

ASSESSMENT OF VOLUNTARY CARBON MARKETS
(MARKET FOR VOLUNTARY CARBON OFFSETS
GENERATED FROM INDIVIDUALS USING ROAD AND
LIGHT RAILWAY TRANSPORTATION IN BRITISH
COLUMBIA)

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ABSTRACT

The goal of this study was to assess the viability of the existing voluntary carbon market to support the development of a specific business concept in that market. A review of literature and market data was employed to determine current and projected future market demand and to segment and analyze the market. Organizations and individuals were surveyed concerning their receptiveness to a variety of product options in the voluntary market. Seventy percent of individuals were likely to participate in the most favoured option, with greatest receptiveness from self-identified “green” consumers. Ninety percent of organizations would be willing to pay to employ employee generated offsets as part of larger sustainability initiatives. The strongest response came from mid-size or larger organizations that are not subject to existing or proposed emissions regulations. A strategy for entry into the voluntary market is proposed based on these favourable results.

EXECUTIVE SUMMARY

In recent years, awareness of the reality and impact of global warming, climate change, extreme weather and peak oil have combined to create the social and political attitudes necessary to take decisive action to reduce the emissions of Greenhouse Gases, one of the leading causes of global warming. Beginning with the negotiation of the Kyoto protocol for the reduction of greenhouse gas emissions, industrialized nations have been seeking mechanisms to create incentives for emitters to reduce their emissions, thus allowing these nations to meet their emission reduction targets.

A variety of emissions trading schemes have been implemented, beginning with the US Acid Rain Program and culminating in the EU ETS and other regulated carbon markets. A parallel set of voluntary markets have emerged, led by the Chicago Climate Exchange and supported by over-the-counter “Offsetters”, allowing organizations and individuals to purchase credits generated by the emission reducing activities of others for altruistic, social responsibility or branding purposes.

Regulated and voluntary markets are growing rapidly. Regulated markets topped \$50 Billion in 2007 and they are projected to top \$100 Billion in 2008. Voluntary markets represent about 10% of the size of regulated markets. This growth will continue as more countries regulate carbon emissions and more individuals and organizations feel compelled to participate.

Two primary methods are available to influence the levels of so-called externalities. Price-based methods use some form of market to allow the price of the

externality to fluctuate while quantity-based methods set quotas on the externality. Blended systems are also possible and are the basis of most real world systems.

The Carbon Market is structured by its Value Chain, which in turn follows the Energy Chain connecting energy producers to transmitters to resellers to consumers. Major participants in the carbon market include the Suppliers, who produce carbon offsets through clean energy or carbon absorption projects, Distributors, who procure, repackage and trade these offsets, Retailers, who direct-sell these offsets to Consumers, who seek to offset their own emissions and the Regulators/Certifiers that ensure projects and credits are valid and meet defined standards.

Porter's framework allows a market to be assessed with respect to entry, rivalry substitutes, and the relative power of buyers and suppliers. Examining these forces, it is evident that Carbonicity would represent a unique product with some distinct competitive advantages in the target segment. As supported by the survey results, this is particularly the case with younger, green-conscious individuals on the individual side, and mid- to large-sized "lifestyle" companies on the organizational side.

A survey of Individuals related to the proposed Carbonicity product produced the following key results:

- Individuals are in general in support of the proposed product
- Verification is not supported, in particular not if tracking mechanisms such as GPS are involved
- Certain demographics, including middle to lower income, higher education level individuals were most favourable

A survey of Corporations related to the product produced the following key results:

- Medium to large sized, non-emitting corporations are the most promising segment
- Regulated industries and government are focused on compliance with regulatory regime and do not consider voluntary market as a viable alternative at this time
- Several large companies are implementing their own carbon tracking systems, including employee related emissions, indicating a strong potential market for corporate solutions

Considering the strong growth anticipated in the underlying market, the lack of entrenched competition and the generally favourable survey results, the segments identified in this study hold great promise for a business that can rapidly enter that market. It is recommended that business partner organization proceed with its intended product offering immediately. During the market entry period, the partner company should pay careful attention to market and strategic forces as this market evolves and matures, as the necessity to change direction are very likely.

DEDICATION

From John: My part of this work is dedicated to my brother, Chris Turner, for sparking my awareness of global warming and for convincing me to do something about it.

From Jacek: My part of this research is dedicated to my son, Robert, for inspiring me to enrol in the MBA program by teaching me every day how to try new things with curiosity, confidence, and courage.

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GLOSSARY

Carbon offset	A carbon offset is a financial instrument that represents a reduction in emissions.
1tCO ₂ e	One metric tone of carbon dioxide equivalent
EPA	U.S. Environmental Protection Agency
CDM	Clean Development Mechanism that allows participants of Kyoto protocol to invest in emission reducing projects in developing countries
JI	Joint Implementation allows participants of Kyoto protocol to invest in projects in other developed countries
ERU	Emission Reduction Unit is a tradable unit that is generated from JI projects
CER	Certified Emission Reduction is a tradable unit generated from CDM projects
ETS	European Union's Emission Trading System started in 2005 to allow EU members to trade carbon credits
CCX	Chicago Climate Exchange is a voluntary market to allow members to trade carbon credits
OTC Market	The term "over-the-counter" can be used to refer to units that trade via a dealer network as opposed to on a centralized exchange
GHG	Greenhouse gases are present in the atmosphere and which increase global temperature through the greenhouse effect. The most abundant gases are water vapour, carbon dioxide, methane and nitrous oxide

1: INTRODUCTION

Although awareness of the impact of humanity on the natural environment is not new, it has become a more vital topic in the face of massive evidence that our impact will lead to potentially irreversible and monumental climate change. In particular, overwhelming scientific evidence points to the effects of so-called Greenhouse Gases (GHG) in raising the average temperature of the earth's surface – a process known as “global warming”.

Greenhouse Gases, such as carbon dioxide, increase the atmosphere's ability to absorb reflected solar radiation. Heat that would otherwise escape into space is instead retained, similar to the effect of the glass in a greenhouse.

Although global warming has been understood by climate scientists since at least the early 1970's, it was several decades before public awareness and scientific development had evolved to the point where positive action could be taken. The agreement of the Kyoto Protocol in 1997 was a watershed event, leading directly to the establishment of carbon markets as a means to reduce global emissions. In recent years, growing public awareness, symbolized by Al Gore's multi-media “An Inconvenient Truth” has provided greater impetus and acceptance for the development of these markets.

This study was commissioned by LEHOO Software Inc, a business in the early start-up stage, created to take advantage of the rapid growth in this market. The study is aimed in particular at the *Voluntary* segments of the market with an initial focus on the

creation of offsets by individuals in this segment for consumption by other individuals or organizations.

Section 2 of this study provides Historical Background, summarizing the evolution of the emissions trading from the earliest experiments of the US Acid Rain Program, through the declaring of the Kyoto Protocol, the experimental UK Emissions Trading System and the fully developed EU Emissions Trading System. Section 2 also discussed emergent voluntary markets including the Chicago Climate Exchange (CCX) and others.

Section 3 is literature survey, including major academic papers that developed the economic theory behind carbon markets, the influential Stern Report (2006) and a variety of market reports and assessments.

Section 4 presents an analysis of the Voluntary Carbon Market, including a description of the Value Chain and the related Energy Chain as it relates to this market and a description of the major participants in each part of the market. The major regulations and certifications applicable to this market are described. A segmentation of the market is proposed to support further analysis.

Section 5 provides a strategic analysis of the segments identified, using Porter's framework. The *Carbonicity* product offering of an online marketplace is proposed and assessed against each of the major strategic factors. A competitive analysis is presented and major strategic recommendations for market entry are provided.

Section 6 introduces the main part of the study, the market survey, and describes the survey instruments to be employed and the methods for data analysis that will be used.

Section 7 provides a summary of the results of in depth interviews conducted during the survey period to help construct the surveys and to provide context for interpreting the results.

Section 8 presents an analysis and interpretation of the individual survey results. Conjoint analysis using linear regression is used to perform this analysis.

Section 9 is a parallel analysis and interpretation of the corporate survey results.

Section 10 is a series of appendices containing the detailed survey results and a variety of other information relating to the surveys.

2: EARLY WORK

One of the earliest proposals came from the 1930's Technocracy movement (Fezer, 1937), which advocated the concept of "energy certificates" to replace price based systems of exchange by measuring the net amount of energy used in the production and distribution of any good or service. All citizens would receive certificates equal to their share of the total energy consumed and use these energy equivalents to purchase needed goods and services. This introduces the notion of valuing energy inputs, but is distinguished from later initiatives by removing the notion of price and markets as measures and determiners of value.

2.1 US Clean Air Act (NO_x / SO_x market)

The first emissions trading scheme implemented on a wide scale was the United States Nitrous Oxide and Sulfur Dioxide trading system introduced to control acid rain through the 1990 Clean Air Act (Schmallensee, et. al. 1998). This legislation established emissions limits for the acid rain gases with the goal of reducing emissions to 50% of 1980 levels. Emitting firms received an allowance based on their baseline emissions, were required to purchase emissions permits for increased emissions, and could sell unused allowances. The U.S. Environmental Protection Agency (EPA) auctioned additional allowances to allow for new emitters and to establish a market price. This was the first "Cap and Trade" emissions market and was largely successful. As shown in the figures below, emissions were reduced through the program by 40% of 1985 levels with a

resultant decrease in acid rain. The cost of the system, according to the EPA (2008), was about 25% of initial estimates. This positive result has been enormously influential on the advocates and designers of more recent trading systems. SO₂ emissions have decreased 5.5 million tons from 1990 levels and more than 7 million tons from 1980 (Figure 1).

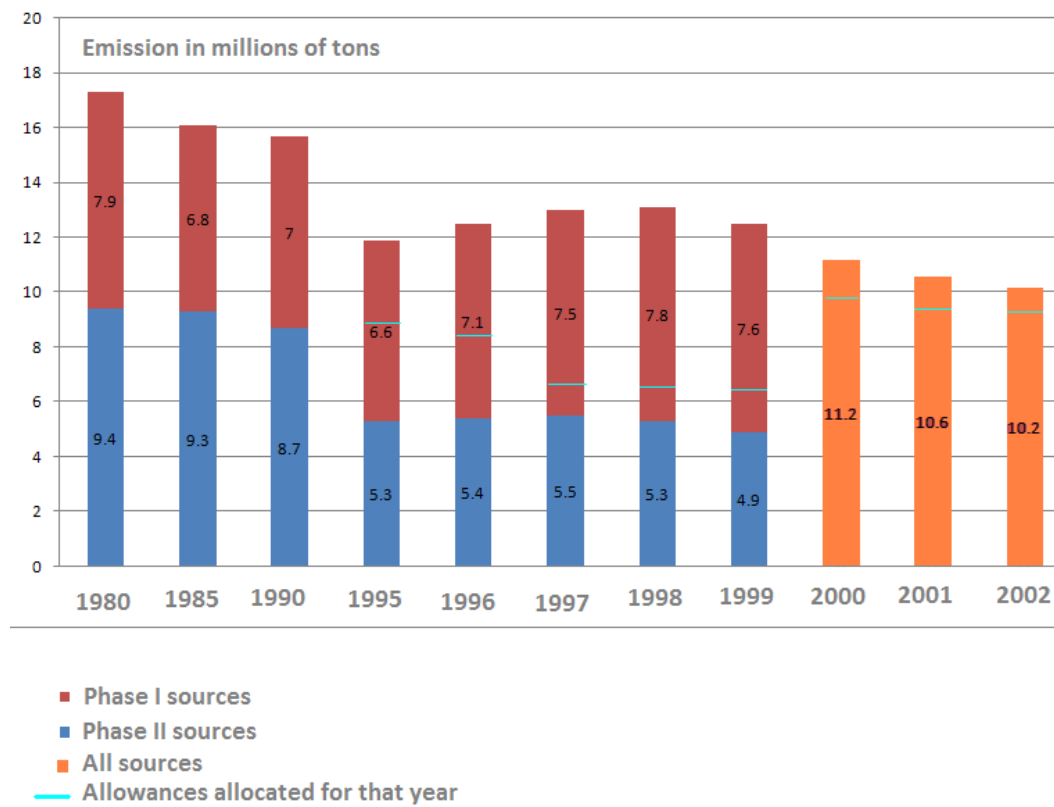


Figure 1 SO₂ Emissions under Acid Rain Program
(Adapted from U.S. Environmental Protection Agency)

2.2 Kyoto Protocol

In 1997, a major watershed was reached with the negotiation of the Kyoto Protocol, an amendment to the United Nations Framework Convention on Climate Change. Kyoto commits its signatories to reducing total Greenhouse Gas (GHG) emissions to 5% below 1990 levels by 2013. Of significance to this discussion, Kyoto established three “Flexible Mechanisms” for signatories to meet their emissions reduction targets:

1. Emissions Trading – nations that reduce their emissions below their allowance generate “carbon credits” that can be traded between signatories
2. Clean Development Mechanism (CDM) – participants can invest in emission reducing projects in developing countries. An Executive Board, established by the UN, approves these projects, thereby generating Certified Emissions Reduction (CER) units that can be traded
3. Joint Implementation (JI) – allows participants to invest in projects in other developed countries (usually Russia, the Ukraine or other “countries in transition”), generating Emissions Reduction Units (ERU’s) which may also be traded

The table below demonstrates the values of these different projects traded in the last two years (Figure 2, Figure 60).

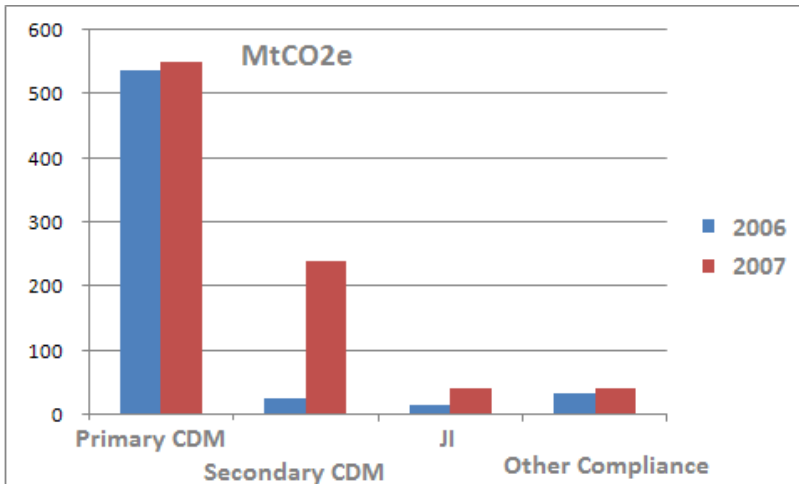


Figure 2 Carbon Market, Trend of Volumes per Project
(Adapted from World Bank, 2006)

Similarly, the table below shows the volumes of these different projects traded in the last two years (Figure 3, Figure 61).

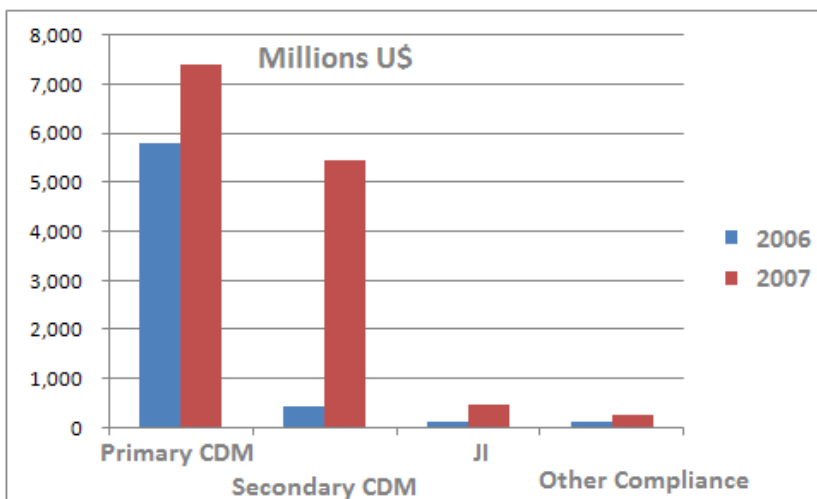


Figure 3 Carbon Market at Glance - Trend in Values by Project
(Adapted from World Bank, 2006)

Kyoto came into effect in 2005. The protocol has been ratified by 182 parties. It has resulted in strong growth in emissions trading worldwide.

2.3 European Union ETS

The first large scale carbon market is the European Union's Emission Trading System (EU ETS), started in 2005 to allow EU members to trade carbon credits in fulfilment of EU climate change regulations developed independently from Kyoto (Labatt and White, 2007). The origins of the EU ETS lie with the voluntary, experimental UK ETS, which was implemented from 2002 to 2006 among 32 "direct participants", conducting 3,500 trades at an average price of £12, resulting in emission reductions of 7.2 million tons of carbon over the life of the scheme. (DEFRA, 2006).

In parallel with this experiment the EU Commission, in 2001, proposed an EU-wide, binding, regulated market for carbon emissions. Legislation was passed by the EU parliament in July, 2003, mandating a regulated cap and trade system for large emitters, to commence in 2005. The EU ETS includes over 11,500 emitters responsible for 40% of all EU GHG emissions (Labatt and White, 2007). A three-year initial phase ran from 2005 to 2007 and a 5 year Phase 2 began in 2008 and will run until 2012. A Phase 3, to run from 2013 to 2020, is being discussed with the goal of reducing EU emission to 1990 levels by 2020. EU member nations set national caps, creating EU Allowances (EUA) granted at no cost to emitters and leaving a small portion of allowances (5% in the first phase, 10% in the second phase) to be auctioned. As in other schemes, emitters can buy or sell their allowances as needed and, starting in 2007, can also buy Kyoto CER's and ERU's. The EU ETS applies to power generation and industrial emitters, excluding for the time being the transportation sector, buildings and individuals (Ellerman and Joskow,

2008). Price, volume and emissions results will be discussed in more detail in the next sections.

2.4 Other National and Regional Systems

A number of regional initiatives have recently been introduced in the wake of the EU ETS and Kyoto, with a number of national schemes not far behind. In Australia, leadership was provided by the introduction of the New South Wales Greenhouse Gas Abatement Scheme, applying to producers and large consumers of electricity. Australia intends to introduce a cap-and-trade system by 2010. In the United States, the Regional Greenhouse Gas Initiative is implementing a similar program for nine northeastern states and the Western Climate Initiative of nine states and three Canadian provinces has the goal of reducing 2020 emissions to 15% below 1990 levels through unspecified market mechanisms. (Kapoor and Ambrosi, 2008).

2.5 Voluntary Markets

In regions where regulated carbon markets have been slow to emerge, voluntary markets have been introduced to act as pilot programs and to prepare participants for regulated markets. The original voluntary market was the aforementioned UK ETS (see above).

The largest of the exchanges is the Chicago Climate Exchange, a legally binding voluntary cap-and-trade market launched in 2003 with 131 members (Bayon, Hawn and Hamilton, 2007) and trading in six GHG's. It and its subsidiaries, including the Montreal, Northeastern and New York Climate Exchanges are unique in publicly trading

allowance-based, rather than the project-based offsets that account for most of the voluntary market.

A similar Australia Climate Exchange was started in 2007, primarily to trade project-based offsets. A final early entrant is the Japan Voluntary ETS, which began in 2005 on a similar basis as the UK ETS, trading “JPA”s between 81 subsidized participants.

The majority of the voluntary market is traded over-the-counter using what are referred to as “carbon offsets”. An offset is created by implementing a project that can be verified to reduce emissions (e.g. a renewable energy project such as a wind farm) or sequester carbon (as through planting trees). These offsets have been in existence since before the emergence of the regulated market, with the first known transaction occurring in 1989 (Bayon, Hawn and Hamilton, 2007). The majority of these voluntary offsets are sold to companies and individuals who wish to balance their emissions through a corresponding emission reduction for marketing, philanthropic or experimental reasons. For example, a common over-the-counter offset allows an individual to compensate for air travel through brokered investment in a verified project. Offsets will be covered in more detail in the section below.

