

A photograph of a male worker in a grey t-shirt and a high-visibility orange and yellow safety vest. He is carrying a large, rectangular block of white foam. He is looking upwards and to the right. The background shows a warehouse interior with a high ceiling, metal beams, and several other large blocks of white foam stacked in the background. A forklift is partially visible on the right side of the frame.

2012 Annual Report  
Vancity's greenhouse gas  
inventory report

**Vancity**  
Make Good Money.™

Foam Only

## **Foam Only offers solutions to the challenge of Styrofoam disposal**

When it comes to recycling challenges, few loom as large as Styrofoam. Bulky and difficult to recycle, Styrofoam fills an estimated 10 to 30 per cent of landfill space in Metro Vancouver. It's a problem acknowledged by municipalities and everyone within the product life cycle. But one Coquitlam-based business, **Foam Only**, has found a solution.

Mark Obedzinski, founder and owner of Foam Only, designed a proprietary system that compresses 100 cubic metres of Styrofoam per hour. The compressed material takes up less space in a landfill and can also be sold to Foam Only's partners, who process it into consumer products such as paving stones and picture frames.

Keen to support this innovative and much-needed environmental business, Vancity supplied Foam Only with a start-up line of credit.

## Appendix: Vancity's 2012 Greenhouse Gas Inventory Report

### Contents

<b>1. Purpose</b>	<b>1</b>
<b>2. Operational boundary and quantification methodology</b>	<b>1</b>
<b>3. GHG assertions and emissions inventory – 2012</b>	<b>3</b>
<b>4. Carbon neutrality intention</b>	<b>3</b>
<b>5. GHG emissions sources, factors and activity data</b>	<b>4</b>
Energy	4
Transportation	5
Paper Use	7
<b>6. Base year</b>	<b>7</b>
<b>7. Assessing and reducing uncertainty</b>	<b>9</b>
Energy	9
Transportation	10
Paper	11
<b>8. GHG information management – roles and responsibilities</b>	<b>12</b>
<b>9. Verification</b>	<b>12</b>
<b>10. References</b>	<b>13</b>
<b>Appendix: Paper use emission factor sample derivation</b>	<b>16</b>

## 1. Purpose

The following report provides additional details regarding Vancity's GHG inventory not included in our integrated Annual Report but required in accordance with ISO 14064 GHG reporting standard.

Specifically, this report provides additional information regarding:

- a statement that the GHG report has been prepared in accordance with this part of ISO 14064;
- reference to, or description of, quantification methodologies including reasons for their selection (4.3.3);
- explanation of any change to quantification methodologies previously used (4.3.3);
- explanation for the exclusion of any GHG sources or sinks from the quantification (4.3.1);
- direct GHG emissions, quantified separately for each GHG, in tonnes of CO<sub>2</sub>e (4.2.2);
- reference to, or documentation of, GHG emission or removal factors used (4.3.5);
- the historical base year selected and the base-year GHG inventory (5.3.1);
- explanation of any change to the base year or other historical GHG data, and any recalculation of the base year or other historical GHG inventory (5.3.2);
- description of the impact of uncertainties on the accuracy of the GHG emissions and removals data (5.4);
- person responsible;
- a statement describing whether the GHG inventory, report or assertion has been verified, including the type of verification and level of assurance achieved.

## 2. Operational boundary and quantification methodology

Vancity includes in our inventory all sources and sinks over which we have operational control and those that are practically and economically feasible to assess. As a financial institution Vancity has few sources of direct (Scope 1) greenhouse gas emissions. They include a small fleet of light duty vehicles and the operation of boilers and other fuel consuming appliances at our facilities. Vancity controls a range of facilities including office buildings and branches to serve our customers. Energy – delivered either in the form of electricity or natural gas - is required to operate these facilities. The emissions associated with purchased electricity make up Vancity's Energy Indirect (Scope 2) emission sources. Vancity has identified a number of Other Indirect (Scope 3) emission sources which are pertinent to our business operations and which are reasonable to quantify. In 2007 Vancity established an operational boundary with regards to Other Indirect emission sources. The sources identified are considered to be within Vancity's operational control.

In 2009, Vancity engaged the Pembina Institute, to quantify and assess the materiality of GHG emissions from three previously unaccounted sources in Vancity's business practice: Employee ferry travel; standalone automated banking machines; and refrigerants. Vancity's materiality threshold for inclusion in its GHG emission management model is one percent of total annual emissions. The report concluded that, at this time, the GHG emissions from these three sources is immaterial and thereby should not be included in our GHG emission management model.

