

# Vancity

## Greenhouse Gas Emissions



## Handbook

Version: 2.2



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# 1 Introduction

This document outlines the procedures and methodologies Vancity shall use to assess and estimate the emissions of greenhouse gasses associated with its business and business operations; Vancity's greenhouse gas emission inventory. The procedures have been 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.

## 1.1 Vancity the Organization

Founded in 1946 to provide financial services to people from all walks of life, Vancouver City Savings Credit Union (Vancity) has grown to become the largest credit union in English-speaking Canada, with almost \$15 billion in assets. Vancity serves more than 417,000 members through 59 branches located throughout Greater Vancouver, the Fraser Valley, Victoria and Squamish.

Vancity employs approximately 2,400 employees and has been recognized as one of the top employers and workplaces in both British Columbia and Canada.

Vancity uses a triple bottom line business model, driven not only by a commitment to financial success, but to environmental and social sustainability as well. Vancity's vision to achieve positive social and environmental change and its focus on community leadership is achieved through the Shared Success program. Each year Vancity gives back a significant portion of net profits—30 per cent since 2000—to members and communities. In 1995, Vancity introduced the first bi-annual externally verified Accountability Report which reports on Vancity and Citizens Bank's social, environmental and financial performance. Vancity's 2004-2005 Accountability Report won the prestigious Ceres-ACCA award for top North American Sustainability Reporting after winning the runner-up award for its 2002-2003 report.

Banking on the unbankable is one of the cornerstones of the Vancity story and today continues to look for ways to improve banking accessibility and financial literacy, through initiatives such as Pigeon Park Savings, a financial institution that provides basic banking services to people in Canada's poorest postal code in the Downtown Eastside; a secured VISA card; financial literacy workshops; and more recently, the Vancity Springboard mortgage that allows individuals living in social housing the opportunity to purchase their own homes. More than 4,600 Lower Mainland and Victoria elementary and secondary school students are members of Vancity's Youth Credit Union program which has set up mini-financial institutions in 25 schools to help

over 2,000 young people learn about money management and improve their math skills. Established in 1996, current funds under administration through Youth Credit Unions amount to more than \$2 million. Vancity's innovative approach to serving the financial needs of its members and the community has led to a number of firsts among Canadian financial institutions—from the first to offer mortgages to women and to market directly to the gay and lesbian community through traditional media, to being the first credit union in North America to receive an R1 rating from the Dominion Bond Rating Service and the first full-service financial institution to offer its own socially-responsible mutual fund, Vancity Circadian Funds, launched in early 2007.

Vancity's reputation for environmental excellence is legendary within British Columbia's borders and beyond. Through its climate change strategy, Vancity supports innovative partnerships involving public transportation and green building projects and invests in organizations doing climate change work. Vancity achieved its target of being the first and only carbon neutral financial institution in Canada in 2008 by way of a combination of retrofits, reduction and carbon offsets, and has already saved \$2 million by cutting its power use by 50 per cent per employee.

Vancity has also introduced a number of innovative programs and products such as the Clean Air Auto Loan, that allow Vancity members the opportunity to reduce their own environmental footprint. As well, Vancity's enviroFund VISA program donates five per cent of its profits to support local environmental projects with the areas of focus being voted on by cardholders. In 2008, Vancity was awarded the first-ever Green Company Award for Environmental Leadership at the Canadian Investment Awards.

## **1.2 Objectives**

Vancity's objectives of estimating its greenhouse gas emissions inventory are:

- Branding – distinguish and associate their products and services with sustainable practices.
- Leadership – define their role in the community as a leader in sustainability.
- Environmental Stewardship – reduce their impacts on the environment.
  - Climate Change - reduce or maintain their emissions of greenhouse gasses in the face of organizational growth.
  - Identifying Actions – identify efficient measures to reduce their emissions of greenhouse gasses and impacts on the environment.

## 2 Roles and Responsibility

The following table outlines the roles and responsibilities that shall be 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.

Name	Responsibility	Training Level
Verification Officer (VO)	This officer is responsible for coordinating the overall emissions inventory effort. The officer is responsible for overseeing the other officers and ensuring they are following the appropriate procedures. The officer is also responsible for coordinating the verification and audit process.	This officer should be familiar with the relevant data collection and modeling standards as well as have an understanding of the overall process including verification.
Data Collection Officer (DCO)	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 (MO)	This officer is responsible for ensuring the emissions inventory model adheres to the methodologies described in this document. 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 through participation in formal training on ISO 14064-01. The officer needs to possess sufficient quantitative skills to understand and run the model.
Finance Officer (FO)	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 (EAO)	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 (SO)	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 should be familiar with survey methodologies including how to correctly conduct a survey and interpret the results.
External Verification Officer (EVO)	This officer is optional. If chosen this officer is responsible for providing expert guidance on the overall emission inventory process. This officer might be a steering committee or some other advisory group.	This officer should be a recognized expert or leader in the area they are providing direction in.

	Procedure	Role
2.1	Identification and review of the responsibilities and authorities of each officer will be done on an annual basis at the beginning of each reporting period (in January).	MO
2.2	At the beginning of each reporting period 0 shall be completed listing the names and contact information for each officer.	VO
2.3	0 shall be logged each reporting period and be available to the auditor.	DCO
2.4	The training needs of officers will be assessed by the Modeling Officer at the beginning of each reporting period based on the training level requirements identified above.	MO
2.5	Appropriate orientation/awareness training will be conducted with all new officers within the first quarter of each reporting period, as well as regular quarterly check-ins to ensure a strong feedback loop is established.	MO



### 3 General Procedures

The following describes the general procedure that shall be followed in estimating the greenhouse gas emissions inventory:

	Procedure	Role
3.1	The procedures described in this document shall be followed to estimate Vancity’s greenhouse gas emissions inventory.	All
3.2	The reporting period shall be January 1 <sup>st</sup> to December 31 <sup>st</sup> .	n/a
3.3	Interim reporting periods occur quarterly (following the end of the quarter) for select data.	n/a
3.4	This document and the procedures described within it shall be reviewed at a minimum of once a reporting period to ensure compliance and conformance with the relevant standards (ISO 14064-1 [1] and GHG Protocol [2] standards). The review shall occur before the inventory is estimated.	VO
3.5	The document revision numbers shall be incremented after an update as follows: the major revision number shall be incremented if this document or the procedures undergo significant change, for example the relevant standards change or there is a major change in a calculation methodology; the minor revision number shall be incremented in all other cases.	DCO

The following describes the steps necessary to complete the greenhouse gas emissions inventory:

Step	Description	Role
1	Assign roles and responsibilities (complete 0).	VO
2	Read and review this document for adherence to standards, correctness, and completeness. Document any changes (see Section 9)	VO
3	Review and update emission factors and other model parameters as required.	DCO/ MO
4	Collect and input activity data.	DCO
5	Using the modelling procedures described in this document, estimate the emissions inventory.	MO
6	Document the results (see Section 9) and record all relevant information (see Section 10)	VO/ DCO
7	Verify and audit the results and the process (see Section 11).	All

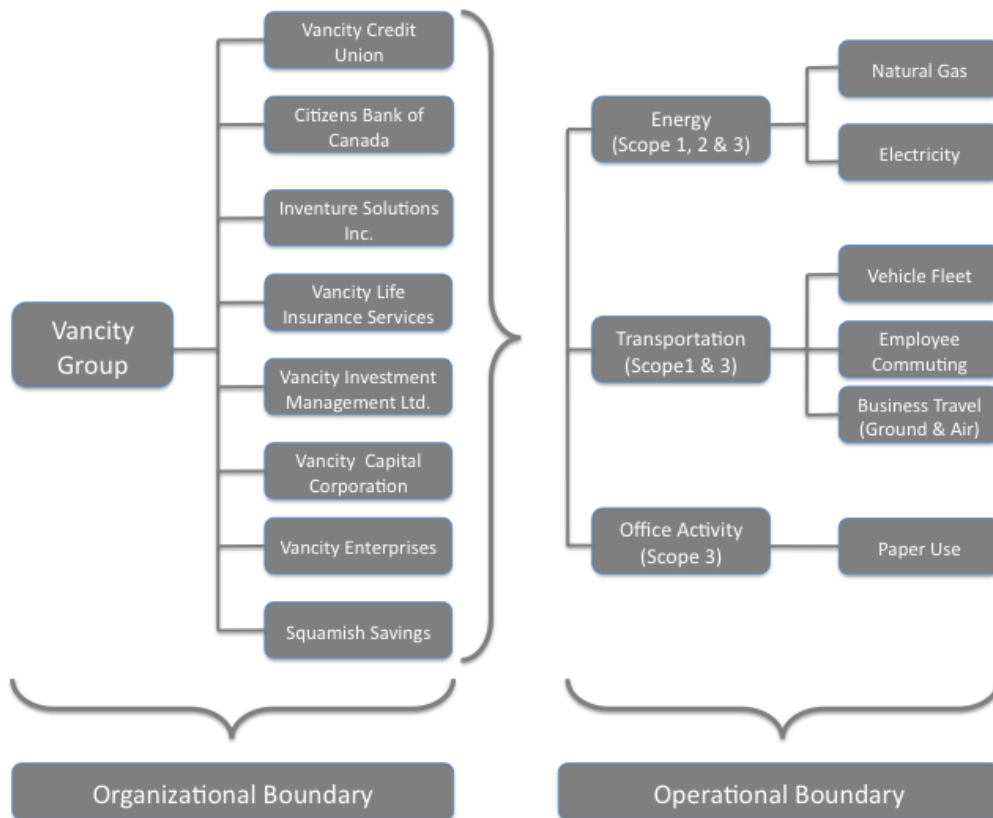
#### 3.1 Information Sources

The foremost authority on greenhouse gas emissions inventories is the Intergovernmental Panel on Climate Change (IPCC). The IPCC has specified the greenhouse gas inventory reporting guidelines that signature nations of the United Nations Framework Convention on Climate Change and the Kyoto Protocol must follow. Although there are significant differences between reporting at the national level and the organizational level, the IPCC guidelines and supporting research shall be considered the overriding authority. Many of the reporting standards (CSA/ISO, GHG Protocol, etc.) have been developed with these reporting guidelines in mind. At the national level, Environment Canada is responsible for preparing Canada’s national inventory report and is an authoritative source. Other organizations such as Natural Resources Canada and Statistics Canada support Canada’s reporting effort and are trusted sources of information. Finally, NGOs such as the World Resources Institute (WRI), who have translated these national reporting standards into organizational reporting standards, are also reliable sources for estimation methodologies and data.

## 4 Organizational Boundary

Vancity is comprised of eight subsidiaries that are collectively referred to as the Vancity Group (see Table 2). ISO 14064-1 recommends that: “Where possible, organizations should follow the organizational boundaries already in place for their financial accounting, provided these are explicitly explained and followed consistently.[1]” Following this recommendation, Vancity has selected the Control approach, specifically the Operational Control approach, to define its organizational and operational boundaries. Vancity shall include in its emissions inventory all sources and sinks associated with the organizations it exercises direct, operational control over. These include: Vancity Credit Union, Citizens Bank of Canada, Inventure Solutions Inc., Vancity Capital Corporation (VCC), Vancity Enterprises (VCE), Vancity Life Insurance Services (VLISL), Vancity Investment Management Ltd. (VCIM), and Squamish Savings.