3: LITERATURE SURVEY

In the late 1800's (See Marshall, 1890) Alfred Marshall and Henry George identified the key concept that by assigning tangible value to use of environmental resources, this value would become part of the price of resource consuming goods and activities and would thus promote conservation.

Carbon Markets and other mechanisms for controlling emissions, such as Carbon Taxes, are in essence mechanisms for pricing and controlling externalities, and thus originate with the work of Pigou (1912). Pigou's analysis of these externalities and the market failures that result led him to propose the use of taxes and subsidies (so-called Pigovian Taxes) to internalise these externalities and lead to minimum social cost. Stern (2005) commences from much the same point in his definitive analysis of climate change and the use of markets to mitigate them.

The formal analysis of the economics of Carbon Trading begins with the work of Coase (1960) on the efficient allocation of social costs. Weitzman (1974) provides a detailed analysis of the trade-off between price-based instruments (as delivered by markets) and quantity based instruments (as set by governments). His analysis focuses on the marginal cost and benefit curves. He concludes that where the cost curve is flat (as for abatement costs in the short term) quantity instruments are preferred, while if the cost curve is increasing or unpredictable (as for long-term abatement costs) price instruments are preferred. Subsequent analysis have largely followed Weitzman, arguing for or against specific instruments based on the author's assessment of the slopes of the cost and

benefit curves over applicable periods. Yohe (1978) extends Weitzman for the case of multiple firms and reinforces the basic conclusion that neither kind of instrument is always the correct choice. Pizer (2002), for example, argues that the high uncertainty over abatement costs and results suggests a price-based solution, and goes on to propose a hybrid system, combining the features of both techniques. In the last several years, there has been an explosion of research and publication in this area. Stern (2006) provides an excellent summary. In general, previous results have been confirmed, supporting the establishment of carbon markets with some form of price control or ceiling to limit abatement cost.

3.1 Carbon Market Past Performance

As organized carbon markets are a relatively recent phenomenon, there is a limited amount of data from which to draw conclusions. Nevertheless, the data that is available points to a rapidly growing, market featuring high volatility, a strongly increasing price trend, and increasing participation. Some specifics are discussed below.

3.1.1 EU ETS

The EU ETS commenced operations in 2005, providing three years of performance data. From modest beginnings (280 Million tons / 6.3 Billion USD) in 2005, the size and value of the market increased more than four fold in 2006 and doubled in 2007, resulting in a market that topped 50 Billion USD in 2007. This strength has continued into 2008, with market volume and value set to double again this year (Figure 4, Figure 5).

	2005	2006	2007
	Volume [MtCO ₂ e]	Volume [MtCO ₂ e]	Volume [MtCO ₂ e]
EU ETS	280	1,104	2,061
New South Wales	9.1	20	25
Chicago Climate Exchange	1.5	10	23
Total	291	1,134	2,109

Figure 4 Carbon Market, Volumes at Glance
(Adapted from EU ETS, World Bank, CCX)

	2005	2006	2007
	Value [US\$ Millions]	Value [US\$ Millions]	Value [US\$ Millions]
EU ETS	6,319	24,436	50,097
New South Wales	90	225	224
Chicago Climate Exchange	3	38	72
Total	6,412	24,699	50,394

Figure 5 Carbon Market, Values at Glance
(Adapted from EU ETS, World Bank, CCS)

This growth has not been without risk. In April and May of 2006, the market for 2006 vintage permits collapsed, reducing from a high of 30 Euro in late 2005 to 8 Euro. This collapse was caused by the release of 2005 emissions data that indicated that permits had been over allocated throughout the Phase 1 period (Figure 6).

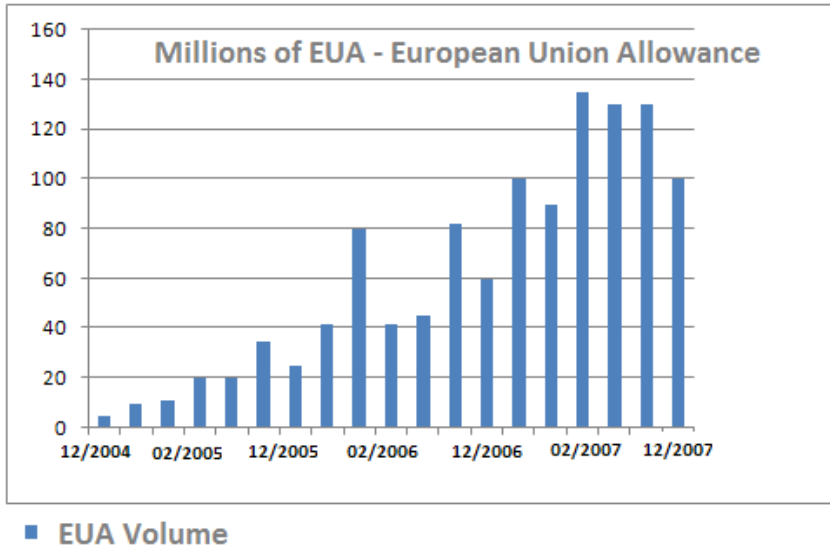


Figure 6 Volume of EUA

(Adapted from Point Carbon and Mission Climat of French Caisse des Depots)

Although the market has remained volatile, it has begun to stabilize with prices at mid-2008 for 2008, and vintage permits at around 25 Euros (Figure 7).

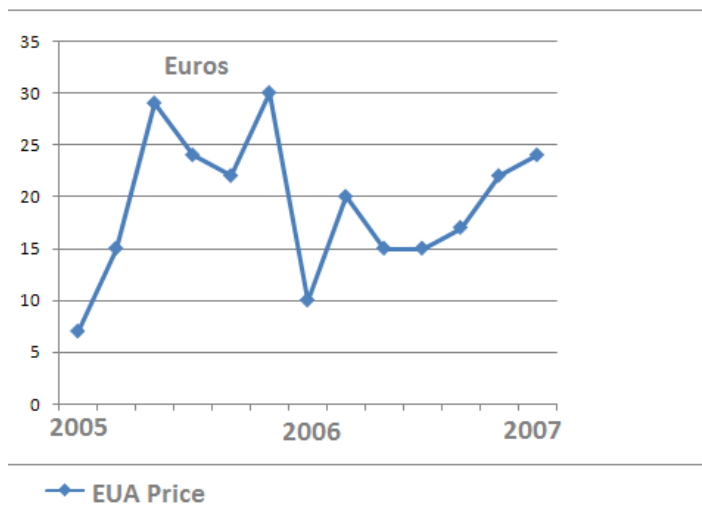


Figure 7 Evolution of EUA Prices

(Adapted from Ellerman and Joskow, 2008)

3.1.2 CCX and Voluntary OTC

The best indicator for the voluntary market is the Chicago Climate Exchange as shown by the data in Figure 8.

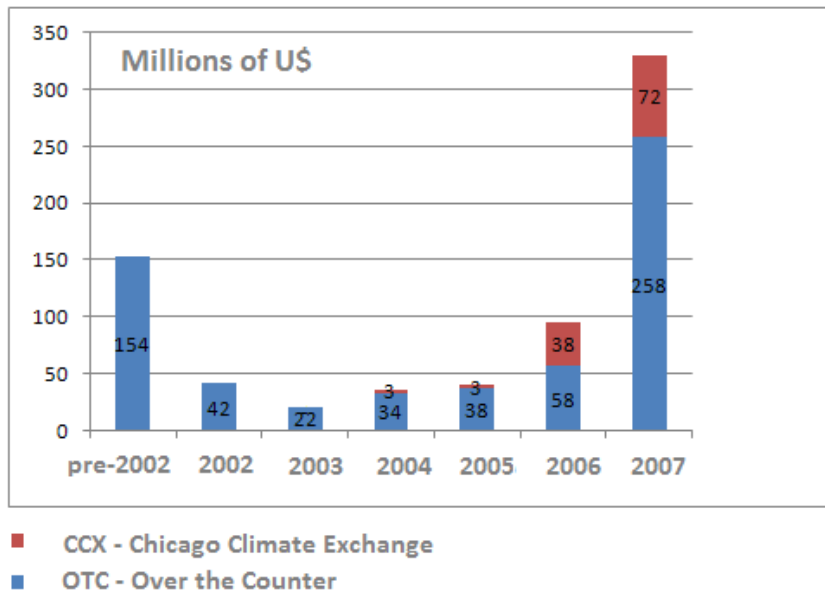


Figure 8 Transaction Volume on Voluntary Carbon Market
(Adapted from Ecosystems Marketplace, New Carbon Finance)

The trend has been similar to the EU ETS, with volume and value increasing 10 times from 2005 to 2006 and a further doubling from 2006 to 2007. Prices in this market have been much lower than for the EU ETS, with a range of \$1.50 to \$7.50, averaging \$3.25 over the past 2 years.

The OTC market has shown the same trend, tripling in volume and increasing 5 times in value between 2006 and 2007, with an average price of \$3.00 per metric ton, increasing to \$6.10 per ton in 2007 (Hamilton, et. al. 2008).

The trend is nearly identical between the various market participants, particularly the 2006 to 2007 growth and 2008 year-to-date data, indicating that the voluntary markets are likely to continue to track the regulated market performance. As additional regulated markets come on line, there will be further growth in the voluntary sector as participants start to gear up for regulation.

Price trends are positive as well, though not as dramatically. Prices in the regulated markets are significantly higher than for voluntary markets, indicating the positive effect on prices due to the penalties and enforcement in a regulated system. The positive price trend in the EU ETS can be explained by the increase in energy costs and the improved mechanisms to prevent over allocation in Phase 2.

Pricing in the voluntary markets is also upward, but for different reasons. Hamilton, et al (2008) noted that the voluntary OTC market has more in common with that for Fair Trade or organic cotton than it does the regulated markets, being influenced by fashion, philanthropy and public relations. Between 2006 and 2007, the average OTC transaction increased by 50% from \$4.10 to \$6.10 per ton of CO₂. This reflects the effects of increased demand, improved verification and a switch to more expensive methods as “low hanging fruit” are used up.

3.2 Carbon Market Prospects

It is very likely that carbon market volume, value and pricing will continue for some time on the current upward trend. Point Carbon (2008) reported results from an extensive survey of carbon market participants, estimating that volume in the EU ETS alone will rise to 2.4 Gt by 2012, 20% higher than their prediction a year earlier. The

same survey predicts a price increase to 35 Euro (\$48 USD) by 2020. This is roughly double the current price.

The wild card in the regulated market is the United States, which has begun implementing regional schemes and appears poised to introduce a national cap and trade market under the next president (both candidates support such a scheme). Point Carbon predicts that the global market will increase from its current \$50 Billion to \$2 Trillion by 2020 if the US joins the system. This would represent a 40-fold increase in the size of the market, having a very likely spill over effect into the voluntary market.

Another factor that will affect carbon pricing is the likely continuing increase in the price of oil and other energy sources. Historically, the correlation between oil and carbon prices has been relatively weak, but there is evidence it is strengthening.

Year	Correlations
2005	0.55
2006	0.17
2007	0.72
2008 to date	0.82

Figure 9: Correlation of Oil Price to Carbon Price
(Adapted from Reuters, 2008)

Figure 9 shows correlations since 2005, with the first 5 months of 2008 showing a very strong correlation of 0.82 (Reuters, 2008). With some analysts predicting oil at \$200 per barrel by 2010, this will cause further upward pressure on the price of carbon.

4: VOLUNTARY CARBON MARKET RESEARCH AND ANALYSIS

4.1 Voluntary Carbon Market Value Chain

In discussing the value chain for the carbon market, there are two value chains of relevance. The first is the Energy Chain, so called because it depicts the transfer of energy from upstream supplier to downstream consumer of energy, and the transformations that occur from step to step and the value chain for the carbon market itself (and for the voluntary market in particular). The energy chain, adapted from Labatt and White (2007) is depicted in Figure 10 below, consists of the following major elements:

- Extractors – remove energy storing mechanisms such as oil, coal or uranium from the natural environment and deliver them to energy producers
- Producers – convert raw materials into energy by burning, collecting, harnessing or otherwise transforming the energy source into electricity, hydrogen or other storage or transmission medium
- Distributors – move the energy from its production location to the location where it is to be used to do useful work
- Users – employ delivered energy to perform work, leaving behind waste materials

- Disposers – collect the waste materials, which may be emissions, materials or other residue, and either use them for other purposes, destroy them or store them

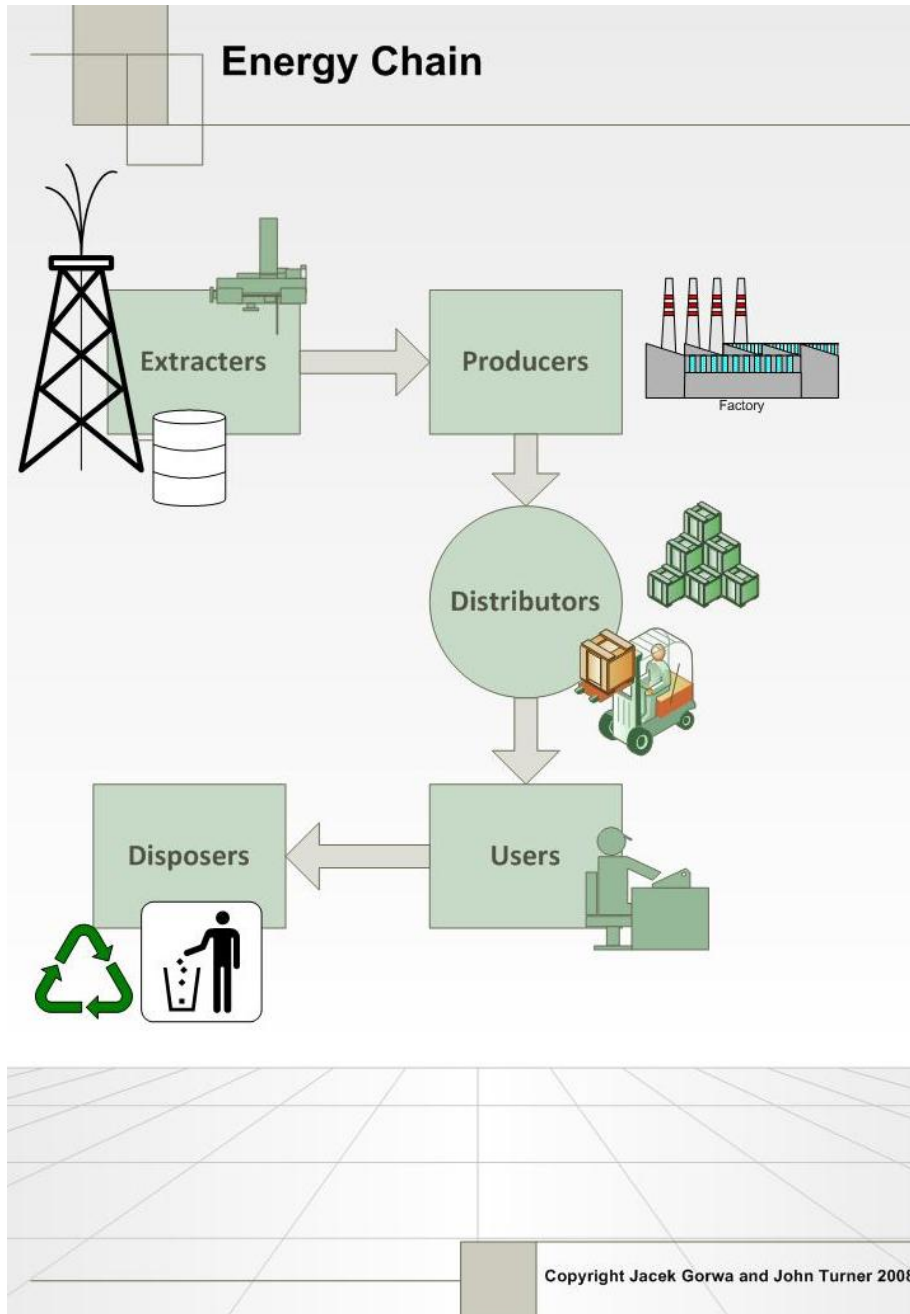


Figure 10 Energy Chain

At each step in the energy chain, energy is used in the process, and GHG emissions may result. Any created product likewise must step through this energy chain, consuming energy and producing emissions at each step. When discussing the energy chain, we refer to *upstream* as being nearer the original source and *downstream* as being near the eventual use and disposal.

The carbon market has a related value chain, as depicted in Figure 11 below and consisting of the following major steps:

- Producers – implement an energy efficiency product, reduce an emission or sequester released CO₂, creating an offset or credit
- Brokers / Investors – either invest in projects, or purchase from producers, aggregating offsets or credits into marketable quantities
- Offsetters / Markets – deliver carbon credits from producers or middlemen to emitters in wholesale or retail quantities
- Emitters – whether organizations or individuals, purchase offsets or credits from any point in the value chain to compensate for their emissions

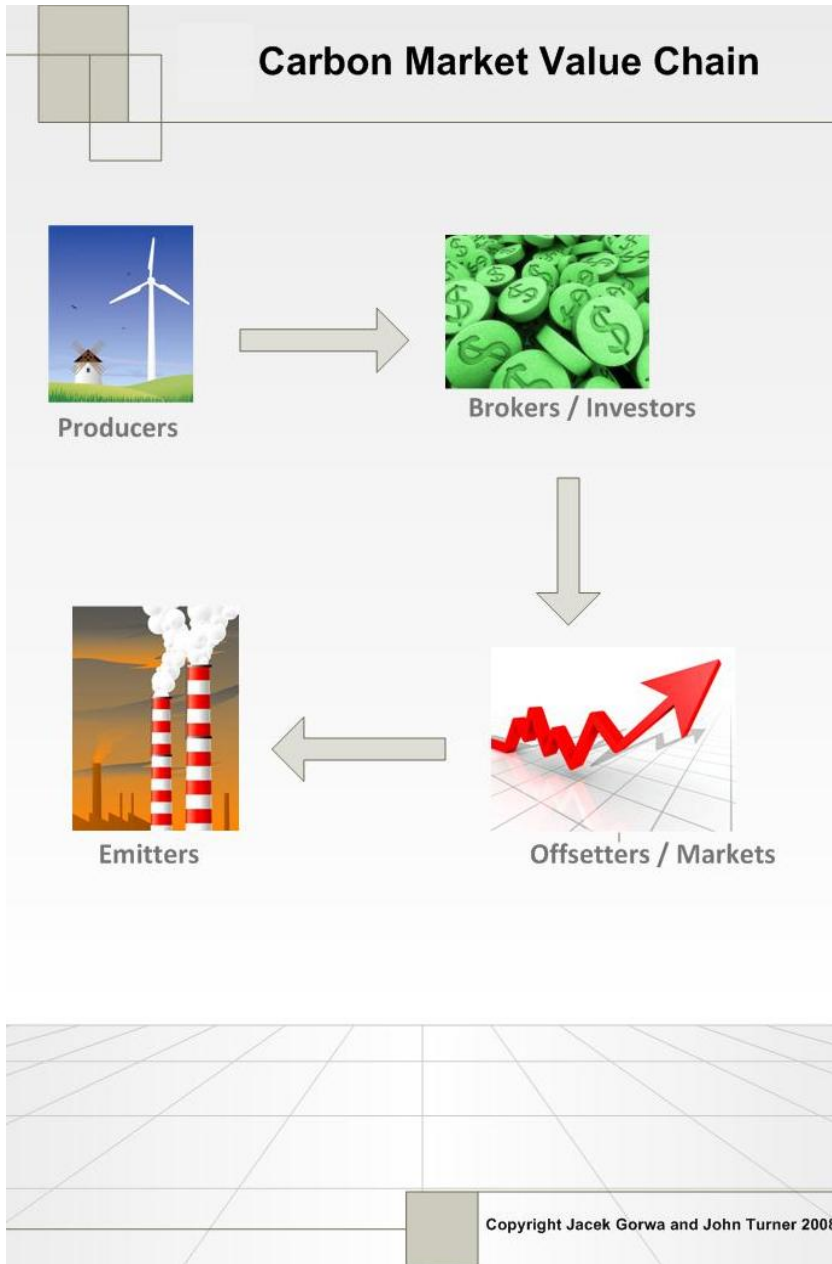


Figure 11 Carbon Market Value Chain

4.2 Voluntary Carbon Market Major Players

The major participants in the voluntary carbon market are the members of the Value Chain described above, with the addition of the certification and regulatory participants. This section will describe the major players in each category.