TABLE 1 describes Vancity's operational boundary, listing the emission sources and sinks Vancity includes in our inventory.

Table 1 - Greenhouse Gas Sources and Sinks

	Source	Classification / Scope	Description
Energy	Electricity Use	Energy Indirect/2	Vancity uses electricity to heat, cool, light, and run appliances at its facilities.
	Natural Gas Combustion	Direct/1 Other Indirect/3	Vancity burns natural gas for space heating and cooling and to heat water in facilities it owns and leases
Transportation	Vehicle Fleet	Direct /1	Vancity leases and operates a small fleet of light-duty vehicles.
	Employee Commuting	Other Indirect/3	Vancity employees commute from their residences to various Vancity facilities.
	Business Related Air Travel	Other Indirect/3	Vancity employees travel by air to conduct business activities.
	Business Related Vehicle Travel	Other Indirect/3	Vancity employees travel by private vehicle to conduct business activities.
	Car Allowance Travel	Other Indirect/3	Vancity employees travel by private vehicle to conduct business activities. Car allowances are used to compensate those employees who travel frequently.
Office Activity	Paper Use	Other Indirect/3	Vancity consumes paper as a result of its business operations.

Due to the nature of financial institutions, it is neither practical nor in many cases possible to directly measure greenhouse gas emissions from the sources identified in the Operational Boundaries listed in Table A, therefore emissions were estimated using a model. The model is of the form:

$$Total\ Emissions = \sum_{Sources} ((Emission\ Factor) \times (Activity\ Level))$$

For all emission sources an emission factor was identified. The emission factor specifies the amount of emissions per unit of activity. Activity data was collected or estimated to quantify the activity level. These methodologies and procedures are described in further detail below and have been adopted from various sources including the World Resources Institute (WRI) [3, 4]. GHG Inventory.

### 3. GHG assertions and emissions inventory – 2012

The Vancity group's GHG Emissions Inventory for the fiscal year 2012 has been prepared in conformance with the CSA/ISO 14064-1 standard entitled *Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals*.

Vancity's GHG emissions for the fiscal year 2012 were 5295.9 tonnes CO<sub>2</sub> equivalent.

Table 2 –2012 GHG Emissions by Scope

	Tonnes CO <sub>2</sub> equivalent	Uncertainty (+/- %)
<b>Scope 1</b>	515.0	4.6%
<b>Scope 2</b>	334.6	17.1%
<b>Scope 3*</b>	4446.2	4.8%
<b>Totals</b>	5295.9	4.2%

Table 3 - 2012 GHG Emissions by Source

	Tonnes CO <sub>2</sub> equivalent	Uncertainty (+/- %)
<b>Electricity</b>	334.6	17.1%
<b>Natural Gas</b>	999.1	4.5%
<b>Vehicle Fleet Travel</b>	47.4	8.8%
<b>Vehicle Travel</b>	11.5	3.9%
<b>Car Allowance</b>	272.1	2.8%
<b>Commuting</b>	2,285.0	9.2%
<b>Air Travel*</b>	476.2	High*
<b>Paper*</b>	869.9	High*

\* Uncertainty not assessed but is high.

### 4. Carbon neutrality intention

In December 2012, Vancity purchased 5,253 tonnes of CO<sub>2</sub> offsets. These offsets were purchased from Offsetters Clean Technology Inc. They included: 3,766 from biomass boiler installation in Chilliwack, BC, and 1,487 tonnes from the Great Bear Forest Carbon Project in BC, which generates emission reductions by protecting forest areas. Thus for the year 2011, the Vancity Group is claiming Carbon Neutrality.

While there is no universally accepted definition of carbon neutrality, for Vancity, carbon neutrality is the result of an organization offsetting their greenhouse gas (GHG) emissions such that their net impact on the climate is neutral.

To achieve this, Vancity completed the following steps:

1. quantified our carbon footprint
2. made efforts to reduce our carbon emissions, and
3. purchased carbon offsets from emission reducing activities that others had undertaken.

It is Vancity's intention to maintain its Carbon Neutral status in 2012 through the purchase of carbon offsets in 2013.