Figure 1: 2011 Vancity Organizational and Operational Boundary



The following describes the procedures to be followed when reviewing the organizational boundary:

	Procedure	Role
4.1	The organizational boundary shall be reviewed once per reporting period, at the beginning of the period, to ensure it is compliant with the relevant standards and reflects any changes in Vancity’s business operations. For example, the organizational boundary would change if a subsidiary was sold or a new one purchased. Any changes to the boundary must be justified and recorded in this document.	VO
4.2	If the organizational boundaries change the base year inventory shall be recalculated (see Section 7).	MO
4.3	If the organizational boundary changes the exact nature of the change shall be noted in Section 4.1 Table 1, Organizational Boundary Changes.	VO

## 4.1 Organizational Boundary Changes

Table 1 below describes changes to the organizational boundary that have occurred since the base year (2007).

**Table 1: Organizational Boundary Changes**

Year	Change	Rationale
2011	Inhance Investment Management	Company was fully divested in 2010
2011	Vancity Community Foundation	Vancity Community Foundation is not under the direct operational control of the Vancity Goup. ISO 14064-1 recommends “organizations follow the organizational boundaries already in place for financial accounting”. Excluding the Vancity Community Foundation is consistent with this recommendation.
2011	Vancity Insurance Services	Portion of insurance services divested in 2010, only life insurance services remain (as noted by name change).

## **5 Operational Boundary: Greenhouse Gas Sources and Sinks**

### **5.1 Emissions Sources and Categories**

As discussed in Section 4, Vancity shall use the operational control approach to define its organizational and operation boundary. Vancity shall include in its inventory all sources and sinks for which it has operational control over and for which it is practically and economically feasible to assess (see Figure 1).

#### **5.1.1 Direct (Scope 1)**

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 natural gas consuming appliances at facilities Vancity owns and operates. Natural gas which is burned in boilers not controlled by Vancity and is used to provide heat to Vancity facilities has been included in other indirect emissions (scope 3), section 5.1.3 below.

#### **5.1.2 Energy Indirect (Scope 2)**

Vancity controls a range of facilities including office buildings and branches to serve its customers. Energy – delivered in the form of electricity - is required to operate these facilities. Emissions associated with electricity make up Vancity's energy indirect (scope 2) emission sources.

#### **5.1.3 Other Indirect (Scope 3)**

Through a stakeholder engagement process Vancity has identified a number of other indirect (Scope 3) emission sources which are pertinent to its business operations and for which it is reasonable and cost effective to quantify. Other indirect emissions are the consequence of Vancity's activities but occur from sources not controlled by the company. Vancity established an environmental/climate change advisory committee made up of leading Canadian environmental organizations. This group has provided assistance and guidance in establishing an appropriate operational boundary with regards to other indirect emission sources. Vancity is including the following sources of other indirect emissions in its emissions inventory: natural gas heating in facilities it does not control, business travel, employee commuting and paper usage. The sources identified are considered to be within operational control and are thus consistent with Vancity's objective of reducing or holding constant its greenhouse gas emissions. It should be stressed that both ISO 14064-1 and the GHG Protocol standards consider the reporting of other indirect (scope 3) emissions optional [1,2]. Table 2 describes Vancity's operational boundary, listing the emission sources and sinks Vancity shall include in its inventory.

**Table 2: Greenhouse Gas Sources and Sinks**

	Source	Classification / Scope	Description
Energy	Natural Gas Combustion	Direct/1 & Other Indirect/3	Vancity burns natural gas to heat, cool, and supply hot water to its facilities. If the gas is burned in an appliance operated by Vancity the associated emissions are classified as Direct (Scope 1) otherwise they are classified as Other Indirect (Scope 3).
	Electricity Use	Energy Indirect/2	Vancity uses electricity to heat, cool, light, and run appliances at its facilities.
Transportation	Vehicle Fleet	Direct/1	Vancity leases and operates a small fleet of light-duty vehicles.
	Employee Commuting (Single Occupancy Vehicles)	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	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 and advertising campaigns.

## 5.2 Inventory Exclusions

### 5.2.1 Other Modes of Employee Commuting

Vancity gathers information on the typical commuting habits of Vancity employees. An annual survey, administered by Acuere Consulting, assesses the following commuting transportation modes: drove alone, carpool/vanpool driver (with at least 2 adults in the vehicle, carpool/vanpool passenger (with at least 2 adults in the vehicle), walked all the way (includes jogging, rollerblading etc), bicycle, motorcycle, public transit, worked from home, and other. Vancity only includes emissions from single occupancy vehicles in its emissions inventory. Emissions from carpooling, and transit have been excluded. As a scope 3 emissions source reporting emissions from employee commuting is optional, Vancity has chosen to report only emissions from single occupancy vehicles in order to incent staff to chose more sustainable transportation.

### 5.2.2 Immaterial Sources

Vancity commissioned the Pembina Institute to examine three potential sources of emissions to determine if they were material, greater than 1% of the total GHG inventory, and should be

measured and included in the inventory. The three sources of emissions were; ferry travel, standalone ATMs and refrigerant leakage from kitchen refrigerators and HVAC systems. The report found that none of the three activities were likely to be material sources of emissions. Even under the highest emissions scenarios all three failed to meet the materiality threshold and as result are not included in the emissions inventory.

The following describes the procedures to be followed when reviewing the operational boundary:

	Procedure	Role
5.1	The operational boundary shall be reviewed once per reporting period, at the beginning of the period, to ensure it is compliant with the relevant standards and reflects any major changes in Vancity's business operations. Any changes to the operation boundary must be justified and recorded in this document.	VO
5.2	If the operational boundary changes the base year inventory shall be recalculated (see Section 7).	MO

## 6 Quantification Methodologies and Procedures

As it is neither practical nor in many cases possible to directly measure greenhouse gas emissions from the sources identified in Section 5, emissions will be estimated using a model. The model shall be of the form:

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

For all emission sources an emission factor shall be identified. The emission factor specifies the amount of emissions per unit of activity. Activity data shall be collected or estimated to quantify the activity level. This section describes how to obtain or calculate the emissions factor and collect or estimate the activity data for each greenhouse gas emission source identified in Section 5. The methodologies and procedures described in this section have been adopted from various sources including the WRI guides [3,4].

### 6.1 Energy

#### 6.1.1 Facilities

Vancity owns and/or leases both office space and retail space to service its customers. Its energy related emissions are associated with the operation of these facilities. To estimate these emissions information about each facility is required.

	Procedure	Role
6.1	Once per reporting period, at the beginning of the period, the following information shall be obtained for each facility: 1)The name 2)The number of Employees at the facility 3)If electricity is metered at the facility 4) If natural gas is metered at the facility 5) If the facility is controlled (owned) by Vancity 6) The area (sqft or m <sup>2</sup> ) 7) The percent of the year the facility has been in operation 8) The type or category of building 9) The province it is located 10) The Address	DCO/ EAO
6.2	For each Vancity subsidiary a head office shall be assigned from the list of facilities	DCO
6.3	Only if a facility is added or removed as a result of a divestment or merger shall the base year inventory be recalculated (see Section 7). Facilities added or removed as a result of organic growth shall not trigger a recalculation, and the base year shall not be recalculated if the facility did not exist in the base year. Furthermore, if the addition or removal of a facility as a result of a divestment or merger results in less than 3% change in total square footage, or less than 1.5% change in total employees, the base year shall not be recalculated.	MO

## 6.1.2 Electricity

### 6.1.2.1 Emission Factors

The majority of Vancity’s facilities are located in the province of British Columbia and thus Vancity purchases the bulk of its electricity from BC Hydro. Prior to 2005, BC Hydro directly reported the greenhouse gas intensity (emission factor) of the electricity it domestically generated and distributed. BC Hydro no longer reports a specific intensity in part because of a controversy over how electricity imports and exports are incorporated [5]. BC Hydro is a net importer of electricity and the electricity it imports has a significantly higher emission factor than the electricity it domestically generates. There are indications that the Climate Action Secretariat of BC will publish an emission factor that accounts for the imports and exports of electricity in BC. At this time however, there is no official published emission factor that accounts for the emissions of imported electricity in BC. Additionally BC Hydro has changed the structure of its annual reports and it is no longer possible to derive an emission factor from the data provided. Given the lack of a data the latest electricity emission factors shall be obtained from Canada’s most recent National Inventory Report.

	Procedure	Role
6.4	The electricity emission factor shall be measured in Metric Tonnes per Gigawatt Hour (t/GWh).	n/a
6.5	If available the electricity emissions factors shall account for the import and export of electricity in each jurisdiction.	DCO
6.6	The electricity emissions factor from the latest National Inventory Report shall be used for all provinces outside of BC that Vancity operates a facility in. If an electricity emissions factor that accounts for imports and exports in BC is not available the electricity emissions factor from the latest National Inventory Report shall be used in BC as well.	DCO/ MO

### 6.1.2.2 Activity Data

Electricity consumption is metered at most Vancity facilities. At non-metered facilities consumption is estimated using a model. The model estimates an average energy use per unit area for all metered Vancity facilities, categorizes these facilities, and then assumes that similar non-metered facilities use approximately the same energy per unit area (see Appendix B).

	Procedure	Role
6.9	Electricity consumption shall be measured in Kilowatt Hours (kWh).	n/a
6.10	Electricity consumption measurements for all metered Vancity facilities shall be collected at a minimum of once a reporting period, at the beginning of the period. The province the facility is located shall also be recorded so that the appropriate emission factor can be selected.	EAO/ DCO
6.11	Where there is no meter at a facility or it is otherwise infeasible to measure electricity consumption, the model described in Appendix B shall be used to estimate consumption for the period at the beginning of the next period. Note that for facilities located outside of BC, estimates from Natural Resources Canada are used (see Appendix B for details).	MO/ EAO
6.12	The model described in Appendix B shall be reviewed each reporting period, at the beginning of the period, to ensure that the underlying assumptions are valid and the estimates up to date for the current reporting year.	MO



### 6.1.3 Natural Gas

#### 6.1.3.1 Emission Factor

Combustion of natural gas releases three greenhouse gasses, CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O. The precise chemical makeup of natural gas varies from province to province and the emissions factor varies accordingly. Emission factors from the latest National Inventory Report shall be used. Emission factors specific to each province shall be used for CO<sub>2</sub> and emission factors for “residential, commercial, institutional and agriculture” shall be used for CH<sub>4</sub>, and N<sub>2</sub>O. There are also emissions associated with natural gas distribution. However, as distribution emissions are small (about 1% based on Terasen Gas’ 2005 estimate of 0.539 kg/GJ) they shall not be included [8].