4.2.1 Suppliers

Suppliers in the market are the “producers” described above. Any organization that generates an offset, either through a clean energy project, carbon sequestration or other means is a potential supplier. The most common project types to date have been:

- Methane capture / gas destruction
- Renewable energy
- Energy efficiency
- Forestry

These suppliers may implement a project and then sell its GHG reduction as an offset, or may market the project’s concept to investors prior to implementation.

4.2.2 Distributors

Distributors can be any of a number of brokers, investors or exchanges that procure offsets from projects.

- Investors - A small number of investors have started to directly fund projects either directly or through funds, including Climate Wedge Ltd. and Mission Point Capital Partners.
- Brokers – Brokers match buyers and sellers of project based offsets (typically VER's), charging a commission on the sale (usually 7.5%)
- Exchanges – perform a similar function to brokers, matching project providers to customers for example CCX and Montreal Climate Exchange.

4.2.3 Retailers

Commonly called offsetters, a large number of for profit companies and non-profit organizations have begun selling small quantities of offsets to individual consumers and small businesses. For example, when booking a ticket with Air Canada, you can add \$16 per ton of carbon to your fare, with credits provided by ZeroFootprint, a Canadian offsetter.

These retailers vary widely in price, quality of offset and reputation. The Carbon Catalog, a website (<http://www.carboncatalog.org>) maintains a list of offsetters. They currently list 85 separate providers, with prices ranging from \$3.50 US to \$45 US per ton. This market is currently quite fragmented, with no clear market leader and a proliferation of standards, offerors, project types, etc.

4.2.4 Customers

The end users of carbon offsets in the voluntary market are companies, organizations or individuals that wish to offset their emissions. Figure 12 below, from Hamilton, et. al (2008) shows the breakdown of 2007 activity by customer type.

<i>Customer Type</i>	<i>Share of Market</i>
Private Businesses	79%
NGO's	13%
Individuals	5%
Governments	<1%

Figure 12: Market Share by Customer Type
(Adapted from Hamilton, 2008)

Private businesses are by far the dominant participants, typically purchasing offsets as part of a corporate social responsibility initiative, for public relations/branding or in preparation for the introduction of regulated markets. The very low participation of governments is surprising and suggests that there is an area for future market growth.

4.2.5 Certifiers/Regulators

The last participants in the voluntary market are not direct participants, but sit outside the value chain to police it. In response to criticism of the quality of some offsets, a number of certification standards have been introduced, including the following:

- CarbonFix Standard – for forestry projects

- CCX Offsets Program – CCX certifies all projects offered on the exchange
- Climate, Community and Biodiversity (CCB) Standards – standard for project design
- The Gold Standard – a standard introduced by the World Wildlife Fund to certify both regulated offsets (CDM’s) and voluntary offsets (VER’s)
- Plan Vivo – a standard designed for small, community-based agricultural and forestry projects
- Social Carbon - a Brazilian program
- Voluntary Carbon Offset Standard – a standard created by a consortium of banks and financial institutions to complement CDM and JI regulations in “pre-compliance” regions
- VER + Standard – certifies both carbon neutrality and offsets
- The Voluntary Carbon Standard (VCS)
- Green-e Climate – certifies retail offset providers

Regulators such as the EU ETS and the UN affect the voluntary markets through the standards imposed for regulated markets and programs. Although not directly a participant in the voluntary market, regulators have great influence on it.

4.3 Voluntary Carbon Market Trends

The voluntary market, although it predates the regulated market by more than 15 years, represents only a small fraction of the total global market for carbon. For 2007, the most recent year on record, the regulated market had a value of just over \$66B, while the voluntary market represented just over \$330M, or about 5% of the total.

Nevertheless, growth in this segment has been impressive, almost trebling in volume and more than trebling in value from 24.6 to 65 MtCO₂e and \$96.7 to \$330.8M dollars respectively. The trend has been exponential, as can be seen in Figure 13 and Figure 14.

	2006	2007
	Volume [MtCO ₂ e]	Volume [MtCO ₂ e]
Voluntary OTC Market	14.3	42.1
CCX	10.3	22.9
Total Voluntary Markets	24.6	65.0
EU ETS	1,104.0	2,061.0
Primary CDM	537.0	551.0
Secondary CDM	25.0	240.0
Joint Implementation	16.0	41.0
New South Wales	20.0	25.0
Total Regulated Markets	1,702.0	2,918.0
Total Global Market	1,726.6	2,983.0

Figure 13 Transaction Volume on Global Carbon Market

(Adapted from Ecosystem Marketplace, New Carbon Finance, World Bank)

	2006	2007
	Values [Million US\$]	Values [Million US\$]
Voluntary OTC Market	58.5	258.4
CCX	38.3	72.4
Total Voluntary Markets	96.8	330.8
EU ETS	24,436.0	50,097.0
Primary CDM	6,887.0	6,887.0
Secondary CDM	8,384.0	8,384.0
Joint Implementation	141.0	495.0
New South Wales	225.0	224.0
Total Regulated Markets	40,073.0	66,087.0
Total Global Market	40,169.8	66,417.8

Figure 14 Transaction Value on Global Carbon Market

(Adapted from Ecosystem Marketplace, New Carbon Finance, World Bank)

4.4 Government Regulations

The regulatory regime surrounding all kinds of carbon markets is rapidly evolving. A number of specific initiatives have been proposed for countries or emitters that are currently under voluntary regimes. This will have impacts on the voluntary market as well.

4.4.1 US proposed regulation

A number of attempts have been made to implement a cap-and-trade system along the EU ETS model in the United States. John McCain and Joe Lieberman have made several, so far unsuccessful attempts, to introduce cap-and-trade legislation in 2001, 2005 and 2007. The 2007 version continues to make its way through congress, calling for a 50% reduction of emissions from 2000 levels by 2050. McCain's opponent for president, Barack Obama, proposes a similar plan, though with more aggressive targets (80% reduction by 2050) and with 100% of permits to be auctioned (vice an unspecified number for McCain). As both candidates support some kind of system, it is a virtual certainty that the US will introduce a system within the next few years.

4.4.2 Canadian proposed regulation

Canada is also making gradual steps towards cap-and-trade, with 5 provinces, including influential Ontario and Quebec, poised to join the Western Climate Change Initiative. The WCI proposes to reduce 2020 emissions to 15% below 2005 levels through a "market-based" mechanism to be finalized by August and likely to be a cap-and-trade system. In addition, BC has become the first Canadian province to introduce a carbon tax, with federal opposition leader Stephane Dion proposing a similar tax.

4.4.3 EU ETS Extensions

The EU has proposed amendments to its legislation to add the aviation sector to the ETS. This controversial initiative would come into effect in 2011 and would apply to all flights to, from or within the EU. This will impact the EU ETS, adding a whole new class of emitter, and will also impact the voluntary market, as commercial aviation is one of the key emitters targeted by offsetters.

4.4.4 UK Proposal for Personal Cap and Trade

One of the more ambitious recent initiatives has been a proposal in the UK to legislate a personal cap-and-trade system. The Department for Environment, Food and Rural Affairs (Defra), has completed a pre-feasibility study into a Tradable Energy Quota (TEQ) system (Defra, 2006-2). This scheme would assign a quota for individuals that would be surrendered at point of purchase for fuel, energy and other carbon producing purchases. The scheme was assessed as being premature as well as generating privacy and equity concerns. In May, 2008, the Environmental Audit Committee of the UK Parliament (House of Commons of the UK, 2008) strongly recommended to the government to continue to move forward on this initiative.

4.5 Market Segments

The carbon market can be segmented on a variety of dimensions. These segments will be further analysed through the survey and used to generate the strategic recommendations below.

The market can be broadly divided into the voluntary segment, where individuals and organizations choose to offset their emissions and the regulated segment, where they

are obligated to do so by legislation. In general, the regulated segment is being well served by the financial services industries, exchanges, brokers and formal verification bodies while the voluntary segment is much more open to new entrants.

The market can be segmented into upstream applications that are aimed at large emitters at the point of production and downstream applications aimed at consumers of energy or products that consume it. In general, the upstream market is easier to serve, as it consists of relatively small number of large emitters, but is less sensitive to market forces, as it is removed from the individual consumer decisions that drive supply and demand.

An additional dimension for segmentation relates to the size of sales. Wholesale participants deal in large transactions closer to the source and rely on aggregation to produce economies of scale, while Retail participants conduct large numbers of smaller transactions with individual consumers or businesses. Prices are much higher in the retail segment, almost certainly reflecting the much higher transaction costs involved in this segment.

Finally, the market can be segmented by the kind of customer served. One segment focuses on individual consumers, who typically interact with providers through websites or as an add-on to another purchase. The other focuses on organizations, which likely represent larger, but more complex sales. The market could be further segmented based on the type of organization, whether business, non-profit or governmental. The next section describes the best strategy for market entry.

5: STRATEGY FOR MARKET ENTRY

There are five competitive forces in an industry (Porter, Competitive Strategy, 1980):

- Threat of entry
- Intensity of rivalry among existing competitors
- Pressure from substitute products
- Bargaining power of buyers
- Bargaining power of suppliers

These forces are discussed in more detail in the next section of this study. To cope with the five competitive forces, there are three potentially successful strategic approaches to competing with other firms in an industry (Porter, Competitive Strategy, 1980):

- Overall costs leadership
- Differentiation of products or services
- Focus on specific market segment

The first strategy can be achieved by pursuing the goal of large production volume and economy of scale that typically requires either large market share or large up-front capital to build large facilities. These requirements are difficult to overcome by a

small start-up company and therefore the first strategy is not suitable for our proposed product.

The second strategy is based on a notion of uniqueness. A firm may create a product or provide a service that is perceived as unique due to its specific features or characteristics in such dimensions as design, brand image, technology, durability, or customer services. Differentiation is a viable strategy that allows firms to earn above average returns because it allows firms to cope with the five competitive forces. Differentiation creates a brand loyalty and insulates firms from competition in an industry. Customer loyalty provides a barrier to entry. Firms that are successful in differentiating their products can command higher price and can realize higher profit margins that allow them to successfully deal with suppliers. Differentiation diminishes the power of substitute products and decreases the bargaining power of buyers as they do not have many comparable alternatives and are typically less price sensitive.

The third strategy involves focusing on a particular buyer group, product segment or geographic location. The main idea of this strategy is that a firm is able to serve its narrow strategic market segment more efficiently or effectively than competitors who compete more broadly. This strategy is not suitable to our proposed trading system as our long-term goal is to have a broad and global audience.

As a result, our strategy of choice is differentiation from existing carbon-offset retailer by offering unique features and benefits to our customers as explained by the proposed personal carbon trading system.

5.1 Proposed Personal Carbon Trading System

Carbonicity is an online “voluntary carbon offsets” management and trading network between individuals (employees) and organizations (employers) to motivate employees to reduce their carbon footprint by allowing them to collect and sell carbon offsets to their employers. By enrolling in *Carbonicity*, individuals will be able to demonstrate how they reduce their own carbon footprint and qualify for carbon offsets by undertaking various initiatives and changing their own behaviour such as using public transportation, carpooling, telecommuting or cycling to work.

As an online network, *Carbonicity* facilitates the process of trading carbon offsets for organizations (employers) that are interested in improving their reputation, meeting corporate social responsibility standards, and reducing their corporate carbon footprint by buying carbon offsets from their employees. The trading may cross-organizational boundaries allowing companies to buy carbon from employees from other participating organizations. Additionally, individuals from participating organizations may also become potential buyers of offsets to reduce their own carbon footprint. *Carbonicity* network will include interfaces to social networks such as Facebook to allow individuals to access their *Carbonicity* accounts and services.

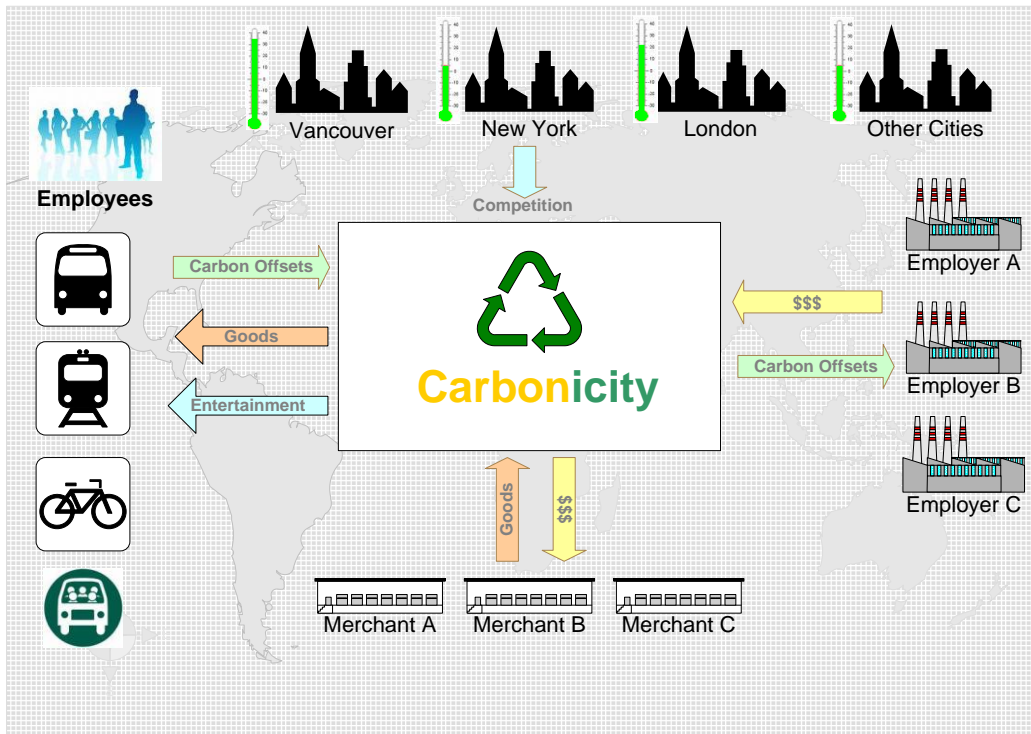


Figure 15 Carbonicity – Overview

The network will include a number of merchants who may offer either discounted merchandise (using the discount as a carbon offset) or exchange the merchandise for carbon thus reducing their own carbon footprint. Ideal merchandise includes products that sell for relatively small amount such as digital songs and videos, electronic books, or phone rings. Merchants may offer gift cards that can be loaded with carbon points and used at retail locations or online e-commerce sites. The network will be appealing to merchants offering and promoting “green” products that are environmentally neutral and have been made according to corporate sustainability and social responsibility standards.

The market value of 1tCO₂e ranges from \$5 to \$33, but on average has a value at \$25 on the voluntary carbon market. To support trading liquidity and increase

motivational factor, Carbonicity will translate each carbon offset into 10 carbon points thus making each carbon point worth \$1. On average, a participating individual should be able to generate from 1 to 2 points a week. For example, taking a public transportation twice a week, can result in annual savings of 2 carbon offsets (2 x 25 = 50 carbon points) each year. Assuming 50 working weeks in a year, the commuter in our example could generate one carbon point each week, which is enough to purchase a new song every week. Alternatively, carbon points can be aggregated and saved allowing individuals to purchase other merchandise, receive discount on car insurance, or sell the points to their employers or other individuals.

Summarizing, Carbonicity can be described as a whole product that provides one-stop shopping for individuals to measure their own personal carbon footprint, generate, manage and trade their personal carbon offsets. Carbonicity network is positioned as a “broker” and “market” in the carbon market value chain as shown in Figure 11. Carbonicity connects employees with employers by aggregating offsets produced by individuals who take “green” transportation mode to work and selling those offsets to employers who reduce their own emissions by purchasing carbon credits from their own employees.

5.2 Verification

Carbon offsets will have 3 levels of certification with corresponding weights: bronze (honour system, 0.5 carbon point), silver (confirmed by a friend, 0.75 carbon point), gold (confirmed by employer, 1.0 carbon point). GPS-based verification will not be implemented because it does not represent a viable option based on responses we

received to our surveys. Survey results are discussed in later sections of this paper. Depending on the certification level of generated carbon offset, individuals will receive a proportional amount of carbon points. The system will leverage the trust that already exists within organizations to discourage cheating. Employers already place great trust in their employees, allowing them to execute contracts, approve purchases and certify their own working hours through timesheets completed on a similar trust-based system.

Carbonicity will also employ the concept of “green” competition between various divisions within a company, different companies, or different cities, all trying to generate more carbon offsets to be listed as the top organizations in various categories. The online real-time dashboard hosted on Carbonicity web site will display the top individuals, companies, and cities competing in different categories. Carbonicity will be internationalised (offered in many languages) and scalable to allow rollout to any major city in North America, Europe and Australia and later other parts of the world.

5.3 Target Market

Our proposed system is targeting the individual or personal segment of voluntary carbon market, offering voluntary “gourmet” carbon offsets that provide an additional value beyond simple environmental responsibility.

For organizations, this will provide an alternate source of carbon credits to the existing voluntary offset market, which has been marred by controversy. Organizations will meet their “carbon neutral” or carbon reduction pledges by investing in their most valuable asset – their employees.

For individuals, we seek to offer tangible and enjoyable benefits as a reward for a reduction in personal carbon footprint. Uniquely, we will do this by aggregating individual offsets and selling them to the organizations that employ them. Specifically, Carbonicity will employ a points-based reward system, allowing participating individuals to trade these points for a variety of goods and services.

Our marketing efforts will be focused on younger consumers from the so-called Generations X and Y. Our survey results confirmed that 80% of respondents in “green” commuters group are under the age of forty-four. This demographic group combines a heightened awareness of the importance of environmental responsibility with the necessary computer and social network skills required to participate in an offering like Carbonicity. A group of “green” commuters typically includes 10-25% of workforce as shown by results from our survey. We estimate that in North America alone, a niche market of 75,000 eco-conscious commuters would be willing to participate in an environmental awards offering such as our product. This number includes only employees working for our initial group of early adopter organizations. The number of potential customers using our trading system is much bigger, but our initial focus is on a niche market that includes mid-size and large organizations not impacted by cap-and-trade regulations and not participating in the regulatory carbon market. We intend to dominate this market by offering a whole product with features not offered by our competitors such as entertainment, connectivity, personal carbon generation, management and trading.