## 5. GHG emissions sources, factors and activity data

Vancity's Greenhouse Gas Emissions Inventory Handbook outlines the procedures and methodologies Vancity uses to assess and estimate the emissions of greenhouse gases associated with our business and business operations. The procedures were developed to meet both the CSA/ISO 14064-1 standard and the World Resources Institutes' GHG Protocol standard [1, 2]. They were designed to reflect the principles of: relevance, completeness, consistency, accuracy, and transparency [1]. As the standards evolve, these principles will guide the evolution of this document and the procedures described within. Finally, the procedures were developed to be independent of a specific implementation or technology solution.

The methodology to calculate emissions from air travel has been updated to account for cabin class.

### Energy

#### Facilities

Vancity owns and/or leases both office space and retail space to service our members, and energy related emissions are associated with the operation of these facilities. Information for each facility is collected on an annual basis in order to estimate these emissions.

#### Electricity

*Emission Factors* – Since 2011, numbers from Environment Canada: National Inventory Report have been used. This report is released yearly and the emissions factors in the model are updated to reflect the most current version.

*Activity Data* - Electricity consumption is metered at approximately 74% of Vancity facilities and measured in kilowatt hours. At non-metered retail facilities, consumption is estimated using a model. The model calculates an average energy use per unit area for all metered retail Vancity facilities, categorizes these facilities, and then assumes that similar non-metered retail facilities use the same energy per unit area. For office based facilities there are not enough metered locations to provide an accurate parameter for estimating electricity usage. For these facilities Vancity uses data from Natural Resources Canada's Comprehensive Energy Use Database Tables to estimate electricity usage per square foot. These tables are also published yearly and the Vancity model is updated with the most current version.

#### Natural Gas

*Emission Factor* – The emissions factor for natural was updated to include CH<sub>4</sub> and N<sub>2</sub>O in 2011. Natural gas is comprised of different types of combustible gases with different chemical properties. The make-up

and corresponding emissions factor for natural gas varies by region. The emissions factor source, the Environment Canada National Inventory Report, has been updated to account for this regional variation.

*Activity Data* - The majority of Vancity facilities are located in the province of British Columbia, there are two office locations in Alberta and Ontario, and thus, Vancity purchases the bulk of our natural gas from Fortis Inc. Natural gas consumption is metered at most Vancity facilities and reported by the gas company in gigajoules. At non-metered retail facilities consumption is estimated using a model. The model calculates average gas use per unit area for all metered retail Vancity facilities, categorizes these facilities, and then assumes that similar non-metered retail facilities use the same amount of gas per unit area. For office based facilities there are not enough metered locations to provide an accurate parameter for estimating natural gas usage. For these facilities Vancity uses data from Natural Resources Canada's Comprehensive Energy Use Database Tables to estimate natural gas usage per square foot. Appropriate conversion factors are used depending on the province.

## **Transportation**

Vancity has a number of transportation related greenhouse gas emission sources within our operational boundary. These primarily include work related travel by air and by vehicle and employee commuting to and from work. ISO 14064-1 requires that emissions inventories be estimated at the facility level (i.e. emissions inventories must be estimated for each Vancity facility); however, business travel (air or ground) is often not associated with a specific facility and is instead associated with a business unit such as a subsidiary within the overall organization. To address this issue, emissions resulting from business travel are associated with the head office of the corresponding subsidiary or business partner with the exception of employee commuting emissions which are tracked at the facility level.

### **Vehicle Travel**

*Emission Factor* - There are a number of categories of vehicle travel within Vancity's operational boundary. For each of these, total fuel consumption (the activity data) is estimated or measured and a set of emission factors are obtained to estimate emissions. Only gasoline and diesel fuel types are modeled as they make up the overwhelming majority of fuel types currently in use [9]. Blended fuels such as biodiesel or ethanol are considered equivalent to the fuel they are blended with (e.g. diesel or gasoline) as the (non-lifecycle) greenhouse gas emissions are nearly equivalent.

*Activity Data* - For the purpose of estimating greenhouse gas emissions, vehicle travel activity data is measured in fuel consumption. As the distance travelled by a vehicle is often known or can be estimated, fuel consumption can be estimated by multiplying the distance travelled by an appropriate estimate of fuel economy. There is some uncertainty associated with fuel economy because it is dependent on many factors including age and vehicle operating conditions; nevertheless this calculation provides the most reasonable estimate of total fuel consumption when it is not directly measured. Updated fuel economy estimates are obtained from Natural Resources Canada (NRCan), which provides estimates for both specific vehicles and vehicle groups.