	Procedure	Role
6.13	The natural gas emission factor shall be measured in Metric Tonnes / Cubic Metre (t/m <sup>3</sup> )	n/a
6.14	The natural gas emission factor for CO <sub>2</sub> shall be obtained at the beginning of each period from the most recent National Inventory Report (eg. [6]): Greenhouse Gases Sources and Sinks in Canada (Annex 12) authored by Environment Canada. The emission factors for “Residential, Construction, Commercial/Institutional, Agriculture” shall be used.	DCO
6.15	The natural gas emission factors shall be reviewed each reporting period at the beginning of the period. Should the emission factors change, the base year inventory shall be recalculated (see Section 7).	DCO/ MO

#### 6.1.3.2 Activity Data

The majority of Vancity facilities are located in the province of British Columbia and thus Vancity purchases the bulk of its natural gas from Terasen Gas. Natural gas is sold by energy units GJ but the National Inventory Report lists emission factors in g / m<sup>3</sup>. The conversion factor from GJ of natural gas to m<sup>3</sup> of natural gas may vary. At this time there is not sufficient gas consumption outside of BC to justify refining this conversion factor for other provinces and therefore the BC conversion factor shall be used in all cases. Natural gas consumption is metered at most Vancity facilities. At non-metered facilities consumption is estimated using a model. The model estimates average gas use per unit area for all metered Vancity facilities, categorizes these facilities, and then assumes that similar non-metered facilities use approximately the same amount of gas per unit area (see Appendix B).

	Procedure	Role
6.16	Natural gas consumption shall be measured in Cubic Metres (m <sup>3</sup> ).	n/a
6.17	Natural gas consumption measurements for all metered Vancity facilities shall be collected at a minimum of once a reporting period at the beginning of the period.	EAO/ DCO
6.18	Natural gas is usually reported by the gas company in Gigajoules (GJ) not m <sup>3</sup> . If this is the case a conversion factor from GJ to m <sup>3</sup> shall be obtained from either the gas company or Natural Resources Canada.	DCO
6.19	Where there is no meter at a facility or it is otherwise infeasible to measure natural gas consumption, the model described in Appendix B shall be used to estimate consumption for the period at the beginning of the next period. Note that for facilities located outside of BC, estimates from Natural Resources Canada are used (see Appendix B for details).	EAO/ MO

## **6.2 Transportation**

Vancity has a number of transportation related greenhouse gas emission sources within its 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 estimate 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 but is instead associated with a business unit such as a subsidiary within the overall organization. To address this issue, emissions resulting from business travel shall be associated with the head office of the corresponding subsidiary with the exception of employee commuting emissions which are tracked at the facility level.

### **6.2.1 Vehicle Travel**

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

#### **6.2.1.1 Emission Factor**

Although emissions of CH<sub>4</sub> and N<sub>2</sub>O are released by internal combustion engines they are comparatively small (less than 8% of the total CO<sub>2</sub>eq emissions factor in the worst case after incorporating GWPs) and highly uncertain [7]. The uncertainty stems from the fact that these emissions factors are both highly dependent on engine and emissions control technology and actual operating conditions. The National Inventory Report lists three CH<sub>4</sub>, and N<sub>2</sub>O emissions factors for both gasoline and diesel burned in light duty vehicles. Since the exact emissions control technology and operating conditions for vehicles included in the Vancity inventory are not known, the most conservative (highest emissions value) shall be used. Estimates of uncertainty shall be sourced from the uncertainty table in the National Inventory Report.

	Procedure	Role
6.20	Vehicle travel emission factors shall be measured in Grams per Litre (g/L) of fuel.	n/a
6.21	Vehicle travel emission factor for CO <sub>2</sub> shall be obtained from the most recent National Inventory Report: Greenhouse Gases Sources and Sinks in Canada (Annex 12 – Mobile Combustion) authored by Environment Canada at the beginning of each period. Because CO <sub>2</sub> emission factors are generally independent of current emissions control technology but dependant on the fuel type, emission factors for both gasoline and diesel fuel shall be obtained.	DCO
6.22	Vehicle travel emission factors for CH <sub>4</sub> and N <sub>2</sub> O emissions shall be obtained from the most recent National Inventory Report. Since the age of vehicles and operating conditions of vehicles is not know the most conservative (highest emissions value) shall be used.	
6.23	Vehicle travel CO <sub>2</sub> emission factors (gasoline and diesel) shall be reviewed each reporting period at the beginning of the period. Should the emission factors change the base year inventory shall be recalculated (see Section 7).	DCO/ MO

### 6.2.1.2 Activity Data

For the purpose of estimating greenhouse gas emissions, vehicle travel activity data shall be measured in fuel consumption. Ideally actual fuel consumption would be directly measured; however, it is often not tracked and therefore must be estimated. As the distance traveled 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 provides the most reasonable estimate of total fuel consumption when it is not directly measured. Fuel economy estimates can be obtained from Natural Resources Canada (NRCan). They provide estimates for both specific vehicles and vehicle groups. See Appendix E for details on sources of fuel economy estimates published by Natural Resources Canada.

#### 6.2.1.2.1 Travel Survey

For some vehicle travel sources neither fuel consumption nor distance traveled is directly tracked. For these sources a travel survey is used to estimate distance traveled and ultimately total emissions. Vancity has developed a travel survey in cooperation with Acure Consulting (see Appendix D). The survey shall be used to estimate emissions associated with employee commuting (see Section 6.2.1.3), car allowances (see Section 6.2.1.2.4), and estimate the percentage of diesel and gasoline vehicles (see Section 6.2.1.2.3).

	Procedure	Role
6.23	The travel survey shall be reviewed once a reporting period prior to running the survey to ensure correctness (e.g. facility and subsidiary names are up to date).	SO
6.24	The travel survey shall be conducted at a minimum of once a reporting period, generally in the fall.	SO
6.25	The travel survey shall have a minimum response rate of 30%.	SO

### 6.2.1.2.2 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 is tracked.

	Procedure	Role
6.26	Vehicle fleet activity shall be measured in Litres (L) of fuel.	
6.27	For every vehicle in the fleet the VIN, license plate number, make, model, year, fuel type, and subsidiary it is associated with shall be obtained and confirmed at the beginning of each period.	DCO
6.28	Natural Resources Canada publishes an annual <a href="#">Fuel Consumption Guide</a> (eg. [10]). For every vehicle in the fleet, the highway and city fuel economy in L/100km shall be obtained from this guide.	DCO
6.29	Where the vehicle operating modes are not known an average fuel economy shall be calculated for each vehicle in the fleet. The following formula, obtained from Natural Resources Canada's Fuel Consumption Guide, shall be used to calculate average fuel economy: Average Fuel Economy (L/100km) = (0.55)x(City Fuel Economy) + (0.45)x(Highway Fuel Economy)	MO
6.30	The odometer reading (km) shall be obtained from the employee responsible for the vehicle on a quarterly basis at the same intervals from year to year.	DCO
6.31	Annual distance travelled shall be calculated by subtracting the last reading in the current reporting period by the last reading from the previous reporting period. For example, to calculate the 2009 distance travelled the 2009 Q4 reading is subtracted from the 2008 Q4 reading.	MO
6.32	For every vehicle in the fleet fuel consumption (L) shall be calculated using: Fuel Consumption (L) = (Annual Distance Traveled (km)) x (Average Fuel Economy (L/100km))/100	MO
6.33	Based on the fuel type, the appropriate emission factor (diesel or gasoline) shall be used to calculate total emissions.	MO
6.34	Both the methodology Natural Resources Canada uses to estimate fuel economy and the weighting between city and highway driving should be reviewed each reporting period at the beginning of the period. If significant changes are made the base year inventory may need to be recalculated. See Section 7 for guidance.	MO/ VO
6.35	The vehicle fleet inventory shall be reviewed twice per reporting period, at the beginning of the period and end of the period, to ensure it is accurate.	DOC

### 6.2.1.2.3 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 in this document) and (2) car allowances. The following procedures describe how activity data is estimated in the case of mileage reimbursement.

	Procedure	Role
6.36	Business vehicle travel activity shall be measured in Litres (L) of fuel.	
6.37	The total mileage reimbursed (\$) for the reporting period, the reimbursement rate (\$/km), and the subsidiary the travel is billed to shall be obtained quarterly. If the reimbursement rate changes during the reporting period, the lesser of the two reimbursement rates will be used for the reporting period to ensure emissions calculations are as conservative as possible.	FO/ DCO
6.38	Total distance traveled (km) shall be calculated using: (Total Mileage Reimbursed (\$)) / (Reimbursement Rate (\$/km))	MO
6.39	An average fuel economy shall be obtained from Natural Resources Canada (see Appendix E for details on sources) for each fuel type (gasoline and diesel) once per period at the beginning of the period. Note that a change in average fuel economy shall <b>not</b> trigger a recalculation of the base year inventory.	DCO
6.40	The percentage of gasoline and diesel vehicles shall be obtained from the Travel Survey. It is assumed that on average the annual distance traveled by diesel and gasoline fuelled vehicles is equivalent.	SO
6.41	Total fuel consumption (L) shall be calculated for each fuel type (gasoline and diesel) using: Total Fuel Consumption (L) = (Total Distance Traveled (km)) x (% Vehicles of the Fuel Type) x (Average Fuel Economy of the Fuel Type (L/100km)/100)	MO
6.42	Based on the fuel type, the appropriate emission factor (diesel or gasoline) shall be used to calculate total emissions.	MO

#### 6.2.1.2.4 Car Allowance Travel

The following procedures describe how activity data associated with car allowances is estimated.

	Procedure	Role
6.43	Car allowance travel activity shall be measured in Litres (L) of fuel.	
6.44	The total number of employees with car allowances shall be obtained once per period at the beginning of the period.	FO/ DOC
6.45	The average annual fuel price for regular gasoline and diesel shall be obtained from Statistics Canada (Table 326-0009) for each region Vancity has operations in up to the month the Travel Survey was conducted.	DCO
6.46	The subsidiary, facility name, average spending on fuel per week, % of work related travel, and fuel type shall be obtained from the Travel Survey annually for each respondent who indicates they are receiving a car allowance.	SO
6.47	For each applicable response from the previous step the average annual fuel consumption shall be 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)	MO
6.48	Based on the fuel type, the appropriate emission factor (diesel or gasoline) shall be used to calculate total emissions.	MO
6.49	The number of employees who have car allowances but did not respond to the survey shall be calculated by subtracting the total number of employees with car allowances by the total number of respondents indicating they were receiving car allowances.	MO/ SO
6.50	Average emissions per car allowance shall be calculated by dividing the total estimated emissions of respondents by the total number of respondents.	MO
6.51	Total emissions of non-respondents shall be estimated by multiply the average emissions per car allowance by the number of non-respondents.	MO
6.52	Total car allowance emissions shall be the sum of the estimated respondent's emissions and the estimated non-respondent's emissions.	MO

#### 6.2.1.3 Employee Commuting

Greenhouse gas emissions associated with employee commuting are very challenging to estimate and correspondingly, there is significant uncertainty associated with the estimate. The most common estimation approach is to conduct a travel survey to assess how often employees are

commuting, what modes of transportation they are using, how far they are traveling, etc.. The travel survey is listed in Appendix D and the employee commuting model is described in Appendix F. It should be noted that this model only accounts for emissions from employee vehicles; emissions associated with transit and other modes of commuting are not estimated, see section 5.2.1 for details.