On the buying side, our customer base includes organizations that would be willing to purchase carbon offsets from their employees. There is large number of organizations that either purchase carbon offsets at the current time or have pledged to do so in the next several years. Our focus is on a group of organizations that might have a compelling reason to use our system as their corporate goals are aligned with the goals of our proposed trading online market. This group of companies include:

- Insurers (e.g., ICBC), who gain by reducing number of claims that accompanies a reduction in total driving
- Energy producers (e.g., BC Hydro, Terasen Gas) who are actively supporting programs to reduce energy consumption
- Government organizations, including federal, provincial and municipal governments, who are increasingly competing amongst themselves for greater and greater environmental credibility
- Environmentally conscious organizations (e.g. MEC, REI, Sierra Club) who see emission reduction as a core value

For these organizations, we will provide a variety of intrinsic and extrinsic benefits, including the following:

- increase in organization's "green" reputation
- engagement of employees in green initiatives at home and at work, while providing tangible benefits to these employees
- achievement of compliance with stated Corporate Social Responsibility (CSR) or sustainability goals

- reduction in the organizational carbon footprint within that organizational ecosystem

Our survey results also demonstrated that majority of mid-size and large companies would be interested in using personal carbon offsets generated by employees as a source of offsets used against corporate carbon footprint. The survey results indicated that any for-profit mid-size or large organizations that are not currently under some regulatory regime to reduce their carbon footprint on regulated market might be interested in participating in our voluntary trading market.

Our market strategy is to offer the system to any company interested in using it located in a selected metro area that has political leadership committed to reduction of carbon emission. Greater Vancouver area meets the above outlined criteria. The provincial government has announced a legislation to implement cap-and-trade system for a number of government sectors. City of Vancouver and other municipalities are working hard to promote their green image and improve standard of living by making an effort to protect the environment. By targeting organizations located in one metro area first, Carbonicity could bootstrap its network and reach critical mass to become the online destination of choice for commuters from various Vancouver-based companies.

Additionally, large participation in one local market could facilitate a concept of competition among commuters from various organizations. Other metropolitan areas that are great candidates for market penetration may include major cities on the West Coast participating in Western Climate Initiative and include Vancouver, Seattle, Portland, San Francisco, Los Angeles, San Diego, Phoenix, and Las Vegas.

We have received especially favorable feedback from large organizations in the following industries in Metro Vancouver: municipal governments, financial, transportation and insurance. Within this local market, we will focus initially on industries that have a stake in using our online personal carbon trading system. Among financial institutions, the response from a couple of credit unions was strongly favorable.

This response confirms that credit unions plan to take similar path as the one Vancouver City Savings Credit Union has taken by becoming carbon neutral and offering “green” services to its members as a strategy of differentiation from its competitors, especially the major Canadian banking institutions. Among insurance companies, a very positive response was received from companies offering travel, road assistance and healthcare insurance. Healthcare insurance companies would benefit from marketing our system to their patients by discouraging individuals from driving alone and promoting more active forms of commuting such as walking, cycling or taking public transportation to work. Property insurers have a stake in fighting climate change that can cause devastating damages due to increasing number of forest fires, hurricanes or floods. Auto insurance have vested interest in reducing number of trips the policy holders take to reduce the risk of accident and number of claims. Public transit companies would benefit from enrolling their employees and prompting our network to increase rider ship numbers.

Our survey showed that approximately 25% of our respondents representing the workforce in Greater Vancouver uses “green” commuting alternatives to travel to work. As reported by Invest British Columbia, there are 300,000 million workers in Finance,

Insurance, Real Estate & Leasing, and Professional, Scientific Services sectors in British Columbia with a majority of organizations concentrated in Metro Vancouver area. Using 25% rate, there are 75,000 “green” commuters in these sectors of economy. This group of commuters would become our initial group of early adopters.

5.4 Revenue Model

Our revenue model will be primarily based on transaction fees on the buying and selling of offsets within our network. For the average individual participant reducing their footprint by 5 tons annually, this \$125 transaction would result in direct revenue of 10% commission of \$12.50 per user in 2008, growing as the value of carbon offsets grows to \$50 per 1MtCO₂e in the future to a predicted \$25 per user by 2013. A large number of users trading personal carbon credits online at Carbonicity will allow for additional revenue from online advertising. Facebook with 80 million users earned 125 million in advertisement revenue in 2007 that translates into approximately \$1.5 per user per year. Having 75,000 users on Carbonicity by supporting the early adopter organizations, our annual revenue could reach $75,000 \times (12.50 + 1.50) = \$1,050,000$. This is the projected revenue from implementing the system in one metropolitan area of Metro Vancouver. Other metropolitan locations on the West Coast could generate higher returns due to their larger populations.

5.5 Distribution

Our early adopter organizations such as auto insurance companies, energy utilities, and “green” retailers may not only install our system for their own employees,

but also promote it to their customers (distribution channel) who later may approach their own employers to implement our system inside their organizations. Carbonicity will offer incentives for individuals to act as Carbonicity Agents to present this idea to their employers for a small commission. Individuals will learn about our system from sponsored ads on Facebook and other social networks to promote our Facebook applications that can be incorporated into Facebook profile (Figure 16).

Distribution Channel	Customers
Internet Advertisement	Individuals
Insurance Brokers, Agents and Promotion	Individuals
Customers of our early adopters approaching their own employers	Corporations
Direct Sales	Corporations

Figure 16 Carbonicity – Distribution Channels

5.6 Competition

The market for voluntary carbon offsets is growing approximately 100% annually and the industry is characterized by a large number of small firms. This situation is typical of a new and emerging industry that over the years will mature and probably include a smaller number of bigger firms. At this time, the competition is not aggressive, as there seems to be room for any firm that tries to provide products or services in the new emerging market. Most of these firms typically invest in projects that generate carbon offsets, which are then verified to a various degree and offered to individuals or organizations.

Because of our research, we found one company that is building a green community for Canadians who want to take personal action to reduce their CO2 emissions. Currently The Good Life community has 14,000 members. Each member can commit to personal actions to reduce greenhouse gas emissions and invite or challenge friends and family to take similar actions. Members will also be able to see the total CO2 reductions across Canada and by province, to see their part in this bigger commitment to making change. The Good Life community offers a similar concept of competition between communities based on CO2 reductions. However, the Good Life does not support a concept of carbon offset trading, verification and providing connection between employees and participating employers that is the cornerstone of Carbonicity network.

A company that probably matches our idea the most is Teletrips Management Services. Teletrips is a Calgary-based company that assists communities that want to establish programs that promote increased use of telecommuting by creating financial incentives for businesses that allow appropriate employees to work from home at least one day a week. By calculating the reduced kilometres travelled by the employees of a business through the company's custom software, the business will earn emission credits that can be traded into existing stationary markets, or into open market systems. Teletrips is limited to using telecommuting as a source of emission credits whereas our proposed system includes all types of "green" commuting options. Additionally, our system gives individual employees the right of ownership of mobile emission reduction credits and freedom to trade, exchange or save them for future use. Teletrips transfers the ownership of emission credits directly to businesses who allow employees to telecommute.

Indirect competition may come from organizations that plan to develop similar system internally. One of the respondents to our corporate survey indicated that it plans to build a system to collect metrics and calculate emission reductions because of “green” commuting options. However, such a system is limited to one company and does not provide an opportunity for participating organizations to create a larger community of “green” commuters from other locally based organizations. Participation in a network that includes other organizations allows corporate members to share metrics and introduce a concept of “green” competition to provide entertainment value to participating employees. Additionally, by providing services to a number of organizations Carbonicity will have an edge by realizing cost savings of economy of scale and scope by incorporating and sharing the best ideas implemented by communicating with many corporate clients.

Many sites offers online carbon footprint tracking services. These competitors attempt to generate traffic to their websites and sell online advertisement. Carbonicity differs from this group of competitors by offering services to accumulate and trade reward points.

Carbonicity also competes with a number of carbon-offset retailers such as Offsetters and other better known carbon retailers in a voluntary carbon market:

- AtmosClear Climate Club (MA, USA) www.atmosclear.org – allows individuals and businesses to buy offsets from various projects
- Atmosfair (Germany), www.atmosfair.de – provides offsets for GHG created by air travel

- Certified Clean Car (San Francisco, CA), www.certifiedcleancar.com – enables drivers to offset carbon emissions by purchasing Renewable Energy Credits (RECs) from Chicago Carbon Exchange (CCX)
- Clean Air Pass (Toronto, CA), www.cleanairpass.com– enables individual and business to purchase carbon offsets from a number of sponsored projects
- Drive Green (Dublin, Ireland), www.drivinggreen.com – allows individuals to offset emissions from driving
- Greenfleet (Victoria, Australia), www.greenfleet.com – plants trees to offset car emissions from individuals and corporate and government fleets
- TerraPass (Menlo Park, CA), www.terrapass.com – offers motorists a way to offset their car emissions through the purchase of emissions offsets which it purchases on CCX
- Offsetters (Vancouver, BC), www.offsetters.ca, – Offsetters Climate Neutral Society is a not-for-profit organization registered in Canada and offers carbon offsets to businesses and individuals
- Carbon Credit Corp (Vancouver, BC), www.carboncreditcorp.biz – provides comprehensive technology solutions, consultancy and services related to GHG emissions and climate protection
- Teletrips (Calgary, Alberta) www.secure-teletrips.com -- Teletrips Management Services will assist businesses and communities to calculate the reduced kilometres travelled by the employees because of telecommuting. Businesses will earn mobile emission credits that can be traded into existing stationary markets, or into open market systems.

What distinguishes Carbonicity from other retailers is its unique combination of various attributes as demonstrated in Figure 17. Strategy canvas is an analytic framework that is central to value innovation and the creation of “blue oceans” (Renee Mauborgne, Chan Kim). The canvas demonstrates unique the value proposition of our personal carbon trading system compared to competitors.

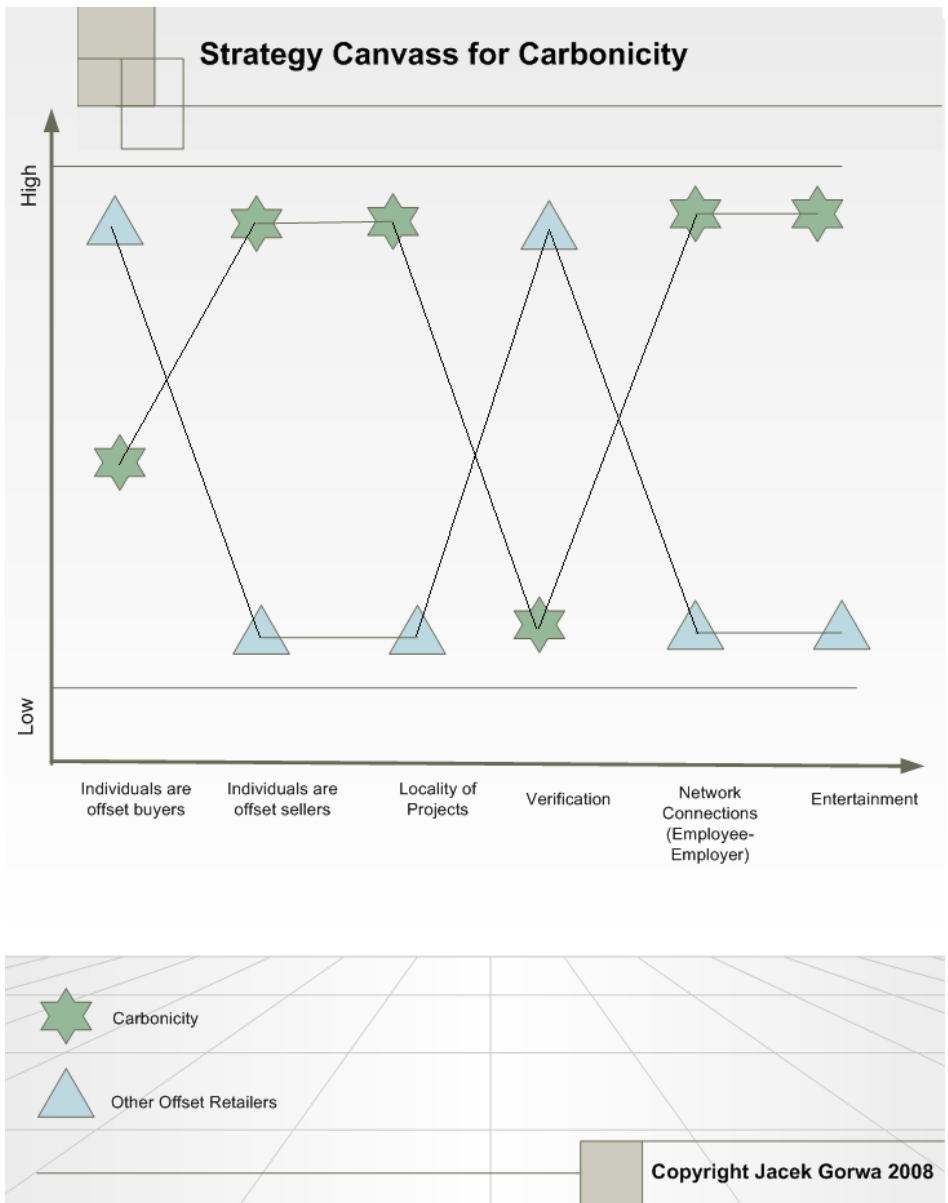


Figure 17 Carbonicity – Strategy Canvas

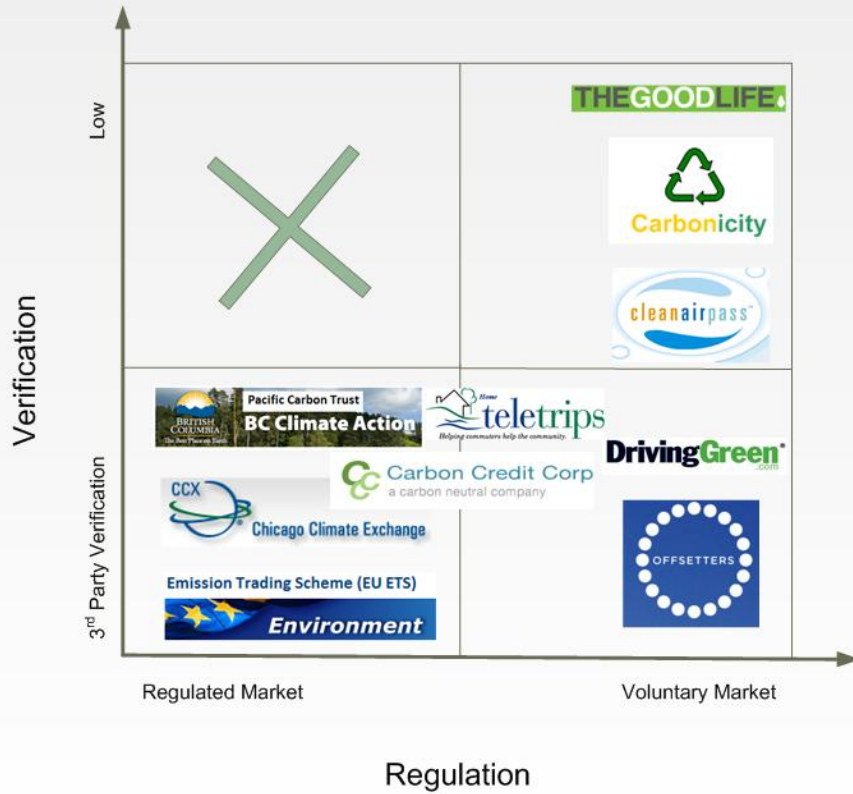
Most of our competitors look at individuals as offset buyers. Carbonicity allows individuals to measure, collect, and trade offsets for various rewards offered by employers. As our survey results show, offset generation by employees is appealing to employers due to its locality factor. The environmental impact benefits the local

community rather than being claimed by remote projects that often are located in Third World countries. The majority of offset retailers offer carbon credits verified by third-party verification companies such as e-Green, whereas Carbonicity relies on credibility established by employee-employer relationship. This link between employees and employers is something unique that no competitor currently offers. The concept of providing competition between various departments within a company, between various companies or between cities is another important attribute that other offsetters lack as they mostly appeal to eco-conscious consumers with a message of dangers of long-term climate change effects. This strategy can be short-lived as consumers may become fatigued and desensitised after hearing doomsday messages over longer period.

Another differentiator that distinguishes Carbonicity from other retailers is our unique positioning along verification and regulation dimensions as demonstrated in Figure 18. Carbonicity is not intended to compete in regulated market. In voluntary market, it is positioned as provider of offsets that have low level of verification. Almost all offset retailers have some sort of third- party verification to increase credibility of their product. Carbonicity, on the other hand, relies solely on employee-employer relationship as the verification factor making carbon offsets a credible product that has mostly marketing value to corporate buyers. Regulated markets require certification, registration and third-party verification before offsets can be traded and all companies. The market for low-level verification carbon on regulated market does not currently exist. This quadrant on the diagram is marked by an X.

Sunday, August 03, 2008

Positioning of Carbonicity



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Figure 18 Carbonicity – Positioning according to Regulation and Verification

5.7 Substitutes

Some individuals and organizations may contribute to reducing carbon footprint and helping the environment in many different ways and may feel that their participation in Carbonicity is no longer necessary to reduce their carbon footprint. Some of the substitutes for our product are as follow:

- Regulatory Carbon Market – businesses may purchase carbon offsets on the regulatory market for example from the European Climate Exchange.
- “Green” products and services – by offering products that were made by not harming the environment, businesses may claim compliance with Corporate Social Responsibility obligations and may not feel it is necessary to buy additional offsets. By paying a premium for “Green” products and services, individuals may feel that they have done their duty to help the environment and may not feel obliged to commit more resources at reducing their own footprint.
- Energy and Emissions Reduction – individuals and businesses may feel that their effort in reducing energy consumption and emissions, for example, by purchasing a hybrid vehicle or installing fluorescent bulbs, makes sufficient positive impact on the environment that no further purchase of offsets is necessary.
- Renewable Energy Credits – despite some resistance to converting renewable energy credits to carbon offsets, this practice is widely accepted. Organizations may choose to purchase “green” power from sources such as wind or solar power and calculate the amount of emissions reduced in comparison to the same amount of energy produced by standard fossil fuel burning power plants.

The power of substitutes can be characterized as strong. Buying carbon offsets to reduce a carbon footprint is only one way to help the planet. Customers could rightly conclude that any of the listed above substitutes makes a positive impact on the environment and reduces the need for carbon offsets.

5.8 Customers and Suppliers

In the context of Carbonicity network, we could look at employees commuting to work “efficiently” as suppliers generating carbon offsets and think of organizations buying those offsets as customers. The power of both customers and suppliers is very strong. The whole notion of a voluntary market is that customers (employers) make a voluntary choice to buy the product that is produced by employees participating on a volunteer basis as well. The challenging response to neutralize customer and supplier power is for Carbonicity to provide some appealing and compelling reasons for both the customers and suppliers to participate in the Carbonicity network.

Some of the attributes on our Strategy Canvass (Figure 17) could act as strong incentives to join the network: locality of carbon offset generation, connection between employees and employers, 3rd party validation for marketing value of “green” image, and entertaining aspect of competition between different departments, organizations or cities. The main advantage or reason for customers and suppliers to participate in the network, however, is administrative. Carbonicity will earn customer’s loyalty by providing simple, intuitive, and fun to use interface that is better and less costly than employers could build in-house. As a further barrier to entry/ substitution, the network introduces some

switching costs by allowing users to build sophisticated profiles, accounts, and contacts that are not easily transferable.

5.9 Competitive Barrier to Entry

There are seven major sources of barriers to entry (Porter, 1980):

1. **Economies of Scale** – economies of scale refer to reduction in unit cost because of high production volume. This barrier to entry forces the new entrants to come in at large scale and face retaliation by incumbents or come in at small scale and risk cost disadvantage. The local competitive aspect and brand recognition act as scale factors for Carbonicity. Both employers and employees will want to participate in a well-recognized market. By signing up large early adopters, the costs of development will be recovered relatively early.
2. **Product Differentiation** – product differentiation means the incumbents have strong branding power and customer loyalties. Differentiation creates a barrier to entry by forcing companies that wish to enter the market and spend heavily on advertisement to convince customers to switch their loyalty. Being a strong local first mover will provide differentiation advantages for other players to overcome.
3. **Capital Requirement** – the requirement to invest up-front a large sum of capital creates a barrier to entry. This is especially true if the up-front investment is a sunk cost that is difficult to recover in case if the market penetration is unsuccessful and new entrants wish to withdraw from the market. Such investment may include risky advertisement or research and development cost. This is not a major barrier in this market.