### **Vancity Vehicle Fleet**

Vancity leases and operates a small fleet of vehicles. Actual fuel consumption is not tracked at this time; however, both the type of vehicle and the distance travelled are kept track of.

## Travel Survey

For some vehicle travel sources neither fuel consumption nor distance travelled is directly tracked. For these sources a travel survey is used to estimate distance travelled and ultimately, the total emissions emitted. Vancity has developed a travel survey in cooperation with Acuere Consulting and conducted in October 2012. The survey is used to estimate emissions associated with employee commuting and car allowances, and to estimate the percentage of diesel and gasoline vehicles.

## Business Vehicle Travel

Vancity compensates employees for use of their private vehicles for business related travel using two methods: (1) mileage reimbursement (referred to as business vehicle travel) and (2) car allowances. The total mileage reimbursed and the reimbursement rate is used to estimate the mileage driven in private vehicles. Total fuel consumption is calculated for each fuel type (gasoline and diesel) using: Total Fuel Consumption (L) = (Total Distance Travelled (km)) x (% Vehicles of the Fuel Type) x (Average Fuel Economy of the Fuel Type (L/100km)/100). Employees are reimbursed for driving Vancity owned vehicles. To avoid double counting emissions from the vehicle fleet are subtracted from business vehicle travel emissions.

## Car Allowance Travel

Car allowance travel is estimated using responses to specific questions in the transportation survey. Average annual fuel consumption is estimated using: Total Fuel Consumption (L) = (% Work Related Travel) x (Average Spending on Fuel per Week(\$))/(Average Annual Fuel Price for the Fuel Type (\$/L)) x (Number of Working Weeks in a Year). Fuel Prices are updated using Statistics Canada information.

## Employee Commuting

Greenhouse gas emissions associated with employee commuting are very challenging to estimate and correspondingly, there is significant uncertainty associated with the estimate. Vancity uses the annual transportation survey to collect and quantify employee commuting data based on assessments of how often employees commute, modes of transportation used, distance traveled etc. It should be noted that this model only accounts for emissions from single occupancy employee vehicles; emissions associated with transit and other modes of commuting are not estimated. Findings from the survey (i.e., per employee emissions from commuting) are extrapolated to apply to all employees. Thus, total emissions are calculated using: Total Emissions (t) = (Emissions per Employee per Week) x (Number of Employees) x (Number of Working Weeks in a Year).

## Air Travel

*Emission Factor* - The UK Department for Environment, Food and Rural Affairs (DEFRA) publishes the most widely used air travel emission factors [11]. These emission factors are specified as a function of flight length and are based on UK flight patterns. The WRI has adopted these emission factors and reclassified the flight lengths to be compatible with the North American aviation environment. DEFRA also incorporates into emission factors the amount of space taken up by seats in each cabin class. In 2012 Vancity started to track the cabin class for all flights and use emissions factors specific to each cabin class.

*Activity Data* - The most common method used to estimate the one way length of a flight is to calculate the great circle distance between the airport of origin and airport of destination; the shortest distance between two points on a sphere. However, as this is the shortest distance between two points, the IPCC recommends adding an additional 9-10% to account for non-direct routing and delays [11, 12]. Air travel is measured in kilometres per person. The flight length determines the flight length classification (e.g. short, medium, or long haul) and the appropriate emission factor to use.

## **Paper Use**

*Emission Factor* - There is significant uncertainty associated with estimating emissions of greenhouse gases resulting from the production and disposal of paper. One of the most comprehensive and relevant studies to date that attempts to quantify these life cycle emissions appears to be a US based study conducted by the Paper Task Force. The study was revised in 2002 and is endorsed by the US Office of the Federal Environmental Executive. The report was commissioned by Environmental Defense, amongst others, and was used to develop an online calculator. In 2010 the paper calculator was transferred to the Environmental Defense Network who are now responsible for maintaining and updating the site.

The calculator estimates greenhouse gases based on the amount of paper used (measured by weight), the type of paper, and the percent of recycled content. Although, the calculator does not explicitly list emission factors; they were extrapolated to provide an updated emission factor (see Appendix B for details).