	Procedure	Role
6.53	Employee commuting emissions shall be estimated once per period using the Employee Commuting Emissions Model described in Appendix F.	MO
6.54	The Employee Commuting Emissions Model shall estimate the total emissions of greenhouse gasses per employee per week for Vancity as a whole and for each Vancity Facility.	MO
6.55	Total emissions shall be calculated using: $\text{Total Emissions (t)} = (\text{Emissions per Employee per Week}) \times (\text{Number of Employees}) \times (\text{Number of Working Weeks in a Year})$	

## 6.2.2 Air Travel

### 6.2.2.1 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. It is widely recognized that the climate change impact of aviation emissions are attributable to more than just carbon dioxide [12,13]. Various other factors influence the overall total impact. Unfortunately, there is considerable uncertainty associated with many of these other impacts especially with regards to the formation of cirrus clouds. The Radiative Forcing Index (RFI) is the mostly widely used measure to compare impacts. The IPCC originally estimated the ratio between total aviation impact RFI and CO<sub>2</sub> RFI (the radiative forcing factor) to be 2.7, excluding any potential impact of cirrus cloud formation [12]. Recent studies, which have been adopted by the IPCC, have estimated a ratio of 1.9 [13,14,15]. In line with these studies and other organizations a radiative forcing factor of 2 shall be used; however this value should be reviewed on a regular basis [15].

	Procedure	Role
6.56	Air travel emission factors shall be measured in Metric Tonnes per Kilometre (t/km) per person.	n/a
6.57	Flight length classifications (eg. short, medium, or long haul) shall be obtained from the <a href="#">World Resources Institute</a> , specifically the “WRI Transport Tool” model, once per period at the beginning of the period.	DCO
6.68	Emission factors for each flight length classifications shall be obtained from <a href="#">DEFRA</a> (e.g. [11]) or the <a href="#">World Resources Institute</a> , specifically the “WRI Transport Tool” model, whichever is most current, once per period at the beginning of the period. Note if DEFRA emission factors are used the CH <sub>4</sub> and N <sub>2</sub> O emission factors shall be converted from CO <sub>2</sub> e to CH <sub>4</sub> and N <sub>2</sub> O.	DCO
6.59	A radiative forcing factor of 2 shall be used.	MO
6.60	Emission factors shall be multiplied by the radiative forcing factor.	MO
6.61	Air travel emission factors shall be reviewed each reporting period at the beginning of the period. If the methodology, emission factors, or flight length classification change the base year inventory shall be recalculated (see Section 7).	DCO/ MO
6.62	The radiative forcing factor shall be reviewed each reporting period, at the beginning of the period to ensure it is consistent with the most current research. If the factor is updated the base year inventory shall be recalculated (see Section 7).	DCO/ MO

### 6.2.2.2 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].

	Procedure	Role
6.63	Air travel activity shall be measured in Kilometres (km) per person.	n/a
6.64	The Finance Officer (FO) shall report all employee business air travel to the Documentation Collection Officer at the end of each quarter. The FO shall report the departure, destination, and intermediate airport codes and the subsidiary the travel is associated with.	FO/ DCO
6.65	For each airport the latitude and longitude shall be obtained in degrees, minutes and seconds from <a href="#">world-airport-codes.com</a> . If the specific airport is not known then the nearest international airport shall be used.	DCO
6.66	For each flight segment the total one way distance traveled (km) shall be calculated using the <a href="#">great-circle distance</a> algorithm. If the flight is round trip the distance shall be multiplied by 2.	MO
6.67	The flight length shall be multiplied by a factor of 1.09 to account for non-direct routing.	MO
6.68	The flight length shall determine the flight length classification (e.g. short, medium, or long haul) and the appropriate emission factor to use (see emission factor procedures).	MO

## 6.3 Office Activity

### 6.3.1 Paper Use

#### 6.3.1.1 Emission Factor

There is significant uncertainty associated with estimating emissions of greenhouse gases resulting from the production and disposal of paper. The most comprehensive and relevant study 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. The online calculator [www.papercalculator.org](http://www.papercalculator.org) is now run by the Environmental Paper Network. 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. It is important to note that these are life cycle emissions and that there are in fact very few greenhouse gas emissions associated with actually paper use.

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).*”

	Procedure	Role
6.69	Paper use emission factors shall be measured in Metric Tonnes per Metric Tonnes (t/t) of paper as a function of recycled content (post consumer waste).	n/a
6.70	Paper use emission factors shall be obtained for office paper (Uncoated Freesheet) once per reporting period at the beginning of the period.	DCO
6.71	Paper use emission factors shall be obtained from <a href="#">Environmental Paper Network’s online calculator</a> . <sup>1</sup>	DCO/ MO
6.72	Paper use emission factors shall be reviewed each reporting period, at the beginning of the period. Only if the methodology used to derive the emission factors changes shall the base year inventory be recalculated (see Section 7).	DCO/ MO
6.73	Paper use data will be collected quarterly.	DCO

<sup>1</sup>The calculator does not explicitly list emission factors; however, they can be extrapolated (see 0 for details).

### 6.3.1.2 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 shall be reported at the subsidiary level; as with transportation emissions, subsidiary level emissions shall be reported against the subsidiary head office. Paper use estimation procedures have been in place for a considerable period of time at Vancity and are described in detail in Appendix G.



## **7 Base Year**

As Vancity has revised its procedures in 2007 to meet the ISO 14064-1 standards, Vancity has defined its base year as the 2007 emission inventory estimates. 2007 was the first year that complete activity data was collected.

### **7.1 Base Year Recalculation**

Determining when to recalculate the base year is ultimately up to the discretion of the Verification Officer. Recommendations as to when the base year should and should not be recalculated have been made throughout this document. The following procedures should guide the Verification Officers in this decision. Neither ISO nor WRI provide guidance on how to adjust the base year when an acquisition is made and there is no historical activity data available. In this case the base year shall be calculated using a rolling average. If a business unit is divested, historical emissions related to that business unit shall be subtracted from the base year. Emissions from energy shall be determined based on the facilities that the business units occupied at the time of the base year. Emissions from transportation and office activities shall be pro rated based on the number of employees working for the business unit during the base year.

### **7.2 Emissions Targets Recalculation**

When the base year has been recalculated emissions targets shall also be updated to reflect the new emissions total. Updated emissions targets shall represent the same relative targets as the original target.

	Procedure	Role
7.1	If changes to the quantification methodologies and procedures described in this document result in significant change of the estimated emissions inventory the base year shall be recalculated. Significant change shall be defined as a percent change greater than 10%.	VO/ MO
7.2	The base year shall not be recalculated if activity levels (i.e. activity data) change unless this change is a result of a change in the collection or estimation procedures.	VO
7.3	If an emission factor changes then the reason for this change shall be determined. If the change is a result of improved understanding or knowledge then the base year shall be recalculate; however, if the change is a result of technological improvement then the base year shall not be recalculated.	VO/ MO
7.4	As discussed in Section 4, the base year shall <b>not</b> recalculate as a result of so called “organic growth”. Only as a result of structural change - divestment or acquisition of organizational entities - shall the base year be recalculated. Note that, if the entity divested or acquired did not exist in the base year the base year shall not be recalculated.	VO/ MO
7.5	If an organizational entity is acquired and historical activity data exists or a reasonable and defensible estimate can be made the base year shall be recalculated to incorporate this acquisition. If historical activity data does not exist and cannot be estimated then the base year shall be calculated using a rolling average.	VO/ MO
7.6	If any change in a procedure or methodology results in percent change to the base year that is less than 10% then the decision to recalculate the base year shall be left to the discretion of the Verification Officer	VO
7.7	If the base year is recalculated the justification for this shall be documented	VO/ DCO
7.8	If the base year is recalculated the emission reduction targets shall be recalculated using the same relative targets.	VO/ MO
7.9	In the event of organizational change the base year shall be recalculated by accounting for the historical emissions of the investiture or divestiture. These emissions will added to the baseline if it is an investiture and subtracted from the baseline in the result of a divesture. As mentioned above if the investiture/divestiture did not exist during the base year, no recalculation is necessary.	VO/ MO

## 8 Uncertainty

ISO 14064-1 specifies that an uncertainty assessment should be conducted but does not specify a methodology. In absence of a specific methodology, the IPCC and WRI guidelines will be followed [16, 17]. There are two fundamental sources of uncertainty associated with any model: (1) model uncertainty and (2) parameter uncertainty. Assessing model uncertainty involves evaluating the mathematical equations used to characterize the relationship between the input parameters and outputs, but is in general beyond the scope of this assessment. Parameter uncertainty refers to the uncertainty associated with the inputs to the model (eg. emission factors, measurement equipment tolerances, etc.) and will be the focus of this uncertainty assessment.

There are two common approaches to estimating and propagating uncertainty: (1) first order error prorogation (Gaussian Method) and (2) Monte Carlo simulation. Monte Carlo simulation is valid in all situations but is significantly more complex to perform and is at this time beyond the scope of this assessment. First order error propagation is much simpler to perform but is only valid if certain conditions hold true (see [17]). First order error propagation shall be used and it shall be assumed that these assumptions hold true. See the IPCC or WRI guides for specific on this method [16, 17]. To describe uncertainty a confidence interval must be specified. The most commonly used confidence interval is 95% [16, 18].

As described in the WRI guide, there will be significant uncertainty associated with the uncertainty assessment itself. Technical understanding, data constraints and practical limitations make it difficult to perform a systematic and comprehensive uncertainty assessment. In some cases estimating uncertainty is not possible, for example paper, as the uncertainties are so great or the scientific understanding so limited. In these cases a specific estimate cannot be made and the uncertainty will be assessed qualitatively. The assessment approach described has its limitations and in the future it may be necessary to develop a more sophisticated approach based Monte Carlo simulation; however, at this time it should provide a reasonable characterization of the uncertainty of the emissions inventory. Furthermore, the purpose of an uncertainty assessment is as much to identify where improvements can be made with maximum value, which this assessment will facilitate.

	Procedure	Role
8.1	First order error propagation shall be used to assess uncertainty. The conditions under which this method is valid shall be assumed to be true.	MO
8.2	The 95% confidence interval shall be used.	MO
8.3	The uncertainty analysis shall be performed/reviewed once per reporting period, at the beginning of the period, to ensure that estimates are up to date and to identify any potential improvements or data quality issues.	DCO/ MO

## 8.1 Uncertainty Sources and Estimates

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.

### 8.1.1 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

#### 8.1.1.1 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 shall be assumed, however, that in all cases there is at a minimum uncertainty of 10% unless otherwise reported. This is based on consultation with experts.