4. **Switching Costs** – a barrier to entry is created by one-time costs facing the buyer who decides to switch from one supplier to another. For example, changing computers from Wintel platform Apple's Macintosh computers would potentially require a new investment in business applications and additional training of users and technical support staff. Switching costs from one provider to another will be a function of the level of interaction with the network. As mentioned earlier sophisticated user profiles, competitions within the firm and between firms, accounts and contracts will increase switching costs.
5. **Access to Distribution Channels** – a barrier to entry can be created by the requirement that the company entering the market needs to secure distribution for its product. The new entrant must persuade and provide incentives to distributors to accept its new product despite the fact that the existing distribution channels have been served by the incumbents. In case of social networks, once the critical mass is reached, the incumbent may realize advantages of network effects, making it very difficult for the new entrants to convince customers to switch.
6. **Cost Disadvantages Independent of Scale** – established firm may have cost advantages related to proprietary technology, favourable locations, government subsidies, or learning or experience curve. Those advantages may be difficult for new entrant firms to replicate no matter what is their size. For example, Carbonicity may establish strong relationships with other Vancouver-based organization by offering a service that will benefit local communities.
7. **Government Policy** – some of the industries are heavily regulated. Government can limit the number of firms competing in selected markets by limiting the

number of licenses that it issues or by controlling the access to raw materials. Government policy is often implemented to realize some social benefits. For example, pollution control may require energy producers invest heavily in order to meet high environmental standards.

In contrast to regulated carbon market, the voluntary market is not currently regulated by governmental agencies or policies. Our product is positioned in a voluntary market to avoid formality of carbon offset registration and verification that stems from strict regulatory regime governing the regulatory market. Our main approach to create a barrier to entry needs to fit the overall strategy to compete in the voluntary carbon market. As discussed earlier, our strategy of choice was differentiation. Using differentiation as a method to create barrier to entry seems to be a natural choice.

All of the competitors treat individuals as potential buyers of offsets generated from various projects or purchased on carbon exchanges. Our offering is unique in treating individuals as a source of carbon offsets. For organizations, we offer the opportunity to procure carbon offsets not from a project in some distant part of the world, but from their own employees, creating an enormous “win-win”. Additionally, our competitors rely on “guilt factor” and appeal to individuals to take action and purchase offsets a way to address the issue of climate change.

This strategy is prone to a “fatigue factor” as individuals are likely to become insensitive over time to “remote problems in the next 50 years” and will be pre-occupied with the daily routine tasks. Our offering is unique because it targets so called “gourmet carbon” market where individuals are attracted to our product not only because it helps

the environment, but also because it offers additional value that is entertainment and competition. By collecting points and having real-time dashboard, individuals will be able to compete against each other to offsets their carbon footprint. The collective effort of employees may be aggregated to represent an effort of the whole business organization, thus allowing one company to compete against other companies for the title of corporate “green” champion. The collective effort of companies in one city may be aggregated to allow cities to compete against each other. The main barrier to competition is primarily the network effect.

Once individuals use our system and start collecting and trading our points, the system will be highly “sticky” and will reward loyal customers, thus requiring customers to make a significant effort to switch to a potential competitor. As more companies join the Carbonicity, the more individuals will be attracted, and the more companies will be interested in participating thus providing a “viral” aspect that will help grow the participation in the network.

6: INTRODUCTION TO SURVEY RESEARCH

A survey was conducted for the purpose of gaining insight into voluntary carbon credits market and measure the effects of various incentives on commuting habits of individuals, but especially the incentive of providing cash rewards for “green” commuting. Cash rewards could be offered by employers to their employees as a reward for not driving alone and promotion of taking alternate means of transportation to commute to work and reducing emissions. Such reductions could be expressed as carbon offsets and valued at current market price of typically \$25 per metric ton of CO₂ equivalent (tCO₂e). By purchasing carbon offsets from their employees, organizations could claim reduction of their own corporate carbon footprint. The study aims to gain understanding if individual commuters and organizations are interested in participating in proposed system to collect, measure, monitor and sell personal carbon credits to corporate buyers.

Additionally, the goal of the survey is to learn what level of verification of employee commuting data the participating organizations are willing to accept as well as the level of inconvenience when dealing with verification process and the time entering commuting information into the system. To find answers to these questions, our research was done by following well-defined phases: planning, data gathering, and results analysis.

6.1 Survey Planning

Before any results were collected, investigators spent considerable amount of time planning and thinking about various aspects of the study such as approval, study objectives, stakeholders, respondents, evaluation methods and results.

6.1.1 Ethics Approval

To comply with research policy of Simon Fraser University and to satisfy requirements demanded by our sponsor, research organization MITACS, investigators applied to Office of Research Ethics for approval of our survey. The approval process was formal and time consuming. After approximately 4 weeks, our surveys were approved (Figure 107) and were ready to be sent out to potential individual and corporate respondents.

6.1.2 Research Objective – Employees

The purpose of our research aimed at individuals is to:

- Learn about awareness and familiarity with concepts of carbon footprint and carbon offsets among individuals.
- Determine if employees are willing to register, collect and monitor their commuting data when using various forms of transportation when commuting to work such as riding a bike, walking, carpooling, or taking public transportation.
- Find out expected monetary benefits required to offset certain levels of inconvenience imposed on individuals who are asked to use online system to manage their commuting information.
- Find out preferred method of verification of commuting data.

6.1.3 Research Objective – Employers

Our research aimed at organizations was designed to answer following questions:

- Are organizations willing to purchase carbon offsets on voluntary market from their employees?
- What level of carbon offset certification corporations are willing to accept?
- Are organizations looking for one or many sources of carbon offsets?
- What is the underlying reason for purchasing carbon offsets on a voluntary market (social responsibility, public relations, marketing strategy to promote green products, etc)?
- Are organizations interested in rewarding (as part of their Corporate Social Responsibility or marketing budget) employees for reducing their personal carbon footprint by “green” commuting to work?
- What kind of verification is required to make emission reductions by employees credible?
- Are organizations interested in using a third party web-based online system to collect and manage this type of information?

6.1.4 Stakeholders

This study is done as part of BUS780 course according to academic standards established by Simon Fraser University. Additionally, this research is sponsored by MITACS and partner organization LEHOO Software Inc. MITACS will benefit from the research by gaining insight into an emerging voluntary market of personal carbon offsets. The partner organization, LEHOO Software Inc will benefit by sponsoring market research that may result in discovery of opportunity that could potentially be

commercialised. Participating organizations will benefit by having access to final survey results.

6.1.5 Sample

The only restriction imposed on our selection criteria for individual respondents was age. Only individuals 18 years and older were asked to participate in our study. Corporate respondents were selected from the list of BC's Top 100 Public and Private companies. Additionally, investigators contacted other organizations including some small and medium size businesses, educational institutions and GVRD organizations to have a better spectrum of participating companies.

6.1.6 Results

The Individual survey was turned off once one hundred twenty five responses were collected. The Corporate survey received thirty submissions, a number required to make our survey sample statistically credible. Results were collected by survey tool provider, Survey Monkey (www.surveymonkey.com) and exported to Excel file for data analysis. Survey results will be published in SFU library as part of this research paper and will be accessible to both corporate and individual participants for viewing.

6.1.7 Method Selection

Investigators looked at various study methods and considered pros and cons of each one before deciding to use surveys, interviews and conjoint analysis as the methods of choice:

- Focus group is a group of similar individuals who provide information during a directed and moderated interactive group discussion. This method is the best for gaining insight and changing practices, but it is difficult to administer due to a number of logistical challenges such as: scheduling appropriate venue, finding the same time that is convenient for a number of people, and hiring experienced facilitator.
- Interview is a directed conversation with an individual using a list of questions designed to gather extended responses. This method is the best for gaining insight and changing practices, but it is limited due to difficulty in reaching a large number of respondents and substantial effort dedicated to contacting participants and arranging an appointment in their busy schedule, especially corporate respondents.
- Observation is the systematic observation of processes or operations using checklists, narrative comments and ratings. This method is the best for gaining insight and changing practices. Its difficulty is medium, but requires investigators to dedicate substantial amount of time to participate in experiments.
- Survey is an ordered series of questions administered to individuals in a systematic manner. This method is the best for gaining insight, changing practices and measuring effect. Its difficulty is medium as it is not very hard to prepare questions and publish them online for web-based access. The advantage of using surveys is an opportunity to target a large group of respondents who can provide answers off-line in their own suitable time.

- Conjoint Analysis requires research participants to make a series of trade-offs which will reveal relative importance of component attributes. This method is difficult to administer, as it is relatively difficult to structure questions in a way that is easy for respondents to understand and answer.

Interview, survey and conjoint analysis were chosen as study methods of choice. Interviews allowed us to gather qualitative information from respondents who had real business experience and could provide feedback about feasibility of our proposed online commuting management system. Surveys allowed us to target a large number of organizations and individuals and obtain quantitative results in very structured form. Conjoint analysis was used to determine utility value of various attributes of our proposed commuting management system.

6.2 Survey Data Collection

6.2.1 Surveys

Two studies were conducted. In one study, individuals were contacted via email (Figure 62) and were asked to click on a link to reply to an online survey that included questions specifically tailored for employees commuting to work. Individual respondents were selected from various sources such as mailing lists of current and former students at SFU Business School, investigators' personal contact lists, and respondents to an online advertisement placed on Facebook social network (Figure 108).

SFU mailing lists exposed our survey to disproportionately large number of highly educated individuals. Investigators' personal contacts also included mostly

individuals with a Bachelor's degree or higher. However, the responses received by publishing an online advertisement on Facebook social network allowed us to gather more than 75% of responses from individual respondents from all brackets of educational spectrum. As discussed in Data Analysis section, investigators filtered submitted responses based on the educational level to look separately at responses from individuals who indicated their level of education as Masters or higher and those who selected other levels of education.

Facebook Ad exposed the survey mostly to users who frequently visit the social network. The demographics of Facebook audience not surprisingly includes mostly young and technically savvy individuals who embraced various aspects of online community such as online collaboration, blogging, online sharing of music or pictures, and instant messaging. Even though the demographics of Facebook users do not correspond to overall demographics of British Columbia, the data we collected is very valuable to our research as the Facebook audience that finds social networking valuable is likely to find our proposed online personal carbon and commuting management system appealing as well.

A separate survey was created to target corporate audience. Investigators phoned BC's Top 100 Public and Private companies asking for either phone number or email address of someone responsible for environmental affairs or social corporate responsibility. Received contact information was used to send email messages with a link to an online corporate survey (Figure 63). Shortly after initial email solicitation, investigators followed up by email or phone to confirm that respondents submitted their data. The following organizations participated in our study: TELUS, ICBC, NGrain,

Teradici, West Fraser Timber, TERASEN Gas, Northgate Minerals Corp, MEC, BCAA, Sky Train, Flight Center, North Shore Credit Union, Washington Marine Group, Cost Capital Savings, School District 45 in West Vancouver, Adult Learning Center in New Westminster, UBC, BCIT, BC Ferries, City of Vancouver, The Great Little Box Company, Vancouver Airport Authority, and Vancouver Coastal Health.

Out of 200 companies, we have received 30 responses resulting in a return rate of 15%. Both the individual and corporate surveys were designed and implemented using Survey Monkey, a survey tool provider based in Portland, Oregon. Survey Monkey offers a number of features we could not easily find anywhere else such as:

- ability to edit logic to control flow of questions depending on the answer of the previous question
- ability to define customized filters to select responses based on the answer to specific questions thus allowing to look at data based, for example, on demographics
- ability to customize reports and display only questions of interest
- ability to export survey results to Excel spreadsheet

6.2.1.1 Survey Questions

All questions from individual survey are documented in the Appendix section (Figure 64 - Figure 71). Similarly, (Figure 85 - Figure 88) show all questions from the corporate survey.

6.2.1.2 Survey Timing

Results from individual surveys were collected between June 21 and July 07, 2008 until we reached 125 responses and the survey was closed. Results from corporate survey were collected between June 28 and July 21 until we reached 30 responses and the survey was closed as well. Results of individual survey are shown in the Appendix section (Figure 72 - Figure 84). Similarly, the results of corporate survey are shown in the Appendix section (Figure 85 - Figure 93).

6.2.2 Interviews

Interview data was captured manually during interviews in the form of interview notes. Some interviewees requested that interview notes were sent to them for approval to allow them to make changes if necessary. Interviewed organizations requested that only amalgamated results be published without emphasizing individual responses. The following representatives from various organizations were interviewed:

- Gary Miller, Manager Environmental Services, ICBC
- Bena Luxton, Manager Environmental Services, ICBC
- Gerri Sinclair, Executive Director, Great Northern Way Campus
- Gabe Batstone, VP Sales and Marketing, NGrain
- Dane Duvall, CFO, Cellfor
- Ian Neville, Environmental Manager, Terasen Gas
- Harold Bent, Environmental Manager, Northgate Minerals
- Cindy Macdonald, Environmental Affairs Manager, Westfraser Timber
- Cara Young-Minichiello, Environment and Communications Manager, The Great Little Box Company

- Bernice Paul, Sustainability Coordinator, BCAA
- Allen Bridge, Regional Director of Environmental Management, Vancouver Coastal Health
- Sean Pander, Climate Change Project Manager, City of Vancouver

Interviews were used to discuss issues that were not covered by questions on the surveys which participating companies were asked to complete. The main objective of interviews with corporate respondents was to learn about their current and future plans to reduce their carbon footprint either by in-house reductions or by buying carbon offsets from third-party projects. Additionally, we tried to take advantage of the vast business experience of our corporate participants and brainstorm with them the feasibility of our proposed concept of getting organizations to buy carbon offsets from their own employees. The feedback we received from business leaders was invaluable as it allowed us to understand some of the real challenges organizations face today to reduce their own carbon footprint and the real challenges our team would face to address these issues.

7: DATA ANALYSIS – INTERVIEWS

Interviews generated large quantities of qualitative data. Collected data was evaluated, and amalgamated to preserve anonymity of respondents. Companies we interviewed encourage employees to take alternative transportation to work and to meetings when possible instead of driving in a single occupancy vehicle. Some of the incentives offered to employees by the one of the organizations we interviewed include:

- Participation in TransLink Employer Pass Program, which offers employees in Lower Mainland a discounted annual transit pass purchased through the convenience of payroll deduction for Lower Mainland transit service. The discount ranges from 11 – 14%. Bi-weekly deductions taken one month prior to pass being active. A one-year initial commitment is required
- Participation in the BC Transit Victoria Pro Pass Discount Program, employees outside Lower Mainland can purchase an annual transit pass through the convenience of monthly payroll deductions. The transit pass is offered at 15% discount off regular retail rates
- Preferred parking at Head Office – all carpool teams of two or more people are eligible for a carpool pass and are permitted to use the 38 carpool spaces
- Employees who are registered with the Jack Bell Foundation Rideshare program receive free parking and are permitted to use the designated carpool spaces at Head Office

- Employees who register with the “End of Trip Facilities Program” have access to change/shower facilities, lockers and secure bike cage facilities
- Participation in the annual Canadian Commuter Challenge, which is a fun, friendly competition between cities and organizations across Canada to see who can get the highest percentage of employees out of their single occupancy vehicles (SOVs) and into more sustainable modes of transportation while commuting to their workplace
- Environmental Services internal website promotes the above alternative transportation programs, and provides links to external sites which provides employees with information such as; transit schedules, bike maps, rideshare and ride-match services

One of the companies we interviewed will be required to reduce its carbon footprint and become carbon neutral by 2010 as legislated by the BC Government and will take the following steps to address climate change issues:

- Host an internal web site for climate change issues
- Participate in the BC Hydro Power Smart Program that provides incentives for crown corporations to reduce energy
- Plan to assess the energy efficiency of its buildings and implement changes to reduce greenhouse gas emissions
- Plan to purchase carbon offsets from the exchange set by the BC provincial government

- Elevate the importance of climate change issues to its executive team. Related BC provincial legislation is high on the agenda
- Focus on a corporate carbon footprint in keeping with organizational boundaries suggested by the World Resource Institute, and the BC Climate Action Secretariat. Commuting aspect is not a reporting requirement for the corporate footprint at this time

One of our respondents we interviewed described how his company has large energy reductions projects and buy offsets from consulting group GEMCO from projects that are independently audited. Companies that do business in industries that are regulated expect to participate in the cap-and-trade system legislated by the BC government. For such companies using personal carbon offsets to offset corporate footprint is an interesting concept that may be implemented in the future, but currently the participation in the regulated market is presenting a much larger and more important challenge. Many large companies are mostly concerned about reducing energy usage of their main operations.

We interviewed a company in mining industry and learned that it has not purchased any carbon offsets, but it expects that it will do so in the near future as part of the BC Legislation and the plan by BC Government to reduce emissions in energy and mining sector. The company can generate some offsets by reducing emission only within a boundary of a facility, so employees commuting to this facility from outside this boundary may create offsets that may not be approved by or compatible with the offsets required to reduce emissions within the facility.

A company in the forest industry we talked to has operations in US, Alberta and BC. This company is or will be impacted by expected legislation in the US, the existing legislation in Alberta and announced legislation at BC provincial and federal levels. Its main concern is that regulatory framework will not be harmonized and there will be some overlapping between regulatory requirements at Federal and provincial levels. The company's operations in Alberta generated carbon offsets. The credits were verified and were in the process of serialization. Once serialized and registered, the company will be able to sell those credits. Credits in Alberta are capped at \$15 per tCO₂e. The company is participating in the work done by both provincial government in British Columbia and the federal government and is getting ready to participate in the announced cap-and-trade system in BC. The focus of the company is on much larger pool of verified carbon offsets than what employees could generate because of their personal emission reduction initiatives.

One of our respondents discussed how the company works with Richmond Chamber of Commerce to establish public transportation to Mitchell Island where their office is located. There is no transit system so the company has set up its own stations where other staff can pick up their co-workers that are waiting there. The company has not and is not planning to purchase any carbon offsets, as it cannot afford additional expense. Becoming carbon neutral could dramatically change economics of doing business and possibly make the company unprofitable as it has large footprint producing paper products.

Another organization participating in our research has been working hard to change behaviour and motivate employees to choose green alternatives at work in various

aspects of corporate life, from promoting recycling paper and carpooling to discouraging employees using Styrofoam plates in the cafeteria. The company is working with a consultant from UBC to outline a 2-3 year long path to becoming carbon neutral. The company is considering offering an option to customers to purchase carbon offsets as part of their home or travel insurance. The company has done a survey and 80% of members said that it was important for them that the company offers green services to maintain its very strong brand. The corporate fleet will include only hybrid vehicles. Various options to reduce emissions generated by towing trucks are currently evaluated. The company has created a Corporate Social Responsibility Team that includes senior executives. Additionally, Sustainability Network includes representatives from the Head Office and all sales centres.

We also talked to a company that has been legislated to becoming carbon neutral by 2010. It is currently working on calculating its baseline footprint. The baseline includes carbon footprint from the following activities: buildings, paper consumption, fleet transportation, and corporate travel. Personal travel of employees is not included in the baseline and cannot be used against the corporate footprint. The company will use the Smart Tool system developed by the government to manage offsets and will purchase offsets from Pacific Carbon Trust.

8: DATA ANALYSIS – INDIVIDUAL SURVEY

The individual survey collected 125 responses from individual respondents. Results of individual survey are shown in figures: (Figure 72, Figure 84). This data was segmented using demographic attributes to help us determine the best segment of potential customers for our proposed online personal carbon trading and commuting management system.