The following citation must be included in any report produced that includes values derived from the calculator: *“Environmental impact estimates were made using the Environmental Paper Network Paper Calculator. For more information visit [www.papercalculator.org](http://www.papercalculator.org).*

*Activity Data* - Tracking paper use in a large and diffuse organization such as Vancity is difficult. Nevertheless, procedures have been developed to capture this as best as is reasonably possible. It is not feasible to track paper use at the facility level and thus paper use is reported at the subsidiary and key department level; as with transportation emissions, subsidiary level emissions are reported against the subsidiary head office. Paper use estimation procedures have been in place for a considerable period of time at Vancity. Paper use is collected by departmental representatives on a quarterly basis and the total weight of paper purchased, as well as the percentage of paper that is post consumer waste (PCW) is tabulated and summarized.

## **6. Base year**

As Vancity revised its procedures in 2007 to meet the ISO 14064-1 standards, Vancity has defined its historical base year as 2007. Vancity's 2007 GHG Inventory forms the historical base year for future inventories.

Throughout 2009 a number of transactions occurred related to Vancity Group subsidiaries including the removal of Citizens Bank from the personal banking marketplace and the sale of both Vancity Insurance Services and Inhance Investment Management Incorporated. These sales resulted in the elimination of 155 full-time equivalent positions (a 6.96% drop in total employees).

The methodology Vancity uses to assess and estimate the emissions of greenhouse gases associated with our business (outlined in Vancity's Greenhouse Gas Emissions Inventory Handbook) outlines that if the addition or removal of a facility as a result of a divestment or merger results in more than 1.5%

change in total employees, the base year shall be recalculated. As a result of a number of divestments initiated in 2009, the base year is being recalculated.

Vancity's original base-year GHG Inventory was 5,504 tonnes CO<sub>2</sub> equivalent. The recalculated total is 5,242 tonnes CO<sub>2</sub> equivalent. Revised GHG emissions by scope and by source for the 2007 base year are provided below. Note, that although the divestitures had a significant impact on total employees, it did not have a significant impact on facilities. As a consequence the baseline for energy and natural gas use has not been adjusted.

Table 4 – Total 2007 GHG Emissions by Scope – Original and Revised

	Revised Tonnes CO <sub>2</sub> equivalent	Tonnes CO <sub>2</sub> equivalent	Uncertainty (+/- %)
<b>Scope 1</b>	468	468	15.6%
<b>Scope 2</b>	386	386	0.0%
<b>Scope 3</b>	4,390	4,650	4.8%
<b>Totals</b>	<b>5,242</b>	<b>5,504</b>	<b>4.3%</b>

Table 5 - Total 2007 GHG Emissions by Source – Original and Revised

	Revised Tonnes CO <sub>2</sub> equivalent	Tonnes CO <sub>2</sub> equivalent	Uncertainty (+/- %)
<b>Electricity</b>	386	386	18.1%
<b>Natural Gas</b>	1,109	1,109	7.7%
<b>Vehicle Fleet Travel</b>	34	36	9.6%
<b>Vehicle Travel</b>	55	58	19.1%
<b>Car Allowance</b>	376	402	2.9%
<b>Commuting</b>	2006	2,146	9.1%
<b>Air Travel</b>	465	498	High*
<b>Paper</b>	811	868	High*

\*Uncertainty not assessed but is high.

A clearer comparison of GHG emissions since the 2007 base year, is provided in the following table – tonnes of GHG emissions by type per employee.

Table 6. GHG emissions by type per employee (FTE) 2007 – 2012

	2012	2011	2010	2009	2008	2007
<b>Premises energy use (t)</b>	0.60	0.70	0.68	0.72	0.64	0.63
<b>Paper use (t)</b>	0.39	0.38	0.45	0.24	0.3	0.37
<b>Vehicle fleet (t)</b>	0.02	0.03	0.02	0.01	0.01	0.02
<b>Employee business travel by air &amp; vehicle (t)</b>	0.34	0.42	0.28	0.32	0.38	0.4
<b>Employee commuting alone (t)</b>	1.02	1.00	0.88	1.01	0.85	0.91
<b>Total tonnes of GHG per employee (FTE):</b>	2.37	2.53	2.30	2.29	2.18	2.32
<b>Total FTE</b>	2,239	2,061	2,080	2,228	2,384	2,371

## 7. Assessing and reducing uncertainty

This section describes the parameter and model uncertainties that have been identified and assessed. For the purpose of this uncertainty assessment it is assumed that all uncertainties are normally distributed. Although in some cases this may not hold true it is a reasonable assumption for the scope of this uncertainty assessment. The bias column is used to provide an indication of whether this assumption holds true and if it does not, which direction the bias is believed to be in.