Type	Description	Source	Bias	+/- %
Parameter	BC Electricity Emissions Factor	Statistical Methods	-	54
Parameter	Alberta Electricity Emissions Factor	Expert Elicitation (Statistical Methods)	?	10 (3)
Parameter	Ontario Electricity Emissions Factor	Statistical Methods	?	24
Parameter	Natural Gas	Environment Canada (2007): National Inventory Report (1990-2005) [6]	No	3.0

### 8.1.1.2 Natural Gas and Electricity Meters

Measurements Canada regulates the tolerance of both electricity and natural gas meters under the Electricity and Gas Inspection Act and corresponding specifications:

Type	Description	Source	Bias	+/- %
Parameter	Electricity Meter Tolerance	S-E-01 Specifications for the Calibration, Certification and Use of Electricity Calibration Consoles	No	0.5
Parameter	Natural Gas Meter Tolerance	LMB-EG-08 - Specifications for Approval of Type of Gas Meters and Auxiliary Devices	No	1.5

### 8.1.1.3 Energy Use Model

See Appendix B for details on the uncertainty associated with the Energy Use Model

## 8.1.2 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 actuals) 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.

### **8.1.2.1 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]. As a result, the court order that owners of Honda vehicles have their warranty coverage extend by 5%. It shall be assumed 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 Consumers 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, US and Canadian test procedures were the same at the time of the study. 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*

The IPCC estimates the uncertainty associated with fuel emission factors to be less than 5 % (Section 2.1.1.6 [16]). As part of the national reporting procedure Environment Canada commissioned a study to quantify the uncertainty associated with various fuel emission factors. Unfortunately these values were not published in their report.

#### *Fuel Prices*

Statistics Canada publishes monthly average fuel prices. Confidence intervals shall be 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 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 shall be calculated for both the fuel spending per week and percent 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.

Type	Description	Source	Bias	+/- %
Parameter	Odometer Tolerance	Karen Vaughn vs. Honda Motor Co Inc (US District Court)	-	5.0
Parameter	Fuel Economy (Both Fuel Types) - Fuel Consumption Guide	Consumer Reports Study [21]	-	25.0
Parameter	Fuel Economy (Gasoline) – Canadian Vehicle Survey	Canadian Vehicle Survey [10]	?	20.0
Parameter	Fuel Economy (Diesel) – Canadian Vehicle Survey	Canadian Vehicle Survey [10]	+	40.0
Parameter	Gasoline Emission Factor	IPCC (2000) - IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (Section 2.1.1.6) [16]	No	5.0
Parameter	Diesel Emission Factor	IPCC (2000) - IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (Section 2.1.1.6) [16]	No	5.0
Parameter	Fuel Price	Statistical Methods	No	(variable)
Parameter	Car Allowance Travel	Statistical Methods	+	(variable)
Model	Employee Commuting Model	Expert Elicitation	?	30.0
Parameter	Working Weeks	Expert Elicitation	?	10.0

### **8.1.2.2 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 don’t give a specific uncertainty estimate [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 traveled; 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]. This value shall be assumed to capture 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 shall be assumed that they are large.

Type	Description	Source	Bias	+/- %
Parameter	Radiative Forcing Factor	Sausen et. al. (2005) - Aviation radiative forcing in 2000: An update on IPCC (1999)	No	2x
Parameter	Aviation Emission Factors	None	?	?
Model	Flight Routing	IPCC (1999) - Aviation and the Global Atmosphere (Section 8.2.2.3) [12]	No	9.0
Parameter	Earth's Radius	NASA (nssdc.gsfc.nasa.gov/planetary/factsheet/earthfact.html)	No	0.5

### 8.1.3 Office Activity

#### 8.1.3.1 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 will not be assessed as the results would be meaningless. It should be noted that the WRI has actually removed paper from their emissions inventory citing that the uncertainty was too great [22]. However, to support improvements of the paper consumption estimate, the estimates shall be graded (A through F) by the Data Collection Officer. If an estimate makes up a significant fraction of the total estimate and receives a poor grade, steps should be considered to improve that estimate.

## 9 Reporting

To claim ISO 14064 conformance Vancity must either produce a report as specified in ISO 14064-1 Section 7 or receive a third-party verification statement. Vancity will report annually on their GHG inventory and will undertake the steps necessary for third-party verification.



	Procedure	Role
9.1	A GHG inventory/carbon footprint report and a Carbon Neutral report shall be prepared at the end of each reporting period and be verified by a third party.	VO
9.2	The reports shall be prepared in accordance with CSA/ISO 14064-1, <i>Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals</i> [1].	VO
9.3	The reports shall document the results of the review of this document and any changes made including supporting sources.	VO
9.4	The reports shall document any deviations from the procedures described in this document and the reasons for these deviations.	VO
9.5	The reports shall document any problems encountered and potential solutions and an implementation strategy.	VO

## 9.1 Reporting Requirements

CSA/ISO 14064-1 recommends documenting directed actions that result in a reduction of greenhouse gas emissions. If and only if the reduction is reported then the standard requires that the reductions associated with each action are reported separately and that the following is described:

- a) the directed action,
- b) the spatial and temporal boundaries of the directed action,
- c) the approach used to quantify GHG emission or removal differences, and
- d) the determination and classification of GHG emission or removal differences attributable to directed actions as direct, indirect or other types of GHG emissions or removals.

The standard also requires that any offsets, purchased or developed, be explicitly reported ([1] Section 5.2.2).

## 10 Information Management

ISO 14064-1 requires that information management procedures be implemented. Documentation supporting the design, development and maintenance of the inventory shall be retained to support the verification process and provide a historical record. This task is the primary responsibility of the Data Collection Officer. In determining what information needs to be retained the following principles can be applied:

- 1) At any point in time, all past emissions inventories should be able to satisfy an audit.
- 2) At any point in time, any past emissions inventory should be able to be recalculated from the retained records

In general the following information needs to be retained in some form:

	Information
1)	The verification report described in Section 9
2)	The procedures, processes, and methodologies used to estimate the emissions inventory (i.e. this document) and relevant sources
3)	All emission factors and their sources
4)	All activity data, activity data models, and their sources
5)	All models
6)	All supporting documentation and sources
7)	The emissions inventory, reported at the facility level

The following directory structure shall be created on a single, backed-up storage location and used to store and maintain all information:

- Emissions Inventory
  - Procedures and Reporting – Contains a copy of this document and other relevant documents and supporting source material
  - Model – Contains a clean copy of all major versions of the model
  - Year (2007, 2008, 2009 ...)
  - Report – Contains the Verification Report.
  - Data – Contains raw activity data and survey results.
  - Model – Contains the emissions inventory model.
  - Base Year – Contains the emissions inventory model of the current base year.

## 11 Verification Procedure

ISO 14064-1 requires a verification procedure be established with the auditor/verifier. The follow describes the general procedures that shall be followed (see Section 8 of [1] for further details).

	Procedure	Role
11.1	Before verification is conducted the procedures described in this document shall have been completed.	n/a
11.2	The appointed auditor/verifier shall have the necessary background, training, and competency to perform the verification as defined in ISO 14065 (see Section 8.3.3 of [1] for further details).	VO
11.3	The objectives, scope, level of assurance, materiality, and data sampling and custody criteria shall be discussed and established with the verifier.	VO
11.4	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).	VO
11.5	The verification statement shall be reviewed to ensure it is consistent with criteria established with the verifier.	VO

## Appendix A Roles and Responsibilities Form

	Name	Contact Information (Phone/Email)
<b>Data Collection Officer</b>		
1		
2		
3		
<b>Verification Officer</b>		
1		
2		
3		
<b>Modeling Officer</b>		
1		
2		
3		
<b>External Verification Officer</b>		
1		
2		
3		
<b>Finance Officer</b>		
1		
2		
3		
<b>Energy Assessment Officer</b>		
1		
2		
3		
<b>Survey Officer</b>		
1		
2		
3		

## Appendix B Energy Use Model

A number of Vancity's facilities are not metered for electricity and/or natural gas use. For these facilities a model is used to estimate facility energy use. There are many factors that influence building energy use such as age, type, construction quality, and weather. However, it is not feasible to develop a model to incorporate all of these factors. To simplify the model only the building type and the province it is located in shall be considered. It shall be assumed that based on this categorization that the buildings Vancity operates are similar and that their energy use per unit area is on average similar. A statistical analysis of the 2006 electricity and gas use for metered Vancity facilities located in BC indicates that this is a reasonable assumption (see Table 3, Table 4, Figure 3 and Figure 2). The sample of metered facilities did not include sufficient numbers of the Office Building category (only one was metered) to make any statistical comparison and there was also insufficient numbers of the Mall Building category so the Mall and Strip Mall categories were combined into a single Mall category. No statistically significant difference was found between Mall and Free Standing building categories (ie. factors other than the building type are responsible for variations in energy use). The analysis also showed that electricity use per m<sup>2</sup> is normally distributed (see Figure 3) and that natural gas use per m<sup>2</sup> appears to be normally or log-normally distributed (see Figure 2). This analysis shows that it is reasonable to use Vancity's metered facilities to estimate energy use of its non-metered sites for Strip Mall, Mall and Free Standing building categories.

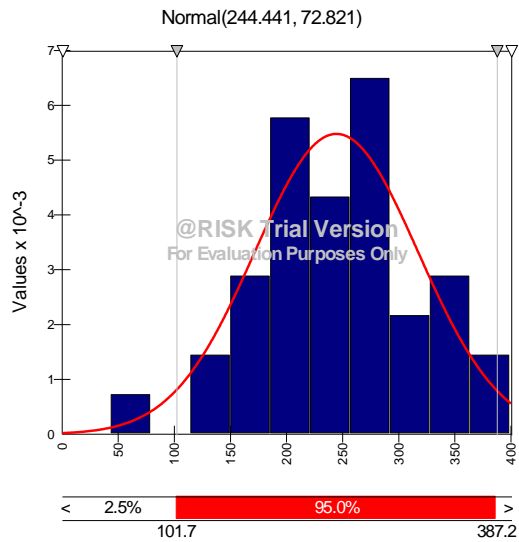
**Table 3: Electricity per m<sup>2</sup> Descriptive Statistics**

Electricity Use per m <sup>2</sup> Analysis					
Free Standing (FS)		Strip Mall (SM)		Mall (M)	
Mean	248.5894138	Mean	251.3535836	Mean	242.5451558
Standard Error	15.71835506	Standard Error	15.55491491	Standard Error	65.97193604
Standard Deviation	62.87342024	Standard Deviation	69.56369426	Standard Deviation	93.29840669
Minimum	158.99196	Minimum	117.7051507	Minimum	176.5732198
Maximum	354.9852696	Maximum	399.1797105	Maximum	308.5170918
Sum	3977.430621	Sum	5027.071673	Sum	485.0903116
Count	16	Count	20	Count	2
Confidence Level(95.0%)	33.50288059	Confidence Level(95.0%)	32.55681101	Confidence Level(95.0%)	838.252926