8.1 Demographics

A small majority of our individual respondents were women (Figure 19). This can be attributed to our Facebook online advertisement. Before our Facebook Ad was posted, the ratio of female and male respondents was almost evenly distributed. Our Facebook advertisement (Figure 108) asked users of the social network to help investigators to collect the data and graduate. This message must have been more appealing to women who were more willing to help.

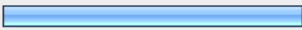
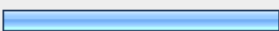
		Response Percent	Response Count
Female		52.0%	65
Male		48.0%	60
		<i>answered question</i>	125
		<i>skipped question</i>	0

Figure 19 Individual Respondents – Gender

Almost half of our individual respondents were people in age group 25-34 (Figure 20). Such a strong participation from this group was likely caused by the fact that SFU MBA mail distribution list generated many responses that came from MBA students who were mostly in this age category. Additionally, the majority of Facebook audience exposed to our online advertisement was in this age category. Even though our survey does not have a normal distribution by age, strong participation of individuals in 25-34 age category is very valuable to our research as this group tends to be well educated, environmentally conscious and technically savvy – attributes that are conducive to participating in our personal carbon trading system.


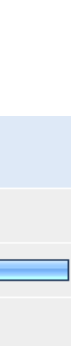




		Response Percent	Response Count
16-24		11.4%	14
25-34		45.5%	56
35-44		20.3%	25
45-54		16.3%	20
55-64		5.7%	7
65 or more		0.8%	1
answered question			123
skipped question			2

Figure 20 Individual Respondents – Age

Distribution of income does not represent a normal distribution because the number of respondents with annual income of more than \$100k is disproportionately high at 27% (Figure 22) in comparison to 18% found for all respondents (Figure 84). Survey results show very high number of respondents with Master’s degree (Figure 21).

Distribution of respondents was skewed by using SFU email distribution lists that include current or former MBA students.


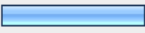
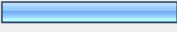
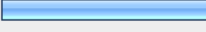
		Response Percent	Response Count
High School or less		8.8%	11
College Diploma or Certificate		24.8%	31
Bachelor Degree		30.4%	38
Masters Degree or more		36.0%	45
		<i>answered question</i>	125
		<i>skipped question</i>	0

Figure 21 Individual Respondents – Education

The number of business graduate students who have temporarily lower income while taking classes full-time is relatively small. At the same time, many graduates earn high wages after completing their MBA program. Most of MBA students are taking classes part-time and working full-time jobs earning high salaries. As a result, it is likely that our sample of respondents will exhibit characteristics and tendencies similar to those of high- income earners.

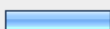

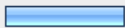
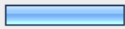
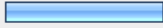
		Response Percent	Response Count
\$40,000 or less		17.8%	8
\$40,000 - \$60,000		15.6%	7
\$60,000 - \$75,000		20.0%	9
\$75,000 - \$100,000		20.0%	9
\$100,000 or more		26.7%	12
		<i>answered question</i>	45
		<i>skipped question</i>	0

Figure 22 Individual Respondents – Income for Masters

To mitigate the impact of having disproportionate high number of respondents with Master’s degree, investigators also analysed responses from respondents with Bachelor’s Degree or lower. Additionally, other filters were also developed to select only desired category of replies from individual respondents:

- Drivers – drive more than 2 days a week as reported in Question 3
- Green Commuters – take public transportation, walk, bike, telecommute or drive only once a week or only occasionally as reported in Question 3
- Carbon Adopters – calculated carbon footprint or purchased carbon offset as indicated in Question 8 and 9
- Men – specified gender as Male in Question 11
- Women – specified gender as Female in Question 11
- Low Income Earners – reported an annual income of less than \$40k in Question 14
- High Income Earners – reported an annual income of more than \$100k in question 14

- Masters Degree Education Level or more – reported having Master’s degree or more in Question 13
- Bachelor Degree Education Level or less– reported having high school diploma, college, or Bachelor’s degree in Question 13

These filters were applied to responses for Question 5 asking if cash reward points offered strong incentive for commuters to take alternate means for transportation. The purpose of this broad analysis was to narrow down a group of respondents to those who would be likely to find our proposed online carbon trading system appealing. The results of segmentation analysis from Question 5 will be used to determine the group of future users of our proposed personal carbon trading and commuting system.

The proposed system has a number of attributes such as reward points, reporting time and verification methods. The combination of these attributes that offers the highest utility to individual users will be chosen based on results from conjoint analysis, which is supported by the following questions:

- Question 6 – to evaluate the utility of reporting time of commuting information as part of our conjoint analysis
- Question 7 – to evaluate the utility of inconvenience due to imposed verification method as part of our conjoint analysis

Our conjoint analysis will be done twice. Once for all respondents and second time for our segment of interest which is a group of green commuters. It will be interesting to see if utility values for both groups are similar or different.

8.2 Reward Points

Question 5: If you drive your own vehicle to work, to what extent would the following incentives encourage you to use an alternative transportation mode?

Our objective when asking Question 5 was to determine if a cash reward system was a strong or very strong incentive for individuals not to drive alone to work.

8.2.1 Filter: Drivers

Drivers indicated that shorter travel time and convenience were strong influencers for 55% and 61% of drivers when choosing driving alone as a preferred commuting option (Figure 23).

2. How do each of the following reasons influence your regular transportation mode choice?							
	Strongly Disagree	Disagree	Agree	Agree Somewhat	Strongly Agree	N/A	Response Count
Prefer to drive alone	11.7% (7)	33.3% (20)	21.7% (13)	15.0% (9)	15.0% (9)	3.3% (2)	60
Alternative transportation not available	16.4% (10)	24.6% (15)	11.5% (7)	14.8% (9)	31.1% (19)	1.6% (1)	61
Alternative transportation too expensive	11.5% (7)	47.5% (29)	9.8% (6)	13.1% (8)	8.2% (5)	9.8% (6)	61
More suited for my work hours	3.3% (2)	6.7% (4)	18.3% (11)	20.0% (12)	45.0% (27)	6.7% (4)	60
Family responsibility	8.3% (5)	13.3% (8)	23.3% (14)	10.0% (6)	21.7% (13)	23.3% (14)	60
Shorter travel time	5.0% (3)	5.0% (3)	18.3% (11)	11.7% (7)	55.0% (33)	5.0% (3)	60
Convenience	3.2% (2)	4.8% (3)	17.7% (11)	11.3% (7)	61.3% (38)	1.6% (1)	62
More socially responsible alternative	14.8% (9)	36.1% (22)	18.0% (11)	9.8% (6)	8.2% (5)	13.1% (8)	61
						Other (please specify)	7
						answered question	63
						skipped question	0

Figure 23 Influencers of Driving for Drivers

This is in contrast to 24% and 38% of Non-Drivers who perceive convenience and shorter commuting time as very strong influencers (Figure 24).

3. How do each of the following reasons influence your regular transportation mode choice?							
	Strongly Disagree	Disagree	Agree	Agree Somewhat	Strongly Agree	N/A	Response Count
Prefer to drive alone	30.5% (18)	27.1% (16)	10.2% (6)	1.7% (1)	3.4% (2)	27.1% (16)	59
Alternative transportation not available	18.6% (11)	23.7% (14)	10.2% (6)	13.6% (8)	15.3% (9)	18.6% (11)	59
Alternative transportation too expensive	13.1% (8)	24.6% (15)	16.4% (10)	19.7% (12)	13.1% (8)	13.1% (8)	61
More suited for my work hours	8.5% (5)	15.3% (9)	22.0% (13)	27.1% (16)	11.9% (7)	15.3% (9)	59
Family responsibility	20.3% (12)	16.9% (10)	13.6% (8)	8.5% (5)	15.3% (9)	25.4% (15)	59
Shorter travel time	6.9% (4)	12.1% (7)	24.1% (14)	17.2% (10)	24.1% (14)	15.5% (9)	58
Convenience	3.3% (2)	10.0% (6)	28.3% (17)	16.7% (10)	38.3% (23)	3.3% (2)	60
More socially responsible alternative	8.5% (5)	22.0% (13)	25.4% (15)	11.9% (7)	18.6% (11)	13.6% (8)	59
					Other (please specify)		12
					answered question		62
					skipped question		0

Figure 24 Influencers of Driving for Non-Drivers

For 80% of respondents who drive to work, cash rewards would be normal, weak or very weak incentive to leave their cars. Financial savings and tax benefits were listed as normal incentives. Not surprisingly, free parking for carpools, showers, lockers or bike racks on transit represented a very weak incentive for this group of respondents (Figure 25).

	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive	Response Count
Discount passes	26.2% (16)	31.1% (19)	23.0% (14)	6.6% (4)	13.1% (8)	61
Cash reward points	23.7% (14)	23.7% (14)	32.2% (19)	11.9% (7)	8.5% (5)	59
Financial savings	14.5% (9)	11.3% (7)	33.9% (21)	25.8% (16)	14.5% (9)	62
Tax benefits	18.0% (11)	11.5% (7)	37.7% (23)	26.2% (16)	6.6% (4)	61
Free parking for carpools	27.1% (16)	20.3% (12)	27.1% (16)	18.6% (11)	6.8% (4)	59
Showers/lockers	50.0% (29)	25.9% (15)	10.3% (6)	10.3% (6)	3.4% (2)	58
Bike racks on transit	47.5% (28)	30.5% (18)	11.9% (7)	6.8% (4)	3.4% (2)	59
	Other (please specify)					11
	answered question					63
	skipped question					0

Figure 25 Individual Respondents – Question 5 – Drivers

However, for 40% of non-drivers, the cash rewards would be a strong or very strong incentive (Figure 26).

	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive	Response Count
Discount passes	12.5% (5)	15.0% (6)	25.0% (10)	32.5% (13)	15.0% (6)	40
Cash reward points	21.1% (8)	18.4% (7)	18.4% (7)	23.7% (9)	18.4% (7)	38
Financial savings	5.1% (2)	5.1% (2)	28.2% (11)	38.5% (15)	23.1% (9)	39
Tax benefits	12.8% (5)	7.7% (3)	28.2% (11)	38.5% (15)	12.8% (5)	39
Free parking for carpools	15.4% (6)	20.5% (8)	17.9% (7)	33.3% (13)	12.8% (5)	39
Showers/lockers	28.2% (11)	28.2% (11)	17.9% (7)	15.4% (6)	10.3% (4)	39
Bike racks on transit	26.3% (10)	18.4% (7)	23.7% (9)	18.4% (7)	13.2% (5)	38
Other (please specify)						9
answered question						40
skipped question						22

Figure 26 Transportation Mode of Choice for Non-Drivers

The group of drivers includes a strong proportion of high-income earners (Figure 27) for whom “time is money” and despite high cost of fuel and impact on environment, driving is an option that in majority of cases still offers the shortest commuting time and a lot of convenience.

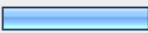
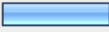


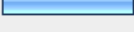
		Response Percent	Response Count
\$40,000 or less		28.6%	18
\$40,000 - \$60,000		20.6%	13
\$60,000 - \$75,000		9.5%	6
\$75,000 - \$100,000		15.9%	10
\$100,000 or more		25.4%	16
		<i>answered question</i>	63
		<i>skipped question</i>	0

Figure 27 Individual Survey – Income of Drivers

8.2.2 Filter: Green Commuters

Thirty two percent of respondents who drive alone only occasionally and take alternate methods of transportation to commute to work indicated that cash rewards would be a strong or very strong incentive for them to leave their cars. This is in contrast to only twenty percent of respondents who drive to work frequently and who indicated that cash rewards represented strong or very strong incentive. Another strong incentive worth mentioning is a free carpool parking as voted for by almost forty four percent of “green” commuters (Figure 28).

	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive	Response Count
Discount passes	15.2% (5)	18.2% (6)	18.2% (6)	30.3% (10)	18.2% (6)	33
Cash reward points	25.8% (8)	22.6% (7)	19.4% (6)	16.1% (5)	16.1% (5)	31
Financial savings	6.3% (2)	6.3% (2)	28.1% (9)	34.4% (11)	25.0% (8)	32
Tax benefits	15.6% (5)	9.4% (3)	28.1% (9)	34.4% (11)	12.5% (4)	32
Free parking for carpools	18.8% (6)	21.9% (7)	15.6% (5)	31.3% (10)	12.5% (4)	32
Showers/lockers	34.4% (11)	25.0% (8)	15.6% (5)	15.6% (5)	9.4% (3)	32
Bike racks on transit	32.3% (10)	16.1% (5)	19.4% (6)	19.4% (6)	12.9% (4)	31
Other (please specify)						7
answered question						33
skipped question						14

Figure 28 Green Commuters – Question 5

By comparing a group of drivers to a group of “green” commuters, we can conclude that the level of cash rewards would not provide a strong incentive for drivers to leave their cars and take a public transportation or carpool to work. This level of

incentive is clearly overshadowed by financial aspect of high cost of gasoline that is the main financial influencer for commuters to drive less and look for alternatives. As discussed previously, drivers value their time as scarce resource and have the means and willingness to pay for it.

8.2.3 Filter: Carbon Early Adopters

Our survey results show that a cash incentive is appealing to a group of respondents who either calculated or purchased carbon offsets. Fifty one percent of respondents in this group indicated that cash rewards system would represent strong or very strong incentive for them to use “green” commuting options (Figure 29).

	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive	Response Count
Discount passes	16.7% (4)	25.0% (6)	4.2% (1)	29.2% (7)	25.0% (6)	24
Cash reward points	17.4% (4)	17.4% (4)	13.0% (3)	34.8% (8)	17.4% (4)	23
Financial savings	4.2% (1)	4.2% (1)	20.8% (5)	45.8% (11)	25.0% (6)	24
Tax benefits	12.5% (3)	4.2% (1)	37.5% (9)	37.5% (9)	8.3% (2)	24
Free parking for carpools	8.3% (2)	20.8% (5)	20.8% (5)	33.3% (8)	16.7% (4)	24
Showers/lockers	43.5% (10)	13.0% (3)	13.0% (3)	21.7% (5)	8.7% (2)	23
Bike racks on transit	42.9% (9)	14.3% (3)	9.5% (2)	19.0% (4)	14.3% (3)	21
Other (please specify)						5
<i>answered question</i>						24
<i>skipped question</i>						5

Figure 29 Individual Respondents – Question 5 – Carbon Early Adopters

8.2.4 Filter: Men

Cash reward points are obviously a weak incentive for men. Only 24% men feel that such an incentive would be appealing (Figure 30).

	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive	Response Count
Discount passes	19.2% (5)	42.3% (11)	19.2% (5)	11.5% (3)	7.7% (2)	26
Cash reward points	19.2% (5)	34.6% (9)	26.9% (7)	3.8% (1)	15.4% (4)	26
Financial savings	11.5% (3)	19.2% (5)	42.3% (11)	11.5% (3)	15.4% (4)	26
Tax benefits	19.2% (5)	19.2% (5)	38.5% (10)	15.4% (4)	7.7% (2)	26
Free parking for carools	28.0% (7)	32.0% (8)	8.0% (2)	24.0% (6)	8.0% (2)	25
Showers/lockers	50.0% (13)	23.1% (6)	3.8% (1)	19.2% (5)	3.8% (1)	26
Bike racks on transit	42.3% (11)	34.6% (9)	7.7% (2)	7.7% (2)	7.7% (2)	26
Other (please specify)						2
<i>answered question</i>						26
<i>skipped question</i>						10

Figure 30 Individual Respondents – Question 5 – Men

A simple explanation could be found by analysing income information male respondents reported as part of our survey (Figure 31). Only 27% of men are in the lowest income bracket and 21% reported an annual income of more than \$100k. Attractiveness of reward points is likely not determined by gender, but rather by income level of individual respondents.

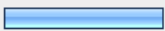



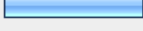
		Response Percent	Response Count
\$40,000 or less		27.1%	16
\$40,000 - \$60,000		20.3%	12
\$60,000 - \$75,000		13.6%	8
\$75,000 - \$100,000		15.3%	9
\$100,000 or more		23.7%	14
		<i>answered question</i>	59
		<i>skipped question</i>	1

Figure 31 Individual Respondents – Question 5 – Men and Income

8.2.5 Filter: Women

On the other hand, women found cash reward points more appealing as 35% of them indicated that reward points would represent strong or very strong incentive to them (Figure 32). Additionally, 54% of women reported that financial savings would be a strong or very strong incentive to use “green” commuting options. This data indicates that women would be more likely to be attracted to a system that offers reward points.

	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive	Response Count
Discount passes	16.7% (6)	19.4% (7)	27.8% (10)	22.2% (8)	13.9% (5)	36
Cash reward points	24.2% (8)	15.2% (5)	24.2% (8)	21.2% (7)	15.2% (5)	33
Financial savings	8.3% (3)	5.6% (2)	30.6% (11)	38.9% (14)	16.7% (6)	36
Tax benefits	14.7% (5)	8.8% (3)	35.3% (12)	29.4% (10)	11.8% (4)	34
Free parking for carools	23.5% (8)	20.6% (7)	29.4% (10)	17.6% (6)	8.8% (3)	34
Showers/lockers	41.2% (14)	29.4% (10)	17.6% (6)	11.8% (4)	0.0% (0)	34
Bike racks on transit	36.4% (12)	27.3% (9)	18.2% (6)	15.2% (5)	3.0% (1)	33
	Other (please specify)					10
	answered question					37
	skipped question					13

Figure 32 Individual Respondents – Question 5 – Women

This could be explained by analysing income information female respondents reported as part of our survey (Figure 33). As much as 42% of female respondents are in the lowest income bracket and only 12% reported an annual income of more than \$100k. Attractiveness of reward points is likely not determined by gender, but rather by income level of individual respondents.


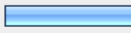



		Response Percent	Response Count
\$40,000 or less		42.2%	27
\$40,000 - \$60,000		21.9%	14
\$60,000 - \$75,000		10.9%	7
\$75,000 - \$100,000		12.5%	8
\$100,000 or more		12.5%	8
		<i>answered question</i>	64
		<i>skipped question</i>	1

Figure 33 Individual Respondents – Question 5 – Women and Income

8.2.6 Filter: High-Income Earners

As expected, respondents earning high wages were not attracted to cash incentives. Only 13% of them indicated that such rewards would represent a strong or very strong incentive (Figure 34).

	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive	Response Count
Discount passes	13.3% (2)	46.7% (7)	33.3% (5)	0.0% (0)	6.7% (1)	15
Cash reward points	26.7% (4)	20.0% (3)	40.0% (6)	0.0% (0)	13.3% (2)	15
Financial savings	6.7% (1)	13.3% (2)	46.7% (7)	33.3% (5)	0.0% (0)	15
Tax benefits	26.7% (4)	13.3% (2)	46.7% (7)	6.7% (1)	6.7% (1)	15
Free parking for carpools	28.6% (4)	35.7% (5)	7.1% (1)	28.6% (4)	0.0% (0)	14
Showers/lockers	40.0% (6)	20.0% (3)	13.3% (2)	26.7% (4)	0.0% (0)	15
Bike racks on transit	46.7% (7)	20.0% (3)	13.3% (2)	20.0% (3)	0.0% (0)	15
Other (please specify)						2
answered question						15
skipped question						2

Figure 34 Individual Respondents – Question 5 – High Income Earners

8.2.7 Filter: Low-Income Earners

Cash reward points were perceived as a strong or very strong incentive by 45% of respondents in this group (Figure 35). This number is almost three times higher in comparison to results reported from high income group (Figure 34) providing a strong evidence that income is a dominant factor responsible for attractiveness of reward points to individuals.