### Energy

There are three main sources of uncertainty associated with energy related emission estimates:

1. Emission Factors (Electricity and Natural Gas)
2. Natural Gas and Electricity Meters
3. Energy Use Model

#### Emission Factors

As part of the national reporting procedure Environment Canada commissioned a study to quantify the uncertainty associated with various fuel emission factors including natural gas. It is assumed that the uncertainty associated with the emission factor captures the uncertainty in the energy content of the fuel and thus the conversion factor from energy to volume (GJ to cubic metres). Neither BC Hydro nor Environment Canada publishes uncertainty estimates of the emission factors (emission intensities) associated with electricity generation. In absence of reported estimates, confidence intervals were calculated for each province using 1990 to 2005 emission factor estimates published by Environment Canada [6]. It is assumed, however, that in all cases a minimum uncertainty of 10% exists, unless otherwise reported.

#### Natural Gas and Electricity Meters

Measurements Canada regulates the tolerance of both electricity and natural gas meters under the Electricity and Gas Inspection Act. Uncertainty for electricity meter tolerance is assumed to be 0.5%, and 1.5% for natural gas meter tolerance

## Energy Use Model

Rough estimates of uncertainties are obtained from Natural Resources Canada's survey "Commercial and Institutional Consumption of Energy Survey Summary Report" [23] and using the quality ranking of the statistics (A, B, C, etc.) and the corresponding coefficient of variation. The confidence interval can be calculated by multiplying the maximum coefficient of variation by 1.96. For BC, confidence intervals are calculated using the metered data.

## Transportation

There are many sources of uncertainty associated with transportation related emissions. The following sources have been assessed:

- Vehicle Odometers
- Fuel Economy
- Fuel Emission Factors
- Fuel Price
- Radiative Forcing Factor
- Aviation Emission Factors
- Flight Routing
- Earth Radius
- Car Allowance Travel Model
- Employee Commuting Model
- Number of Working Weeks

Both commuting and car allowance estimates are based on a survey conducted once per reporting period. The survey provides only a single snap shot of the activity data in a very dynamic organization. Facilities and employees are added and removed throughout the course of a reporting period, some before and some after the survey is conducted. The results of the travel survey will inevitably be biased and reflect the organization and its operations at the time the survey is conducted. In a growing organization this means the estimates would likely be positively biased (estimates would likely be higher than actual reports) and in a shrinking organization, negatively biased, assuming the survey is conducted at the end of the reporting period, as it has in the past. Car allowance results in particular are likely to be biased as there is an incentive for employees to report a higher than actual percentage of work related travel.

### Vehicle Emission Uncertainty Sources

*Odometer* - Vehicle odometer tolerance is not specifically regulated; manufactures are only required to specify the tolerance. However, Honda Motor Company was recently sued in the US on grounds that odometers in their vehicles were biased and outside of what was deemed as *reasonable tolerance* [19, 20]. This report assumes that other manufactures either are or will be in compliance with this tolerance.

*Fuel Economy*- There is uncertainty associated with fuel economy estimates because they are dependent on factors such as the vehicle weight, engine technology, fuel type, and actual operating conditions. Two sources of fuel economy estimates are used: (1) Natural Resources Canada's Fuel Consumption Guide and (2) Natural Resources Canada's Canadian Vehicle Survey. The estimates published in the Fuel Consumption Guide are based on a standard test procedure but there is uncertainty as to what degree the test procedure captures actual real-world driving conditions. A 2005 Consumer Reports study found that in a test of 303 light duty vehicles that actual fuel economy deviated from the published rating by

between +21% and -28% [21]. The study also found that 90% of the vehicles tested had fuel economies worse than the published rating. Although this was a US study, at the time of the study, American and Canadian test procedures were the same. It should be noted that the US has recently revised their test procedure and Canada is likely to follow. The Canadian Vehicle Survey provides rough data quality rankings and corresponding confidence intervals.

*Fuel Emission Factors* – Environment Canada has listed the uncertainty of gasoline and diesel fuel emissions factors as 0.5%.