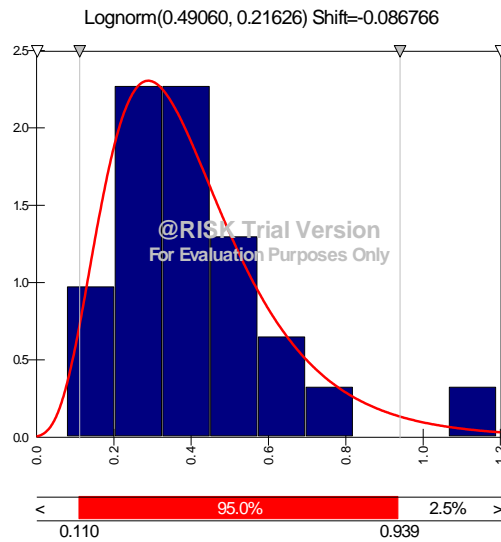
**Table 4: Natural gas per m<sup>2</sup> Descriptive Statistics**

Natural Gas Use per m <sup>2</sup> Analysis			
Free Standing (FS)		Strip Mall (SM)	
Mean	0.423048	Mean	0.381238
Standard Error	0.069411	Standard Error	0.059119
Standard Deviation	0.259713	Standard Deviation	0.196074
Sample Variance	0.067451	Sample Variance	0.038445
Minimum	0.080014	Minimum	0.133146
Maximum	1.191162	Maximum	0.783595
Sum	5.922668	Sum	4.193619
Count	14	Count	11
Confidence Level(95.0%)	0.149954	Confidence Level(95.0%)	0.131724

**Figure 3: - Electricity Use Histogram for Freestanding and Mall building Categories**



**Figure 2- Natural Gas Use Histogram for Freestanding and Mall building Categories**



For the Office Building category and for all categories of buildings located in provinces other than BC, estimates based on Natural Resources Canada’s energy use surveys shall be used. The most recent and most relevant survey is the “Commercial and Institutional Consumption of Energy Survey Summary Report”[23]. This report provides an average energy use per square metre (GJ/m<sup>2</sup>) by province for various building categories. The split between electricity and natural gas is reported by province but not by building category. For this reason the energy split for BC buildings shall be obtained using data from metered sites. This process shall be used to develop estimates when there are an insufficient number of metered facilities to generate a statistically valid estimate; a minimum of 5 facilities are needed (see Table 5). Rough estimates of uncertainties can also be obtained from the report using the quality ranking of the statistics (A, B, C, etc.) and the corresponding coefficient of variation (CV). The confidence interval can be calculated by multiplying the maximum CV by 1.96. For BC confidence intervals are calculated using the metered data .

**Table 5 - NRCan Building Energy Estimates**

<b>From Table 4 - Energy consumption by energy source, by region (GJ)</b>					
<b>Province</b>	<b>Ontario</b>	<b>Alberta</b>	<b>BC</b>	<b>Uncertainty (+/-%)(BC)</b>	
<b>Electricity</b>	164,658,915	70,986,485	-	39.2%	
<b>Natural gas</b>	236,771,531	120,650,263	-	39.2%	
<b>Total</b>	401,430,446	191,636,748	-		
<b>Energy Split</b>					
<b>Electricity</b>	41.0%	37.0%	67.0%	39.2%	16.0%
<b>Natural gas</b>	59.0%	63.0%	33.0%	39.2%	16.0%
<b>From Table 3 - Energy intensity by activity sector, by region (GJ/m2)</b>					
<b>Province</b>	<b>Ontario</b>	<b>Alberta</b>	<b>BC</b>	<b>Uncertainty (+/-%)(BC)</b>	
<b>Offices</b>	1.54	1.28	1.61	39.2%	
<b>Estimated Energy Use for Offices</b>					
<b>Province</b>	<b>Ontario</b>	<b>Alberta</b>	<b>BC</b>	<b>Uncertainty (+/-%) (BC)</b>	
<b>Electricity (GJ)</b>	0.63	0.47	1.08	55.4%	42.3%
<b>Electricity (KWh)</b>	175	132	300	55.4%	42.3%
<b>Natural gas (GJ)</b>	0.91	0.81	0.53	55.4%	42.3%

Note on uncertainty calculation: A ranking implies a CV < 20%; a CV of 20% implies a CI = 1.96 x 0.20 = 39.2%

## Appendix C Paper Use Emission Factor Sample Derivation

To obtain a paper use emissions factor Environmental Paper Network's 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:

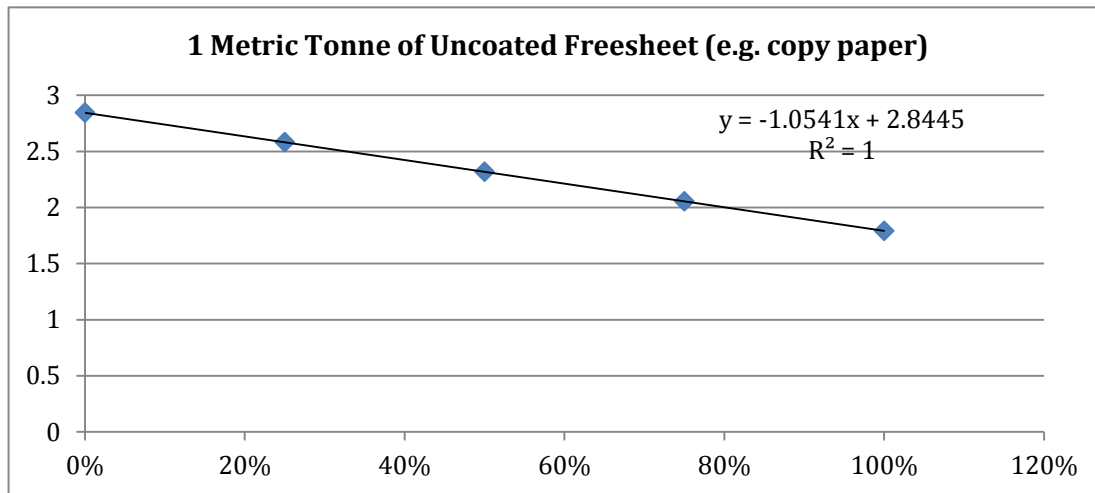
### Inputs:

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%	6,271	2844.477	2.84
25%	5,690	2580.94	2.58
50%	5,109	2317.403	2.32
75%	4,528	2053.866	2.05
100%	3,947	1790.329	1.79



This formula ( $y = -1.054x + 2.844$ ) 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.

## Appendix D      Example Employee Travel Survey

### *Welcome to the Vancity Group Transportation Survey*

This survey is used to calculate the Vancity Group's carbon emissions from employee car travel. It is implemented and hosted by Vancity in association with Acuere Consulting. Please be assured that your responses will be kept strictly confidential. Information is only reported in aggregate.

The survey will take from 5 to 10 minutes, depending on which sections apply to you.

#### **Navigation Instructions**

**To avoid exiting improperly, DO NOT USE-the BACK, FORWARD or REFRESH buttons on your browser.** Please only use the survey buttons at the bottom of each page. Should you not be able to advance, look for a red error message at the top of the page.

If at any time, you wish to quit, click on the '**EXIT**' button. This will log you out of the system.

#### **Privacy Protection**

[Click here to read about this survey's privacy protection policy](#)

ON SEPARATE PAGE:

### **Privacy Protection**

- Vancity is committed to protecting your privacy and the confidentiality of your personal information.
- Vancity is committed to keeping the personal information you share with us confidential.
- The information you provide will only be used for the purposes of this research. Under no circumstances do we sell contact lists or personal information to others.
- The information you provide will be retained only for the time it is required for the purposes of this research.



- We will protect the information you provide with appropriate safeguards and security measures.
- We are fully compliant with the new federal privacy legislation (New act is called PIPEDA: Personal Information Protection and Electronic Documents Act)
- The information you provide will be combined with the responses given by all other survey respondents and reported only in aggregate form. Your answers will remain completely confidential.

## WORK LOCATION

### 1. In which division or subsidiary do you work? (COMPANY DIVISIONS) [drop down list]

Citizens Bank – NCC
Citizens Bank – Office of the President and CEO
Citizens Bank – Retail & Marketing
Citizens Bank – VISA
Citizens Bank - Treasury & Foreign Exchange
Citizens Bank – Other
Governance, Compliance & Risk
Corporate Secretary
Finance – Purchasing
Finance – Business Performance
Finance – Internal Audit
Finance – Planning and Analysis
Finance - Risk Compliance & External Reporting
HR – Strategic Talent Management
HR – Compensation, Benefits & Employee Services
Inhance Investment Management
Inventure – Business Information Systems
Inventure – Facility Management
Inventure – Operations
Inventure – Technology Strategy
Inventure - Other
Member Engagement – Marketing
Member Engagement – Communications & Engagement
Member Engagement - Other
Member Services – Investments
Member Services – Sales and Service
Member Services – Sales and Service (Head Office)
Member Services – Vancity Insurance Services
Member Services – VISL – Retail
Member Services – Strategy & Operations
Member Services - Investments

Member Services - Other
Risk Management & Ops – Credit & Operations – Business Credit
Risk Management & Ops – Credit & Operations – Collections
Risk Management & Ops – Credit & Operations
Risk Management & Ops – Credit & Operations – Retail Credit
Risk Management & Ops – Treasury & Foreign Exchange
Risk Management & Ops – Treasury & Foreign Exchange – FX Vancouver
Risk Management & Ops – Treasury & Foreign Exchange – FX Calgary
Risk Management & Ops – Treasury & Foreign Exchange – FX Toronto
Social Finance – Business Banking – Branch Business Specialists
Social Finance – Business Banking – Business Banking Strategy
Social Finance – Business Banking – Community Business Banking
Social Finance – Business Banking – Eastern Banking Centre
Social Finance – Business Banking – Operations & Cash Management
Social Finance – Business Banking – Special Loans
Social Finance – Business Banking – Western Banking Centre
Social Finance - Business Banking - Other
Social Finance – Commercial Mortgages - Commercial Mortgages
Social Finance - Commercial Mortgages - Credit & Administration
Strategy – Community Leadership
Strategy – Strategic Planning
Strategy - Enterprise Project Management Office
Vancity - Office of the CEO
Vancity Community Foundation
Vancity Enterprises
Vancity Capital
VCIM
Squamish Savings
Other division or subsidiary - please specify:

**2. And at which physical location do you work? (SITE/BRANCH LOCATION)**

<b>Citizens Bank</b>
183 Terminal Ave
815 W Hastings
Toronto Office
Calgary Office
<b>Inventure Solutions</b>
183 Terminal Ave - Vancity Centre
369 Terminal Ave
815 West Hastings
<b>Vancity Insurance Services</b>
Branch 2
Branch 3