	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive	Response Count
Discount passes	9.1% (3)	18.2% (6)	27.3% (9)	21.2% (7)	24.2% (8)	33
Cash reward points	12.9% (4)	19.4% (6)	22.6% (7)	22.6% (7)	22.6% (7)	31
Financial savings	3.1% (1)	12.5% (4)	28.1% (9)	28.1% (9)	28.1% (9)	32
Tax benefits	6.3% (2)	9.4% (3)	37.5% (12)	31.3% (10)	15.6% (5)	32
Free parking for carpools	18.8% (6)	12.5% (4)	18.8% (6)	37.5% (12)	12.5% (4)	32
Showers/lockers	35.5% (11)	25.8% (8)	16.1% (5)	9.7% (3)	12.9% (4)	31
Bike racks on transit	31.3% (10)	28.1% (9)	18.8% (6)	15.6% (5)	6.3% (2)	32
	Other (please specify)					8
	<i>answered question</i>					33
	<i>skipped question</i>					10

Figure 35 Individual Respondents – Question 5 – Low Income Earners

8.2.8 Filter: Masters Degree

Only 20% of respondents in this group perceive a cash reward as a strong or very strong incentive (Figure 36). As discussed previously, a high percentage of high-income earners belong to this group and attractiveness of reward points is not a function of education level but depends mostly on income level of individual respondents who tends to be higher for individuals with higher level of education.

	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive	Response Count
Discount passes	16.7% (6)	36.1% (13)	19.4% (7)	25.0% (9)	2.8% (1)	36
Cash reward points	29.4% (10)	17.6% (6)	32.4% (11)	14.7% (5)	5.9% (2)	34
Financial savings	8.3% (3)	13.9% (5)	38.9% (14)	25.0% (9)	13.9% (5)	36
Tax benefits	14.3% (5)	11.4% (4)	40.0% (14)	28.6% (10)	5.7% (2)	35
Free parking for carpools	17.1% (6)	31.4% (11)	20.0% (7)	25.7% (9)	5.7% (2)	35
Showers/lockers	35.3% (12)	38.2% (13)	11.8% (4)	14.7% (5)	0.0% (0)	34
Bike racks on transit	32.4% (11)	38.2% (13)	11.8% (4)	14.7% (5)	2.9% (1)	34
Other (please specify)						7
answered question						37
skipped question						8

Figure 36 Individual Respondents – Question 5 – Masters Degree or higher

8.2.9 Filter: Bachelor Degree or lower

Twenty three percent of respondents in this group perceive reward points as a strong or very strong incentive (Figure 37). This number is similar to results received from analysis of respondents with Master’s Degree confirming that level of education is not a factor in deciding attractiveness of reward points.

	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive	Response Count
Discount passes	21.9% (7)	25.0% (8)	25.0% (8)	9.4% (3)	18.8% (6)	32
Cash reward points	20.0% (6)	26.7% (8)	20.0% (6)	10.0% (3)	23.3% (7)	30
Financial savings	12.5% (4)	9.4% (3)	34.4% (11)	28.1% (9)	15.6% (5)	32
Tax benefits	19.4% (6)	12.9% (4)	38.7% (12)	16.1% (5)	12.9% (4)	31
Free parking for carpools	33.3% (10)	20.0% (6)	23.3% (7)	13.3% (4)	10.0% (3)	30
Showers/lockers	54.8% (17)	16.1% (5)	12.9% (4)	12.9% (4)	3.2% (1)	31
Bike racks on transit	46.7% (14)	26.7% (8)	13.3% (4)	6.7% (2)	6.7% (2)	30
Other (please specify)						7
<i>answered question</i>						32
<i>skipped question</i>						13

Figure 37 Individual Respondents – Question 5 – Bachelor Degree or lower

8.2.10 No Filter – All Responses

Overall, approximately 30% of all respondents indicated that cash rewards represent a strong or very strong incentive for them to use “green” commuting options. The next step in our analysis will be focused on trying to find such a sub-segment among our survey respondents that includes more than 30% of individuals for whom reward points are very appealing (Figure 38).

	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive	Response Count
Discount passes	20.6% (21)	24.5% (25)	23.5% (24)	16.7% (17)	14.7% (15)	102
Cash reward points	22.4% (22)	21.4% (21)	26.5% (26)	16.3% (16)	13.3% (13)	98
Financial savings	10.8% (11)	8.8% (9)	31.4% (32)	30.4% (31)	18.6% (19)	102
Tax benefits	15.8% (16)	9.9% (10)	33.7% (34)	30.7% (31)	9.9% (10)	101
Free parking for carpools	22.2% (22)	21.2% (21)	23.2% (23)	24.2% (24)	9.1% (9)	99
Showers/lockers	40.8% (40)	27.6% (27)	13.3% (13)	12.2% (12)	6.1% (6)	98
Bike racks on transit	38.8% (38)	26.5% (26)	16.3% (16)	11.2% (11)	7.1% (7)	98
Other (please specify)						20
answered question						104
skipped question						21

Figure 38 Individual Respondents – Question 5 – All Respondents

8.2.11 Reward Points Summary

Based on responses to Question 5, we can summarize that the following groups are strongly influenced by cash reward points:

- 52% of early carbon adopters

- 45% of respondents in low income bracket (this is in contrast to 13% of respondents in high income group)
- 32% of “green” commuters (this is in contrast to 20% of respondents who drive to work frequently)

As previously discussed, education and gender are not strong indicators of attractiveness of reward points, whereas income level is. As income is one of common demographic attributes influencing respondents in any group or sub-segment, we will simply analyse income of carbon adopters and green commuters as one of the factors in our analysis.

So let us have a closer look at the demographics of Carbon Early Adopters and “Green” Commuters to gain understanding of characteristics that these groups may exhibit due to their demographic composition. Women represent majority of respondents in Commuters group (Figure 39) and significantly dominate Carbon Adopters segment (Figure 40).

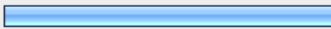
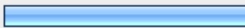
		Response Percent	Response Count
Female		57.4%	27
Male		42.6%	20
		<i>answered question</i>	47
		<i>skipped question</i>	0

Figure 39 Commuters – Gender


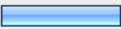
		Response Percent	Response Count
Female		79.3%	23
Male		20.7%	6
		answered question	29
		skipped question	0

Figure 40 Carbon Adopters – Gender

Carbon Adopters and Green Commuters have similar composition of respondents when it comes to age. Both segments tend to be dominated by respondents between 25 and 34 years of age. Carbon Adopters have higher percentage of respondents in 16-24 age bracket (Figure 41), whereas Green Commuters have more individuals in 35-55 group category (Figure 42).


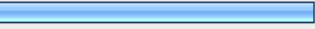



		Response Percent	Response Count
16-24		17.2%	5
25-34		55.2%	16
35-44		10.3%	3
45-54		6.9%	2
55-64		10.3%	3
65 or more		0.0%	0
		answered question	29
		skipped question	0

Figure 41 Early Adopters – Age



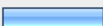



		Response Percent	Response Count
16-24		10.9%	5
25-34		52.2%	24
35-44		17.4%	8
45-54		15.2%	7
55-64		2.2%	1
65 or more		2.2%	1
answered question			46
skipped question			1

Figure 42 Commuters – Age

Table 1 shows percentage of “green” commuters and early adopters for each age category. The group that has the highest number of “green” commuters is the age category 24-34. The highest percentage (43%) of carbon adopters was reported by a group of respondents in the age category 55-64.

Age	Carbon Adopters	Green Commuters	Total Respondents	Carbon Adopters [%]	Green Commuters [%]
16-24	5	5	14	36%	36%
25-34	16	24	56	29%	43%
35-44	3	8	25	12%	32%
45-54	2	7	20	10%	35%
55-64	3	1	7	43%	14%
65 or more	0	1	1	0%	100%

Table 1 Green Commuters and Early Adopters by Age Category

There is no significant difference in distribution of education level between all two segments. Commuters have higher percentage of individuals with Bachelor’s Degree (Figure 44) and Carbon Adopter higher percentage of respondents with College Diploma (Figure 43). As shown in Table 2, 45% and 40% of respondents with Bachelor and Masters Degree do not drive alone to work. However, only 16% and 18% of these respondents have purchased carbon offsets or calculated its carbon footprint.

Education	Carbon Adopters	Green Commuters	Total	Carbon Adopters [%]	Green Commuters [%]
High School or less	4	2	11	36%	18%
College Diploma	11	10	31	35%	32%
Bachelor Degree	6	17	38	16%	45%
Masters Degree or more	8	18	45	18%	40%

Table 2 Green Commuters and Early Adopters by Education


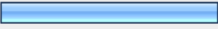

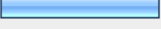
		Response Percent	Response Count
High School or less		13.8%	4
College Diploma or Certificate		37.9%	11
Bachelor Degree		20.7%	6
Masters Degree or more		27.6%	8
answered question			29
skipped question			0

Figure 43 Carbon Adopters – Education


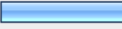
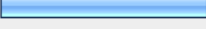
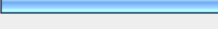
		Response Percent	Response Count
High School or less		4.3%	2
College Diploma or Certificate		21.3%	10
Bachelor Degree		36.2%	17
Masters Degree or more		38.3%	18
		<i>answered question</i>	47
		<i>skipped question</i>	0

Figure 44 Commuters – Education Level

Significant percentage of “green” commuters and carbon adopters is in low-income bracket and relatively small percentage of respondents constitutes high-wage earners. Both of these groups have relatively similar income distribution (Figure 45, Figure 46).

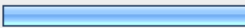
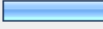



		Response Percent	Response Count
\$40,000 or less		42.9%	12
\$40,000 - \$60,000		17.9%	5
\$60,000 - \$75,000		14.3%	4
\$75,000 - \$100,000		10.7%	3
\$100,000 or more		14.3%	4
		<i>answered question</i>	28
		<i>skipped question</i>	1

Figure 45 Carbon Adopters – Income

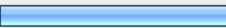
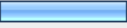
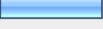


		Response Percent	Response Count
\$40,000 or less		40.0%	18
\$40,000 - \$60,000		22.2%	10
\$60,000 - \$75,000		17.8%	8
\$75,000 - \$100,000		11.1%	5
\$100,000 or more		8.9%	4
		<i>answered question</i>	45
		<i>skipped question</i>	2

Figure 46 Commuters – Income

Table 3 shows percentage of “green” commuters and carbon adopters in each income category. Forty two percent of respondents in the lowest income bracket take alternate means of transportation to get to work. Only 18% percent of respondents in the two highest income categories take “green” commuting options.

Income	Carbon Adopters	Green Commuters	Total	Carbon Adopters [%]	Green Commuters [%]
\$40k or less	12	18	43	28%	42%
\$40-60k	5	10	26	19%	38%
\$60-75k	4	8	15	27%	53%
\$75-100	3	5	17	18%	29%
\$100 or more	4	4	22	18%	18%

Table 3 Green Commuters and Carbon Adopters by Income

Carbon Adopters group exhibits characteristics similar to those found in Commuters group due to strong participation of women and similar income and education level distribution found in both segments. Due to relatively small size sample

of Carbon Adopters group, our analysis of Question 5 can be finalized with a conclusion that our target segment includes a group of “green” commuters who drive alone not more than once a week or only occasionally and take alternate means of transportation to travel to work.

8.3 Introduction to Conjoint Analysis

Conjoint analysis is the market research methodology for studying how buyers value various attributes of products or services. The name “conjoint analysis” implies that analysis is focused on studying joint effects. In marketing applications such as our research, we study the joint effect of multiple product attributes on product choice.

Conjoint analysis surveys ask respondents to make a trade off and choose among different version of products or services offering different set of features. Conjoint analysis allows investigators to decide which features offer the most value and is the most appealing to customers.

Many methods can be used to analyse the collected data. One of the simplest models used to express the utility of different product attributes is the part-worth model. The part-worth utilities are numeric values that reflect how desirable different features are. There are primarily three distinct variations used to create conjoint questions

- Self-Explicated Model - In this model, the respondents are asked "direct" questions about the desirability of a particular list of products and profiles.
- Discrete Choice - Here respondents are asked to choose between multiple products and the relative weights for each of the attributes are calculated indirectly.

- Ratings Based Conjoint - Here respondents are asked to "Rate" the likelihood of purchase for two products at a time.

Choice based or Discrete Choice Conjoint is by far the most preferred model for a conjoint questionnaire. This is primarily because it models consumer behaviour in real-life. Most purchases that consumers make today are trade-off based. For example, consumers may be presented with a choice of buying a \$350 ticket with two flight stops and no air miles or a \$500 ticket with no stops and four thousand air miles. However, discrete choice method requires investigators to present survey respondents with a relatively large number of tasks. Our survey included various questions collecting information about commuting and carbon offsets and could not burden users with additional large number of tasks. As a result, investigators decided to use two questions with ratings based conjoint where respondents were ask to rate each combinations on a scale from *Definitely Would Not Participate* to *Definitely Would Participate*. Once survey data has been collected, the ratings-based conjoint utilities have been estimated using Ordinary Least Square (OLS) regression at the individual respondent level. Excel Data Analysis Add-In module was used to perform regression analysis.

Our survey included Question 6 and 7 that were specifically designed to determine our respondents' utility value of these attributes

- Reward Points – level of cash rewards
- Reporting Time – time spent reporting commuting patterns
- Verification Level – level of verification needed to validate accuracy of reported data

Having determined the utility of reporting time and verification level, we could decide which combination of reward points and verification level or time reporting provides the highest utility to our individual respondents, and which option is best for corporate organizations.

An important objective of this survey is to determine the optimal amount of rewards offered to commuting employees to compensate them for spending time to report commuting data and for making an effort to verify the accuracy of reported data. The following options of data verification were presented to respondents:

- a) Approval system – one option is for supervisors at work to approve your commuting routine using the newly established online system verifying your report with a co-rider, bus ticket or fellow cyclist.
- b) GPS-tracking – another option is for commuters use GPS-enabled device to track travelled distance.
- c) Honour system – employers trusts their employees and no verification is necessary, similar to the honour system that works well for brewing departmental morning coffee in many organizations.

Respondents had a choice between dedicating five or fifteen minutes of their time every week to collect and enter the commuting data to online commuting management system. To compensate commuters for loss of time and inconvenience of verification, respondents were offered \$1, \$2 or \$3 daily rewards. These are the ranges of feasible attributes for reward points, reporting time, and verification level:

Reward Points	Reporting Time	Verification Level
\$1/day	5 min/weekly	Honour System
\$2/day	15 min/weekly	Approval System
\$3/day		GPS Tracking

Table 4 Conjoint Analysis – Attributes

When it comes to choosing a combination of reward points and verification methods, individual commuters and corporate commuting sponsors have conflicting interests. On one hand, it is expected that individual commuters would prefer the least imposing level of verification for the biggest reward. On the other hand, it seems only logical that organizations would prefer to offer the smallest amount of reward for the most verified commuting data. Conjoint analysis allowed us to find out if this assumption was correct.

Additionally, the conjoint analysis allowed us to determine our respondent's utility value of time spent on reporting commuting data and the utility value of inconvenience related to being obligated to comply with a verification method. These two utility values were captured by asking respondents to rate various combinations of reward points, reporting time and verification level in Question 6 and 7 on individual survey and Question 9 on corporate survey. Only individual respondents were asked to rate the following combinations of reward points and reporting time:

[Rewards Reporting Time]
\$1/day 5 min/weekly
\$1/day 15 min/weekly
\$2/day 5 min/weekly
\$2/day 15 min/weekly
\$3/day 5 min/weekly
\$3/day 15 min/weekly

Table 5 Combinations of Rewards and Reporting Time

Both corporate and individual respondents were asked to rate the following combinations of reward points and verification method.

[Rewards Verification]
\$1/day Honour system
\$2/day Honour system
\$3/day Honour system
\$1/day Approval system
\$2/day Approval system
\$3/day Approval system
\$1/day GPS-tracking system
\$2/day GPS-tracking system
\$3/day GPS-tracking system

Table 6 Combinations of Rewards and Verification Method

8.4 Conjoint Analysis – All Respondents

This section will cover a description explaining how the data collected from all respondents was processed as part of conjoint analysis. The second conjoint analysis for

green commuters was done by following the same steps and only the final summary of the analysis was reported.

8.4.1 Assumptions

To simplify number of combinations listed in Question 6 and 7, the investigators had to make an assumption that direct dependence between two attributes: verification method and reporting time is negligible for the purpose of the study. Our main attention is focused on reward points offered to commuters in exchange for their time spent to report commuting data and inconvenience imposed from necessary method of verification. It is intuitively obvious that such a trade-off is well understood by respondents who are expected to make some effort to be eligible for some sort of compensation. However, it was not obvious to us that similar trade-off and give-and-take relationship between the reporting time and verification methods exists and is easy for respondents to understand. Even though GPS-tracking verification could offer a promise of automated reporting, using such a tracking device still requires time and effort to configure and operate. It is expected that commuting employees would need to spend time registering their data regardless of the verification method implemented by their employer making both attributes independent.

8.4.2 Results Processing

The survey results were downloaded to Excel spreadsheet and were expressed as a function of dependent variable Y and independent variables X with coefficients B1...B6:

$$Y = \text{Constant} + B1 * X1 + B2 * X2 + B3 * X3 + B4 * X4 + B5 * X5 + B6 * X6$$

- Constant – In our analysis this constant was not used and set to zero

- Y – Rating provided by the user
- X1 – Reward of \$1 a day (Reward\$1)
- X2 – Reward of \$2 a day (Reward\$2)
- X3 – Reward of \$3 a day (Reward\$3)
- X4 – Verification using honour system (Honour)
- X5 – Verification using approval system (Approval)
- X6 – Verification using GPS tracking system (GPS)
- B1...B6 – Coefficients that indicate how differences in each of the features levels make a difference in the overall rating.

Based on the above description, our function between respondent's rating and product attributes such as reward points and verification method can be expressed as:

$$\text{Rating} = B1(\text{Reward\$1}) + B2(\text{Reward\$2}) + B3(\text{Reward\$3}) + B4(\text{Honour}) + B5(\text{Approval}) + B6(\text{GPS})$$

Similarly, a function between respondents' rating and reward points and reporting time can be described as:

$$\text{Rating} = B1(\text{Reward\$1}) + B2(\text{Reward\$2}) + B3(\text{Reward\$3}) + B4(\text{Reporting 5 min}) + B5(\text{Reporting 15 min})$$

For each combination of reward points and verification method we need to indicate which of those variables was either present or absent during the rating. Therefore, for a combination asking respondents to rate the combination of \$1 reward and 5-minute reporting time the variables X1...X6 would have the following values:

Reward\$1	Reward\$2	Reward\$3	Honour	Approval	GPS
1	0	0	1	0	0

Table 7 Answers Expressed for Regression Processing

Table 8 shows excerpts from our real data file that was used for regression analysis. The coefficients are interpreted as the difference between various levels that makes a difference on the rating. For example, B1 is the effect on the rating of the difference between reward of \$1 and \$3. B2 is the effect on rating of difference between \$2 and \$3 and so on. These coefficients are the part-worth utilities of each individual level for given attribute of our conjoint analysis.