*Fuel Prices* - Statistics Canada publishes monthly average fuel prices. Confidence intervals are calculated to estimate the uncertainty of the average annual fuel price.

*Employee Commuting Model* - The model used to estimate employee commuting does not estimate uncertainty and as previously discussed there will be biases present in the survey. Without having a more detailed understanding of biases present in the survey it is difficult to estimate uncertainty; however, an estimate of uncertainty of 30% was made based on discussions with the model developer and fuel economy uncertainties.

*Car Allowance Travel* - Assessing uncertainty from a survey is difficult; there is no simple way of assessing the accuracy of estimates made by respondents nor how representative the estimates at the time of the survey are over the course of a year. In addition, there will be biases present in the survey. To provide some measure of uncertainty, confidence intervals are calculated for both the fuel spending per week and percentage of work related travel.

*Working Weeks* - There is uncertainty associated with the average number of weeks in a year an employee works. Vancity's human resources department provided an estimate and a range from which an uncertainty estimate was derived (10%).

### **Aviation Emission Uncertainty Sources**

There is considerable uncertainty associated with both the impact and release of aviation emissions. In particular there is great uncertainty associated with the radiative forcing factor. Recent studies have suggested the value could be as much as two times current estimates but no specific uncertainty estimate is given [13]. At this time there is no widely accepted measure of uncertainty associated with the radiative forcing of aviation emissions. Because of variations in aircraft, fuels, flight paths, loads, and operating conditions there is significant uncertainty associated with aviation emissions factors that are a function of distance travelled; however, there are no published estimates. Finally, there is model uncertainty associated with estimating the length of a flight. The IPCC suggests that due to air traffic control inefficiencies and indirect flight routing that the flight length be increased by between 9-10% over the direct route [11, 12]. Vancity assumes this value captures the uncertainty in the flight length as well. As there is significant uncertainty associated with radiative forcing and no published estimates of emission factor uncertainties, the uncertainties associated with aviation emissions will not be assessed quantitatively, although it is assumed that they are large.

### **Paper**

There are significant uncertainties with regards to both paper consumption activity data and emission factors. There are no published estimates of uncertainty associated with the emission factor but it is believed to be very high, likely orders of magnitude. As a result uncertainties associated with paper are not assessed as the results would be meaningless. It should be noted that the WRI removed paper from their emissions inventory citing that the uncertainty was too great [22]. However, to support improvements

of the paper consumption estimate, Vancity estimates are graded (A through F). If an estimate makes up a significant fraction of the total estimate and receives a poor grade, steps are taken to improve that estimate.

## 8. GHG information management – roles and responsibilities

The following table outlines the roles and responsibilities that were assigned before estimating the greenhouse gas emissions inventory. Note that multiple people or a group can be responsible for a single role and that a single person can be responsible for more than one role.

Table 7 – Roles and Responsibilities of GHG Inventory Management

Name	Responsibility	Training Level
Data Collection Officer	This officer is responsible for collecting, managing and logging all data used to estimate Vancity's greenhouse gas emissions inventory, as described in this document. The officer is responsible for ensuring all data is reported to them and that the data adheres to the specified data collection standards and quality assurance procedures. Finally, the officer is responsible for ensuring that all data collection procedures in this document adhere to the relevant standards.	This officer should have a thorough understanding of the relevant data collection procedure and standards as well as quality assurance procedures.
Modeling Officer	This officer is responsible for ensuring the emissions inventory model adheres to the methodologies described in Vancity's GHG Emissions Inventory Handbook. The officer is also responsible for reviewing the methodologies described in this document to ensure they are current and adhere to the relevant standards. Finally, this officer is responsible for running the model and reporting the results of the emissions inventory to the Data Collection Officer.	This officer should have a thorough understanding of the relevant standards and modeling methodologies. The officer needs to possess sufficient quantitative skills to understand and run the model.
Finance Officer	This officer is responsible for collecting and reporting activity data derived from accounting records to the Data Collection Officer.	This officer should be familiar with the accounting system and accounting practices at Vancity.
Energy Assessment Officer	This officer is responsible for collecting and recording energy use (electrical and fuel) at all Vancity facilities and reporting this information to the Data Collection Officer. This officer may be an external contractor.	This officer should be familiar with energy systems and utility reporting processes.
Survey Officer	In some cases, for example employee commuting, a survey may need to be conducted to estimate activity data or other model parameters. The survey officer shall be responsible for conducting and interpreting such a survey. This officer may be an external contractor.	This officer should be familiar with survey methodologies including how to correctly conduct a survey and interpret the results.