Branch 4
Branch 6
Branch 8
Branch 11
Branch 16
Branch 17
Branch 18
Branch 19
Branch 21
Branch 23
Branch 29
Branch 41
Branch 66
Branch 67
Branch 69
Branch 98
183 Terminal - Vancity Centre
425 Hornby Street
1013 Brunette Avenue
<b>Vancity Group (including Vancity Credit Union and other subsidiaries)</b>
183 Terminal Ave - Vancity Centre
BOSA Building
369 Terminal Ave
815 West Hastings
900 West Hastings
425 Hornby Street
13450 102nd Ave, Surrey
12820 96th Ave, Surrey
The Shop, Burnaby
Branch 1 - Vancity Centre
Branch 2 - Victoria Drive
Branch 3 - Hastings
Branch 4 - Kitsilano
Branch 5 - West Vancouver
Branch 6 - North Burnaby
Branch 7 - Fraser Street
Branch 8 - Fairview
Branch 9 - Main Street
Branch 10 - Downtown
Branch 11 - 4th Avenue
Branch 12 - Commercial Drive
Branch 13 - Collingwood
Branch 14 - Marpole
Branch 15 - Kerrisdale
Branch 16 - North Road
Branch 17 - South Burnaby

Branch 18 - Pinetree
Branch 19 - North Delta
Branch 21 - North Vancouver
Branch 22 - Point Grey
Branch 23 - Langley
Branch 25 - Semiahmoo
Branch 26 - Richmond
Branch 27 - Newton
Branch 28 - Chinatown
Branch 29 - Maple Ridge
Branch 30 - Guildford
Branch 31 - Chilliwack
Branch 32 - Surrey City Centre
Branch 33 - Shaughnessy
Branch 34 - Abbotsford
Branch 35 - Station Square
Branch 36 - Mission
Branch 41 - Oakridge
Branch 42 - Victoria
Branch 43 - Brentwood
Branch 44 - Cedar Hills
Branch 45 - Dunbar
Branch 46 - Lynn Creek
Branch 47 - West End
Branch 49 - Westview
Branch 50 - Pitt Meadows
Branch 51 - Maillardville
Branch 52 - Port Moody
Branch 53 - North Side
Branch 54 - Walnut Grove
Branch 56 - South Slopes
Branch 57 - Lynn Valley
Branch 58 - Tsawwassen
Branch 59 - Royal Oak
Branch 60 - Waterfront
Branch 61 - New Westminster
Branch 62 - Saanich
Branch 63 - Telus
Branch 64 - Johnston Heights
Branch 65 - Kruger
Branch 67 - Blanshard Street
Branch 68 - Scott Street
Branch 69 - Langford
Branch 81 - Squamish Savings Downtown
Branch 82 - Squamish Savings Highlands
Other

## CARBON EMISSIONS FROM EMPLOYEE CAR TRAVEL

### 3. Thinking of your typical week at work, please indicate how you travelled to and from work each day.

- If your last week of work was unusual, please complete for a typical working week.
- If you usually work a compressed fortnight (9 days out of 10), please answer for a 5 day working week.
- If you use more than one mode of transportation to get to (or from) work, select up to three modes in order of use (note: walking to the bus stop or SkyTrain station is not provided as an option).

**Example:** If you usually drive alone to a SkyTrain station and then take the SkyTrain into work, select “Drove alone” as mode one, and “Public Transit” as mode two.

- Select “Did not work” for each day you did not work.

Click on the down arrows in the table to make your selections. Your choices are:

- Did not work
- Drove alone
- Carpool/vanpool driver (with at least 2 adults in vehicle)
- Carpool/vanpool passenger (with at least 2 adults in vehicle)
- Walked all the way (includes jogging, rollerblading, etc.)
- Bicycle
- Motorcycle
- Public Transit
- Worked from home
- Other (please specify below) \_\_\_\_\_

**Please ensure you have read the instructions above carefully before completing this section.**

MONDAY	Mode One:	Mode Two:	Mode Three:
To work:			
From work:			

TUESDAY	Mode One:	Mode Two:	Mode Three:
To work:			
From work:			

WEDNESDAY	Mode One:	Mode Two:	Mode Three:
To work:			
From work:			

THURSDAY	Mode One:	Mode Two:	Mode Three:
To work:			
From work:			

FRIDAY	Mode One:	Mode Two:	Mode Three:
To work:			
From work:			

<b>SATURDAY</b>	Mode One:	Mode Two:	Mode Three:
To work:			
From work:			

<b>SUNDAY</b>	Mode One:	Mode Two:	Mode Three:
To work:			
From work:			

If you selected “other” as a transportation mode on any day, please specify the mode below.

---

**4. Do you work a compressed fortnight (9 days out of 10)?**

- Yes
- No

**5. On average, how long does it take you to get to work by the mode(s) of travel you most frequently use?**

- Less than 15 minutes
- 15 to 30 minutes
- 31 to 45 minutes
- 46 to 60 minutes
- 61 to 75 minutes
- 76 to 90 minutes
- more than 90 minutes
- Work from home / Do not travel to a Vancity Group office → SKIP TO Q.12

**6. So we can approximate the distance from your home to work:**

**What is your home Postal Code?**      \_ \_ \_ \_ \_

**OR ... IF REFUSED/DON'T KNOW POSTAL CODE, ASK DISTANCE:**

**What is the average distance you travel from your home TO work (ONE WAY ONLY) in kilometres?** If you are not certain, please estimate. One kilometre is approximately 6 blocks. For reference, Metrotown to downtown Vancouver is about 15 km.      \_\_\_\_\_

**7a. Do you receive a monthly, flat-rate car allowance?**

- YES → CONTINUE      **[SAMPLE B → USE CAR FOR WORK]**
- NO → SKIP TO Q.8      **[SAMPLE A → DO NOT USE CAR FOR WORK]**

**7b. (IF YES To 7a): Which of the following best describes your current position?**

- Mortgage Development Manager

- Life Insurance Specialist
- Branch Manager / Senior Branch Manager / Regional Director
- Commercial Mortgages – Account Manager / Senior Account Manager / Director / VP
- Investment – Advisor / Manager
- Business Services – Account Manager / Area Manager / Portfolio Manager
- Senior Manager / Director / Executive
- Other (SPECIFY) \_\_\_\_\_

**8. (COMPLETE QUESTION 8 IF DRIVE ALONE, RIDE A MOTORCYCLE, CARPOOL OR VANPOOL AT LEAST ONE DAY PER WEEK. Otherwise, SKIP TO Question 11) When commuting in a vehicle, what type of vehicle do you drive or ride in most often?**

- Motorcycle
- Small/compact (e.g. Pontiac Grand Am; Ford Focus; Chevy Cavalier; Toyota Tercel)
- Mid Size (e.g. Toyota Camry; Pontiac Grand Prix; Dodge Stratus)
- Full-size/Luxury/Station Wagon (e.g. Buick Regal; Cadillac DeVille; VW Passat SW)
- Pick-up truck (e.g. Ford F-150; Chevrolet Silverado)
- Small SUV (e.g., Honda CRV, Toyota RAV)
- Larger SUV (e.g. Ford Explorer; Jeep Cherokee)
- Van/Minivan (e.g. Ford Windstar; Dodge Caravan)
- Don't know

**Questions 9 and 10a,b,c for Sample B only. Others go to Q11**

**9. What fuel does the vehicle run on?**

- Gas
- Diesel
- Propane
- Hybrid (Gas & Electric)
- Other (please specify): \_\_\_\_\_
- Don't know

**10a. On average, approximately how many kilometres do you drive per year? If not sure, please estimate.**

TOTAL kms driven per year: \_\_\_\_\_ km per year

**10b. Of these kilometres, please estimate the percentage related to a) personal use, b) commuting to and from work, and c) driving for work purposes (e.g. to meetings, to other branches, etc.)**

- \_\_\_\_\_% personal use
- \_\_\_\_\_% to/from primary work location

θ \_\_\_\_% work-related driving (i.e. to meetings, etc.)  
(FORCE THIS TO ADD TO 100% BEFORE CONTINUING)

**10c. On average, using today's fuel prices, how much do you typically spend on fuel for ONE WEEK (total – include all personal and work related driving).**

\$ \_\_\_\_\_ per week.

**11. (Ask Q11 IF CARPOOL OR VANPOOL AT LEAST ONE DAY PER WEEK (WHETHER DRIVER OR PASSENGER, OTHERWISE, GO TO Q12) What is the average number of persons in your carpool or vanpool vehicle, including you, on a typical day?**

- θ Two
- θ Three
- θ Four
- θ Five
- θ Six
- θ Seven
- θ Eight
- θ Nine

## DEMOGRAPHICS

The following questions are for classification purposes. Responses will be shown in aggregate only.

**12. Are you?**

- Male
- Female

**13. Into what age category do you fall?**

- Less than 20
- 20-25
- 26-34
- 35-44
- 45-54
- 55+

**14. Which of the following categories best describes your position? (CHECK ONE ONLY)**

- Senior Management



- Management
- Non-management

## CUT THE CARBON WRAP UP

This year we launched Cut the Carbon, an eight month campaign focused on reducing Vancity’s carbon emissions. Your responses to these two questions will help us to assess the success of this campaign.

**15. Which of the following actions are you currently doing to reduce your environmental impact while working at Vancity? (select any that apply)**

Check All That Apply	Options
θ	I always ensure that the lights are off whenever I leave a room, or when I am the last person to leave the office.
θ	To the best of my ability, I use reusable mugs and food containers whenever possible.
θ	I regularly share copies of materials in meetings and I always print on both sides of the page.
θ	I always turn off office machines at the end of the day (photocopiers, scanners, computers, fax machines, etc).
θ	In the past month, I have never completely filled my tiny trash bin.
θ	I always turn off my computer monitor when I leave my desk.
θ	I take alternative transportation (carpooling, bike, walk, public transit) to work at least once a week.

**16. Please indicate your level of motivation to reduce your CO2 emissions related to work and work travel -- including commuting -- on a scale of 1-5 (5 being ‘highly motivated’ and 1 being ‘not motivated at all’).**

\_\_\_\_\_ [text control to allow only numbers from 1 to 5]

***Thank you for taking the time to complete this survey!***

## Appendix E      Natural Resources Canada Fuel Economy Estimates

Natural Resources Canada (NRCan) publishes a number of fuel economy estimates for both specific vehicles and vehicles classes.

### *Specific Vehicles*

Every year NRCan publishes a fuel consumption guide (available online) listing the tested city and highway fuel economy ratings for all vehicles sold in Canada (for example [10]). They also report an average fuel economy rating that can be used when the driving mode is not known.

