break to drink water, we can easily calculate how many disposable cups we managed to reduce our conference's waste: 199 attendees x 4 sessions (Early morning plus 3 breaks) x 3 days = **2,388 disposable cups**. We did not consider in this calculation disposable cup for coffees, which would make this number increase drastically;

- *Ceramic cups, ceramic plates, and metal cutlery.*

In the kitchen, there is a dishwasher with *Energy Star* label (see section 2.3.2), which helped to minimize drastically the usage of disposable materials without high consume of energy and water. The ceramic cups were used not just to drink water (for the attendees that did not bring their own bottle water), but also to drink the beverage (including coffee) served during the breaks. If we consider that each attendee consumes one cup of coffee in the morning break, another one in the afternoon break, and 1 beverage in the lunch time per day, we have: 199 attendees x 3 (two coffee breaks and 1 lunch) x 3 days = **1,791 disposable cups**. The ceramic plates were used during the lunch and the two coffee breaks. Considering 199 attendees and 2 days of lunch served plus 5 coffee breaks (two breaks in the first two days plus one in the last day) we have: 199 x 2 lunch x 5 breaks = **1,990 disposable plates**.

- *Preview survey to be sure the number of attendees.*

In case of social meal outside of the event, making a survey to be sure who exactly intends to attend the meal can minimize food waste. This survey would help to calculate the quantity of the food to be served.

##### b) Suggestions

- *Calculation of the food.*

There are some ways to calculate the quantity of the food per person. This quantity cannot be exact; however, it can be very close to the reality. If combine this action with a survey of attendee numbers, waste food can be minimized considerably (see Figure 1 and its explanation). The organizer of the event can ask for the calculation of the quantity to the buffet company and evaluate it before sign any contract.

- *Social action for leftover untouched food.*

During the decision-making phase about the food suppliers, choose one that has a social awareness. Include a plan in the contract for donation of the untouched food of the event. Although the calculation cannot be precisely, an action of food donation can also minimize the waste and feed people.

- *Define previously a specific space for the waste of the conference.*  
Make sure that all contractors and workers have acknowledge about the resource should been done during the conference to guarantee that the waste (the data collection) is not lost (see section 2.1.3).

### 3.2 Transportation

#### a) Good Practices

- *Send previously public transportation information.*  
People feel insecure in an unknown city, so sending information about map and public transportation before their trip can make them more comfortable to use the public transportation. Also, sending this information and specify the importance of it to minimize the environmental impact can motivate the attendees to use the public transportation.
- *Ride/share sheet.*  
In the end of the conference, a flipchart was erected at the entrance for attendees to share their car and create a group that can leave together. This can make the attendees more comfortable, provide social network opportunity, make the trip cheaper for each one, and reduce CO<sub>2</sub> emissions.

#### b) Suggestions

- *Take transportation from original site to conference city into consideration*  
We were unable to include flights from original site to conference city into the transportation impacts calculation because we did not have the information. But if people want to get full impacts of transportation of a conference, this transportation should be included in future conference LCA.
- *Organize transportation.*  
There could be an organizer responsible to arrange the transportation information of the attendees and to motivate attendees to use public transit or share cars. It would be good as well if create a partnership with some hotels and send the information to the participants of the conference motivating them to reside in those hotels, so that shuttles can be provided.

### 3.3 Conference Organization

#### a) Good Practices

- *Surveys and exchanged information before the conference.*  
Many environmental concerns were put into the organization, positively influencing the environmental impacts of the conference.

#### b) Suggestions

- *Material sheet.*  
According to the results of LCA about the paper sheet used in this conference (see section 2.2), we suggest to use regular office paper and organize the information of one day in same page. Moreover, we suggest to create an

electronic schedule sheet that can be viewed on cellphones (most of the people nowadays use smart phones). In this case, printed schedules are only to back up. A survey can be previously done to ask if the attendee would like to have a printed schedule.

- *Management plan.*

We suggest defining the specific environmental impacts that the conference wants to minimize and create a plan for it. Be sure how each indicator will be evaluated and how the data will be collected during the conference.

- *Send the attendees environmental goals prior to the conference.*

Send to the attendees a report with the good practices and actions that the conference intends to apply and the expected results. This can motivate the attendees even more to be sustainable and pay attention to their behaviors during the conference. Also they will become an auditor of the conference.



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