## 9. Verification

ISO 14064-1 requires a verification procedure be established with the auditor/verifier. The following describes the general procedures Vancity follows:

1. Before verification is conducted the procedures described in Vancity's GHG Emissions Inventory Handbook shall have been completed.

2. The appointed auditor/verifier shall have the necessary background, training, and competency to perform the verification as defined in ISO 14064-1 (see Section 8.3.3 of [1] for further details).
3. The objectives, scope, level of assurance, materiality, and data sampling and custody criteria shall be discussed and established with the verifier.
4. A verification statement shall be obtained from the verifier that includes as a minimum: a description of the objectives, scope and criteria of the verification activities, a description of the level of assurance, and the verifier's conclusion indicating any qualification or limitations (see Section 8.3.4 of [1] for further details).
5. The verification statement shall be reviewed to ensure it is consistent with criteria established with the verifier.

This GHG Inventory report was prepared by Vancity management in conjunction with Will Wright of Ecocentric Carbon Management. The greenhouse gas assertions including the 2012 carbon footprint have been externally verified by an independent auditor, Ernst & Young LLP, with a reasonable level of assurance, and in a manner consistent with the requirements of ISO 14064-3.

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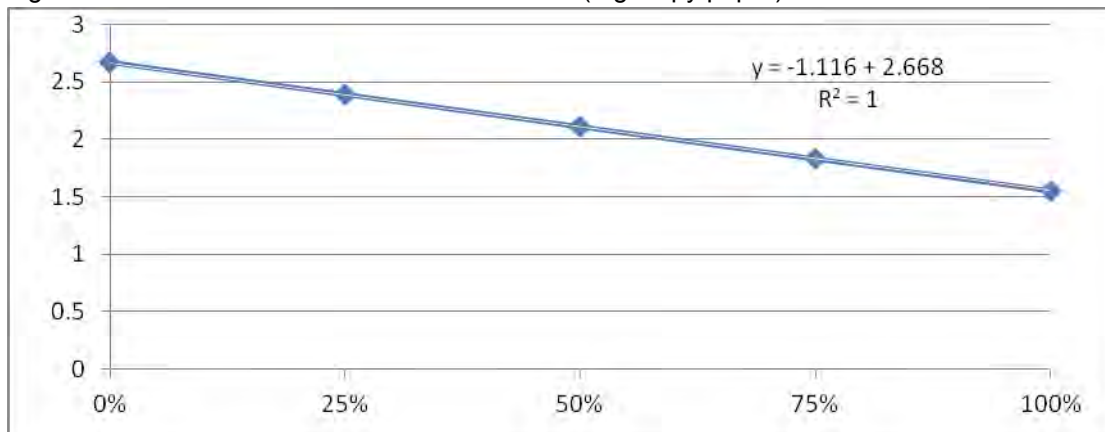
### Paper use emission factor sample derivation

To obtain a paper use emissions factor [Environmental Defense' online calculator](#) is used. The calculator does not explicitly list emission factors; however, they can be extrapolated by calculating the greenhouse gas emissions associated with 1 Metric Tonne of each paper type for the following recycling percentages: 0%, 25%, 50%, 75%, 100%. Presently the relationship is linear ( $R^2 = 1$ ) and a linear regression can be used to determine emission factors as a function of recycled content. For example:

Inputs: Paper Type: Uncoated Freesheet; Amount: 1 Metric Tonne; % Recycled Content: 0%, 25%, 50%, 75%, 100%

% Recycled content	lbs of CO2	Kg of CO2	Metric tonnes of CO2 / metric tonne of paper
0%	5,882	2668.030	2.668
25%	5,267	2389.071	2.389
50%	4,652	2110.112	2.11
75%	4,037	1831.152	1.831
100%	3,422	1552.193	1.552

Figure 1: 1 Metric Tonne of Uncoated Freesheet (e.g. copy paper)



This formula ( $y = -1.116x + 2.668$ ) can then be used to calculate the emissions factor as a function of recycled content, where  $y$  is the emission factor in Metric tonnes per metric tonne of paper and  $x$  is the percent recycled content.