### *Vehicle Classes*

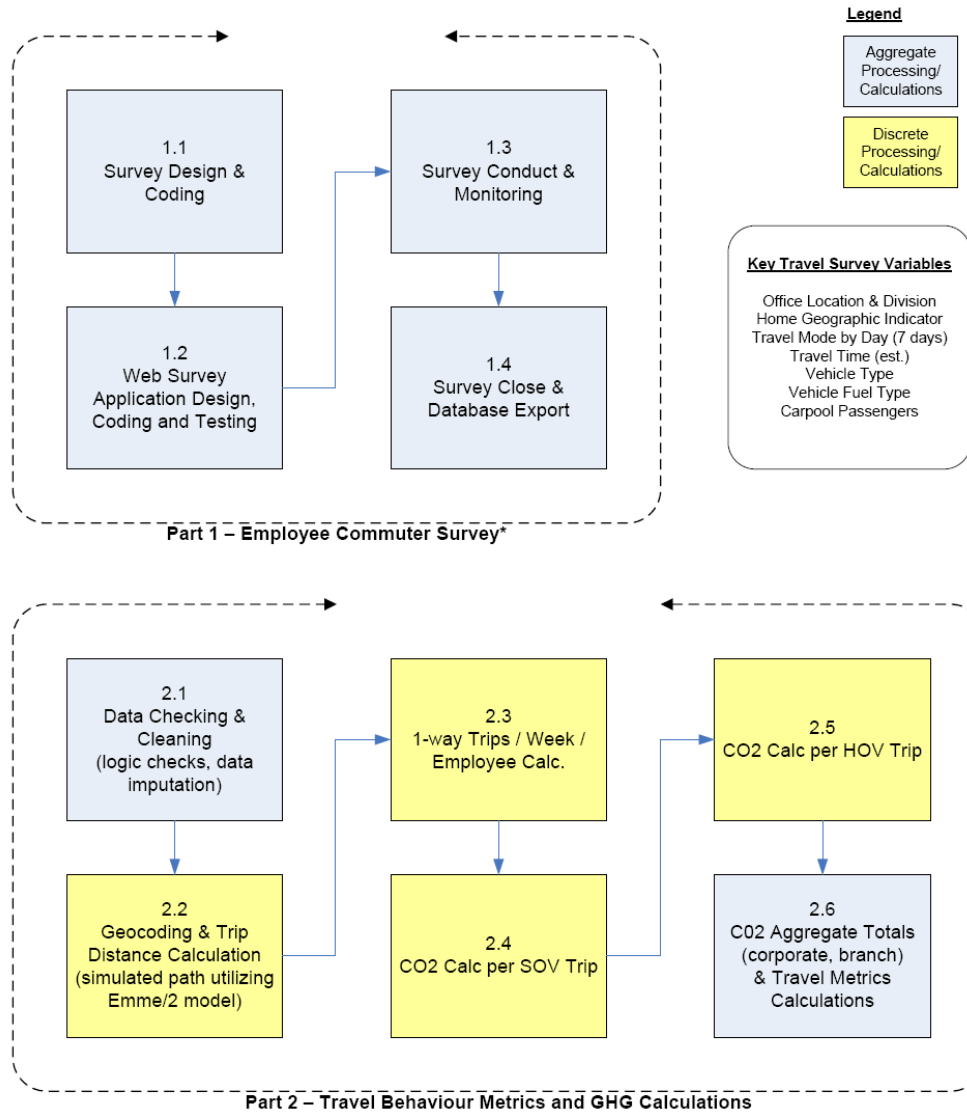
NRCan publishes a number of fuel economy statistics. The data is collected through a number of methods and aggregated in three main data collections:

- (1) Vehicle Fuel Economy Information System (VFEIS) (maintained by Transport Canada) [24]
- (2) Vehicle Information System (VIS) [24]
- (3) National Energy Use Database (NEUD)

The VFEIS and VIS systems contain the same data that is published in the fuel consumption guides and the NEUD contains estimates based on models (eg. Transportation End Use Model) and survey results. From the NEUD NRCan produces the Energy Use Data Handbook which includes a section on transportation. In addition, NRCan also publishes summary reports based on the surveys they conduct. The latest report on transportation was published in 2007 and provides an estimate of the average fuel economy of 2005 light duty gasoline and diesel vehicles (10.6 L/100km, 11.6 L/100km) [9]. It is recommend that this and future summary reports be the source of average fleet fuel economy.

## Appendix F Employee Commuting Emissions Model

This appendix describes the methods and procedures developed in cooperation with Acuere Consulting to estimate greenhouse gas emissions associated with employee commuting.



**Calculation Notes:**

- 2.1 – Incomplete or unreconcilable data removed
- 2.2 – Trip origin & destination postal codes used as geo-reference for geocoding to Emme/2 Traffic Zone System. Simulated trip distances packed to each applicable record.
- 2.4 – Average fuel consumption rates (NRCAN) for each vehicle type used to determine litres of fuel consumed per vehicle trip. Incorporating fuel type information, fuel (litres) to emission (grams) rates (Metro Van; Environ. Canada) calculated for each vehicle trip.
- 2.5 - Per person emissions (grams) calculated based on total passengers in an average carpool commute for a particular employee.
- 2.4 & 2.5 – Multi-modes taken per trip considered in calculations by equally dividing trip distances for each mode used (up to 3).
- 2.6 – Travel behaviour metrics consist of mode share totals, distribution of distances, vehicle and fuel type distribution, trips/week/emp, CO2 emissions per trip, CO2 emission totals by branch and corporate-wide

## Appendix G Paper Use Estimation Procedure

Procurement of paper based products for use by the Vancity Group is generally decentralized. Apart from general office paper used for photo copiers, faxes, member statements, company letterhead, stationary, and envelopes, departments order and purchase their own paper products as needed.

The following table lists examples of departments that have been identified as purchasers of paper products and the use of the paper.

Department	Paper Use
Vancity Marketing	Brochures, posters, letterhead and envelopes, buckslips, mailers and other campaign materials, etc.
Purchasing	Member forms, both generic and custom, statements, memo pads, letterhead, cheques, deposit books, brochures, business cards, branch vouchers, envelopes, other miscellaneous office paper
Public Affairs and Corporate Communications	Member newsletters and other communications, corporate reports, corporate business plans, employee communications
Governance	AGM and election materials including statement stuffers, ballots, voting cards, envelopes

### Procedure:

1. Paper use data is collected by Data Collection Officer from each of the departments listed above on either a quarterly or annual basis depending on the volume and specific use of paper.
2. Total weight of paper purchased, as well as percent of paper that is post consumer waste (PCW) is tabulated and summarized.

## References

1. CSA/ISO, *National Standard of Canada CAN/CSA-ISO 14064-1:06 (ISO 14064-1:2006)*. 2006, Canadian Standards Association.
2. WRI/WBCSD, *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)*. 2004, World Resources Institute and World Business Council for Sustainable Development.
3. WRI, *HOT CLIMATE, COOL COMMERCE: A Service Sector Guide to Greenhouse Gas Management*, S.P. Pino, R. Levinson, and J. Larsen, Editors. 2006, World Resources Institute: Washington DC.
4. WRI, *Working 9 to 5 on Climate Change: An Office Guide*, S.P. Pino and P. Bhatia, Editors. 2002, World Resources Institute: Washington DC.
5. Hanova, J., *Environmental and Techno-Economic Analysis of Ground Source Heat Systems*, in *The Faculty of Graduate Studies*. 2007, University of British Columbia: Vancouver. p. 87.
6. EnvCan, *National Inventory Report: Greenhouse Gas Sources and Sinks in Canada (1990 - 2005)*, in *The Canadian Government's Submission to the UN Framework Convention on Climate Change*. 2007, Environment Canada. p. 684.
7. SGA, *Emission Factors and Uncertainties for CH<sub>4</sub> & N<sub>2</sub>O from Fuel Combustion*. 2000, SGA Energy Limited: Ottawa.
8. Terasen. *2005 Progress report: To the Canadian Standards Association Climate Change, GHG Registries' Canadian GHG Challenge Registry*. 2005 [cited 2007 Nov. 28]; Available from: <http://www.terasengas.com/documents/GHGVCReport2005.pdf>.
9. NRCan, *Canadian Vehicle Survey 2005 Summary Report*. 2007, Natural Resources Canada: Ottawa.
10. NRCan. *Fuel Consumption Guide: 2007*. 2007 [cited; Available from: <http://oee.nrcan.gc.ca/transportation/tools/fuelratings/fuel-consumption.cfm?attr=16>].

11. DEFRA. *Guidelines to Defra's greenhouse gas (GHG) conversion factors for company reporting* 2007 [cited; Available from:  
<http://www.defra.gov.uk/environment/business/envrp/pdf/conversion-factors.pdf>.
12. IPCC, *Aviation and the Global Atmosphere: A Special Report of IPCC Working Groups I and III in Collaboration with the Scientific Assessment Panel to the Montreal Protocol on Substances that Deplete the Ozone Layer*, J.E. Penner, David H. Lister, David J. Griggs, David J. Dokken, Mack McFarland, Editor. 1999, Intergovernmental Panel on Climate Change.
13. Sausen, R., et al., *Aviation radiative forcing in 2000: An update on IPCC (1999)*. *Meteorologische Zeitschrift*, 2005. **14**(4): p. 555-561.
14. IPCC, *Climate Change 2007: The Physical Science Basis*, S. Solomon, Dahe Qin, Martin Manning, Melinda Marquis, Kristen Averyt, Melinda M.B. Tignor, Henry LeRoy Miller Jr., Zhenlin Chen, Editor. 2007, Intergovernmental Panel on Climate Change.
15. Jardine, C.N. *Part 1: Calculating the Environmental Impact of Aviation Emissions*. 2005 June [cited; Available from:  
[http://www.climatecare.org/media/documents/pdf/Aviation\\_Emissions\\_&\\_Offsets.pdf](http://www.climatecare.org/media/documents/pdf/Aviation_Emissions_&_Offsets.pdf).
16. IPCC, *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, J. Penman, D Kruger, I Galbally, T Hiraishi, B Nyenzi, S Emmanul, L Buendia, R Hoppaus, T Martinsen, J Meijer, K Miwa and K Tanabe Editor. 2000, Intergovernmental Panel on Climate Change.
17. WRI, *GHG Protocol guidance on uncertainty assessment in GHG inventories and calculating statistical parameter uncertainty*. 2003, World Resources Institute: Washington DC.
18. IPCC, *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, S. Eggleston, Leandro Buendia, Kyoko Miwa, Todd Ngara, Kiyoto Tanabe, Editor. 2006, Intergovernmental Panel on Climate Change.
19. Robbins, M.A. *Odometer Settlement May Earn Class Lawyers \$9.5 Million in Fees*. 2006 [cited 2007 Oct. 14]; Available from:  
<http://www.law.com/jsp/article.jsp?id=1163194119145>.

20. *Vaughn v. Am. Honda Motor Co.*, 2007 U.S. Dist. LEXIS 76150 (E.D. Tex., Sept. 28, 2007) 2007.
21. CR, *Fuel Economy: Why you're not getting the MPG you expect*. Consumer Reports, 2005. **70**(10): p. 20-23.
22. WRI. *World Resources Institute Carbon Dioxide (CO2) Inventory Report For Calendar Years 2004 & 2005*. 2006 Nov [cited 2007 Oct. 29]; Available from: <http://www.wri.org/publication/wris-annual-carbon-dioxide-inventory-report-2004-2005#>.
23. NRCan, *Commercial and Institutional Consumption of Energy Survey Summary Report 2005*. 2007, Natural Resources Canada: Ottawa.
24. NRCan, *Canadian New Light Duty Vehicles: Trends in fuel consumption and characteristics (1988-1998)*, M. Schingh, É. Brunet, and P. Gosselin, Editors. 2006, Natural Resources Canada.