Respondent	Rating	Reward \$1	Reward \$2	Reward \$3	Verify Honor	Verify Approval	Verify GPS
1	1	1	0	0	1	0	0
1	1	0	0	1	1	0	0
1	1	1	0	0	0	1	0
1	1	0	1	0	1	0	0
1	1	1	0	0	0	0	1
1	3	0	0	1	0	0	1
1	3	0	0	1	0	1	0
1	1	0	1	0	0	1	0
1	1	0	1	0	0	0	1

Table 8 Conjoint Analysis – Response Processing Example

Having calculated utilities attached to each level of product's attributes, we can also calculate the relative importance of one attribute (for example reward points) compared to other attributes (for example verification method). The ratio of particular attribute's utility to the sum of all the attributes' utility is used to calculate the importance (or global utility) of a particular attribute below (Smith, 2005):

$$O_p = \frac{(\max u_p - \min u_p)}{\sum_{p=1}^t (\max u_p - \min u_p)}$$

- O_p is the relative importance of the product attribute
- $\max u_p$ is utility of the attribute's most preferred level
- $\min u_p$ is utility of least preferred performance level of the attribute

8.4.3 Reward Points and Reporting Time – Question 6

Using OLS regression analysis of Question 6 results, the following regression statistics were produced:

<i>Regression Statistics</i>	
Multiple R	0.924779514
R Square	0.855217149
Adjusted R Square	0.851788489
Standard Error	1.315702364
Observations	714

Table 9 Regression Statistics – Reporting Time by Individuals

R Square value of 0.855 can be interpreted to mean that 85 percent of the variation in rating was explained by associating the rating with reward points and reporting time. The actual utility values were found to be:

X Variable 1 - Reward \$1	-0.483193277
X Variable 2 - Reward \$2	0
X Variable 3 - Reward \$3	0.25210084
X Variable 4 - Reporting 5 min	3.460784314
X Variable 5 - Reporting 15 min	3.026610644
Importance – Rewards	0.63
Importance- Reporting	0.37

Table 10 Regression Summary – Reporting Time by Individuals

As expected, individuals would prefer to receive \$3 daily. Cash rewards also had more importance than reporting time. The complete output summary results are shown in Figure 109.

8.4.4 Assign Values to Attributes

The next step involves assigning found utility values to each of the conjoint attributes to find the preferred ranking order of various combinations of reward points and reporting time as shown in Table 11.

REWARD POINT\REPORTING TIME	5 MINUTES PER WEEK (3.5)	15 MINUTES PER WEEK (3.0)
\$1 PER DAY (-0.5)	5 (-0.5 + 3.5 = 3.0)	6 (-0.5 + 3.0 = 2.5)
\$2 PER DAY (0)	2 (0 + 3.5 = 3.5)	4 (0 + 3.0 = 3.0)
\$3 PER DAY (0.25)	1 (0.25 + 3.5 = 3.75)	3 (0.25 + 3 = 3.25)

Table 11 Utilities for Rewards and Reporting for All Respondents

Each of these combinations between reward point values and reporting time values can now be associated with a sum of the values of corresponding individual attributes. For example, a combination of \$1/day and 5 min/week is ranked 5 and is associated with a value of 3.0 ($-0.5 + 3.5$). A combination of \$3/day and 15 min/week is ranked 3 and is associated with a value of 3 ($0.25 + 3$), and so on.

It is important to notice that the highest value is assigned to top ranked combination and the smallest value is assigned to the lowest-ranked combination. In general, the assigned values are ranked in the same order as our original ranking of various combinations 1 (3.75), 2(3.5), 3(3.25), 4 (3.0), 5(3.0), 6(2.5) as shown in Table 11.

What is interesting is that, while generally higher rewards were preferred, a \$2 reward with 5 minute reporting was preferred to a \$3 reward with 15-minute reporting time, so a “better” system can payoff for employers in terms of lower financial reward costs. In addition, the difference between \$1 and \$2 is quite a bit larger than the difference between \$2 and \$3 – so maybe \$2 would be sufficient even though \$3 is obviously preferred.

8.4.5 Reward Points and Verification Method – Question 7

Similarly, the same process needs to be applied to help us determine utility of available combinations of reward points and verification methods as presented to our respondents in Question 7. Regression statistics and results for all respondents are shown in Table 12 and Table 13 respectively.

<i>Regression Statistics</i>	
Multiple R	0.916853
R Square	0.840619
Adjusted R Square	0.838145
Standard Error	1.326224
Observations	1071

Table 12 Regression Statistics – Verification by Individuals

X Variable 1 - Reward \$1	2.349206
X Variable 2 - Reward \$2	2.592904
X Variable 3 - Reward \$3	2.873016
X Variable 4 - Honour System	0.829132
X Variable 5 - Approval System	0.392157
X Variable 6 - GPS Tracking	0
Importance - Rewards	0.387164
Importance- Verification	0.612836

Table 13 Regression Summary – Verification by Individuals

Interestingly, the verification level has higher importance for individuals than higher cash rewards. This finding is opposite to what was found out for reporting time, which was perceived as less important than cash rewards. In other words, individuals would not mind spending weekly extra 10 minutes of their time online managing their

commuting information, but they perceive the inconvenience imposed by approval verification method as not worth the additional pay-out of one or two dollars. As done before, we can represent the ranking order of various combinations as a matrix.

REWARD POINT\REPORTING TIME	HONOUR SYSTEM (0.8)	APPROVAL SYSTEM (0.4)	GPS-TRACKING (0)
\$1 PER DAY (2.4)	4 (2.4 + 0.8 = 3.2)	7 (2.4 + 0.4 = 2.8)	9 (2.4 + 0 = 2.4)
\$2 PER DAY (2.6)	2 (2.6 + 0.8 = 3.4)	5 (2.6 + 0.4 = 3.0)	8 (2.6 + 0 = 2.6)
\$3 PER DAY (2.9)	1 (2.9 + 0.8 = 3.7)	3 (2.9 + 0.4 = 3.3)	6 (2.9 + 0 = 2.9)

Table 14 Ranking of Reward Points and Verification

The most preferred option selected by individuals is to be paid \$3 daily based on honour system. The least favorable is an option of being paid \$1 daily and use GPS-based tracking system. However, individuals would rather be paid \$2 and use honour system (ranked 3) than receiving slightly more for using more inconvenient approval verification (ranked 4).

8.4.6 Conjoint Analysis Summary – All Respondents

As expected, the maximum number of reward points (\$3) and the simplest verification method (honour system) had the highest utility value. However, one important conclusion from the results of conjoint analysis is that, surprisingly, the GPS-tracking system was not perceived as a very desirable feature and had very small utility for our respondents. In the example above, respondents would rather collect fewer reward points and have their supervisor to approve their commuting data, than receive more rewards in exchange for GPS-tracking system. This could be explained by concern about privacy or by the fact that most respondents still does not have GPS-enabled

phones or devices, although this will change as more and more manufactures, including Apple and its iPhone, plan to introduce GPS features as part of their wireless offering.

In summary, \$2 rewards, with 5 minute reporting and an honour system, while not the most highly rated alternative was not that different from the best and would be acceptable to employees and much cheaper for employers to implement with easy to use software.

In the next section, we will see if a group of green commuters has the same utility value as a group of all respondents.

8.5 Conjoint Analysis – Green Commuters – Question 6

The conjoint analysis of reward points and reporting time for a group of “green commuters” was done by executing the same steps that were followed for a group of all respondents in the previous section. To avoid unnecessary description of intermediary steps that were explained in previous section, only final summary data is reported in the following tables:

- Table 15 – statistics of regression analysis of “green” commuters’ data
- Table 16 – regression results of analysis of “green” commuters’ data
- Table 17 – rewards and reporting time utility values for “green” commuters

<i>Regression Statistics</i>	
Multiple R	0.945168162
R Square	0.893342854
Adjusted R Square	0.884621157
Standard Error	1.248903724
Observations	270

Table 15 Regression Statistics – Reporting Time by Green Commuters

X Variable 1 - Reward \$1	0
X Variable 2 - Reward \$2	0.411111111
X Variable 3 - Reward \$3	0.522222222
X Variable 4 - Reporting 5min	3.407407407
X Variable 5 - Reporting 15 min	3.125925926
Importance - Rewards	0.649769585
Importance- Reporting Time	0.350230415

Table 16 Regression Results Summary – Reporting Time by Green Commuters

The utility of rewards and reporting time, as well as, the importance of rewards and reporting time matches the results for all respondents.

REWARD POINT\REPORTING TIME	5 MINUTES PER WEEK (3.4)	15 MINUTES PER WEEK (3.1)
\$1 PER DAY (0)	5(0 + 3.4 = 3.4)	6 (0 + 3.1 = 3.1)
\$2 PER DAY (0.4)	2 (0.4 + 3.4 = 3.8)	4 (0.4 + 3.1 = 3.5)
\$3 PER DAY (0.5)	1 (0.5 + 3.4 = 3.9)	3(0.5 + 3.1 = 3.6)

Table 17 Green Commuters – Rewards and Reporting Utility Values

The ranking of various combinations of reward points and reporting time for “green” commuters is the same as the ranking for all respondents . Again, the difference between \$1 and \$2 is much larger than between \$2 and \$3 and shorter reporting time can compensate for lower rewards.

8.6 Conjoint Analysis – Green Commuters – Question 7

The conjoint analysis of reward points and verification method for a group of “green commuters” was done by executing the same steps that were followed for a group of all respondents. Only the final data is reported in the following tables:

- Table 18 – statistics from regression analysis of “green” commuters’ data

- Table 19 – regression results from analysis of “green commuters’ data
- Table 20 – rewards and reporting time utility values for “green” commuters

<i>Regression Statistics</i>	
Multiple R	0.927572895
R Square	0.860391476
Adjusted R Square	0.85399539
Standard Error	1.302533145
Observations	405

Table 18 Regression Statistics – Verification by Green Commuters

X Variable 1 - Reward \$1	3.081481481
X Variable 2 - Reward \$2	3.2
X Variable 3 - Reward \$3	3.340740741
X Variable 4 - Honour System	0.525925926
X Variable 5 - Approval System	0
X Variable 6 - GPS Tracking	-0.614814815
Importance - Rewards	0.185185185
Importance- Verification	0.814814815

Table 19 Regression Results Summary – Verification by Green Commuters

REWARD POINT\REPORTING TIME	HONOUR SYSTEM (0.5)	APPROVAL SYSTEM (0)	GPS-TRACKING (-0.6)
\$1 PER DAY (3.1)	3 (3.1 + 0.5 = 3.6)	6 (3.1 + 0 = 3.1)	9 (3.1 - 0.6 = 2.5)
\$2 PER DAY (3.2)	2 (3.2 + 0.5 = 3.7)	5 (3.2 + 0 = 3.2)	8 (3.2 - 0.6 = 2.6)
\$3 PER DAY (3.3)	1 (3.3 + 0.5 = 3.8)	4 (3.3 + 0 = 3.3)	7 (3.3 - 0.6 = 2.7)

Table 20 Green Commuters – Aggregated Verification Responses

8.7 Individual Survey – Summary

Our individual survey has provided results that are very valuable to understanding the potential market for our proposed personal carbon trading system:

- The most attractive alternative was rated by 40% of respondents as “definitely would participate and about 70% would or definitely would participate. This provides strong evidence that our respondents would at least consider participating in this kind of program.
- Majority of individuals are not attracted to GPS-tracking as a method of verification. This method of verification was overwhelmingly listed as the least favourable option among individual respondents. Verification based on honour system was the most favourable and was perceived as more important attribute than cash rewards.
- On the other hand, cash incentive was perceived as more important attribute than reporting time. Reward points do not offer commuters a compelling reason not to drive alone. If high price of gasoline and potential savings of thousands of dollars annually on fuel do not provide such incentive, additional \$1 reward point a day will not provide a strong incentive either.
- Our target market segment is a group of people who already take “green” means of transportation to work, but the design of the program is not different between the two groups, which is good news – the same program appeals to both, just at different levels.

The most preferred option selected by individuals is to be paid \$3 daily based on honour system. The least favorable is an option of being paid \$1 daily and use GPS-based

tracking system. However, individuals would rather be paid \$2 and use honour system (ranked 3) than receiving slightly more for using more inconvenient approval verification (ranked 4). These results are identical to our findings for all respondents.

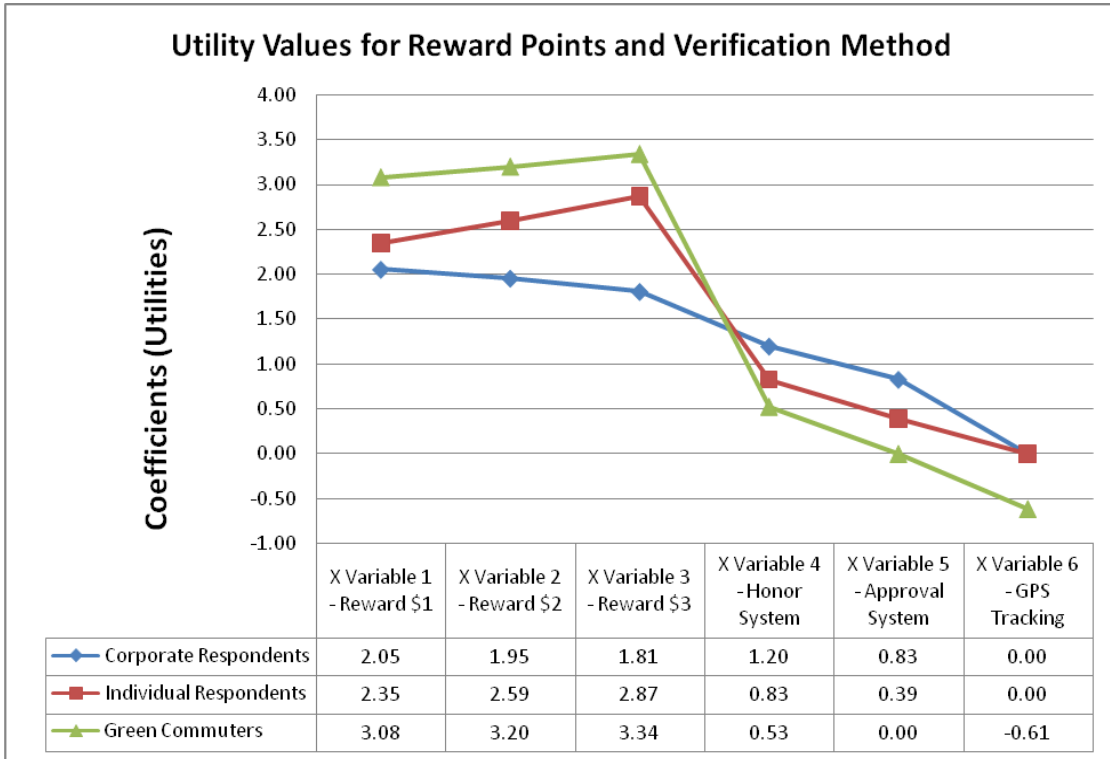


Figure 47 Utility Values for Rewards and Verification

Utility values for reward points and reporting time are practically the same for both individual respondents and the segment of “green” commuters. “Green” commuters are slightly more influenced by cash rewards compared to the overall population of our respondents (Figure 48).

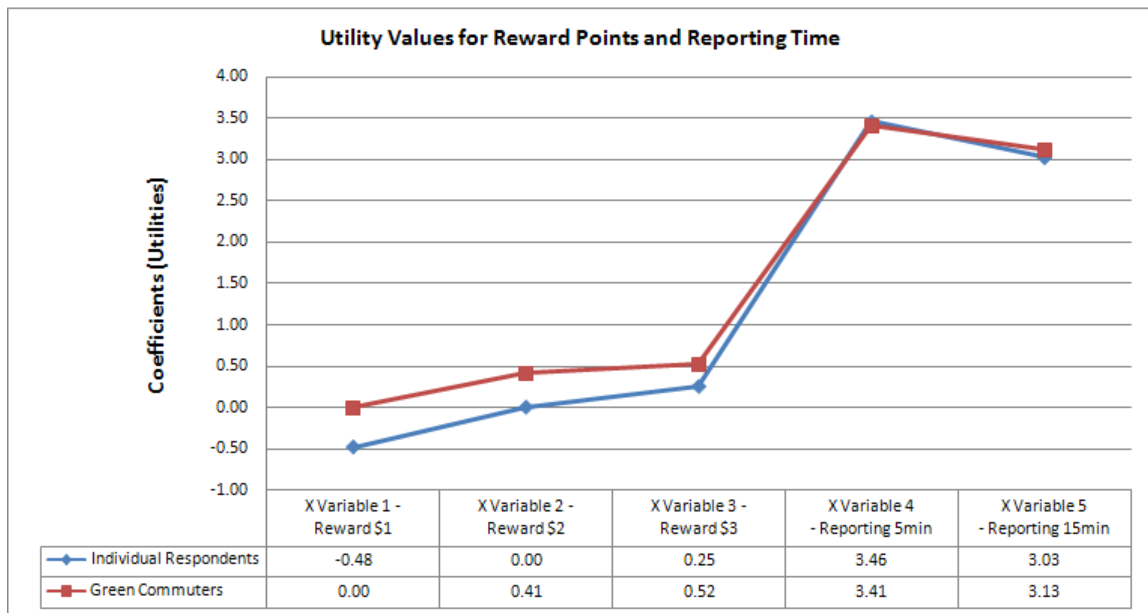


Figure 48 Utility Values for Rewards and Reporting

9: DATA ANALYSIS – CORPORATE SURVEY

Results of corporate survey are shown in (Figure 86, Figure 93). Companies participating in our survey indicated a number of employees in their organization. The following diagram represents the breakdown of participating organizations by size (Figure 49).



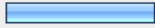
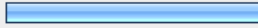

		Response Percent	Response Count
1-10		10.7%	3
10-100		14.3%	4
100-1,000		25.0%	7
1,000-10,000		42.9%	12
10,000 or more		7.1%	2
		<i>answered question</i>	28
		<i>skipped question</i>	2

Figure 49 Corporate Survey – Organizations by Size

Our corporate respondents ranged from educational sector, software, energy, finance, healthcare, government, insurance, and transportation among others. Participating organizations were asked to report their industry as shown in Figure 50.

13. Industry			
	1. University	13. educational institution	
	2. Insurance, travel, road assistance.	14. Financial Institution	
	3. Manufacturing	15. Financial Institution	
	4. Software.	16. Education	view
	5. Energy	17. Insurance	answered question
	6. Fitness	18. education	skipped question
	7. Travel	19. Healthcare	
	8. government	20. Technology/Telecommunications	
	9. transportation	21. Retail	
	10. Marine Transportation	22. Outdoor recreation Industry	
	11. Forest Products	23. Aviation	
	12. Mining	24. non-profit	
			Response Count
			24
			24
			6

Figure 50 Corporate Survey – Organizations by Industry

Half of surveyed organizations have already calculated their corporate carbon footprint (Figure 51), but only small minority have ever purchased carbon offsets to reduce their own corporate carbon footprint (Figure 52).

4. Has your organization calculated its carbon footprint?			
		Response Percent	Response Count
Yes		50.0%	14
No		50.0%	14
	Other (please specify)		6
		answered question	28
		skipped question	2

Figure 51 Corporate Survey – Carbon Footprint Calculation


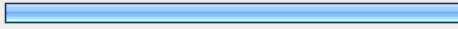
5. Has your organization ever purchased a carbon offset to reduce emissions?			Response Percent	Response Count
Yes			21.4%	6
No			78.6%	22
Other (please specify)				7
			<i>answered question</i>	28
			<i>skipped question</i>	2

Figure 52 Corporate Survey – Carbon Footprint Purchase

The following are the key questions that allow us to assess if there is a support for our proposed online personal carbon trading and commuting system among corporate respondents. Whether there is support among organizations for reduction of employees’ personal carbon footprint and corporate carbon footprint based on answers from

Question 2:

- Whether organizations have already implemented a system to manage commuting data based on answers from Question 3.
- Whether the principle of carbon offsets is important to organizations and does it meet the Additionality principle is based results from Question 7. The Additionality principle of carbon offsets states that activities that generate offsets must produce authentic benefits and are genuinely "additional" activities that would not otherwise have been undertaken. Our proposed system plans to generate carbon offsets that may not meet rigid interpretations of the Additionality principle, as it will target not only new (“additional”) commuters

who switch to “green” transportation, but also people who have already been using “green” commuting alternatives.

- Whether companies would consider personal emission reduction of their employees as a source of carbon offsets that could be used against corporate carbon footprint based on answers from Question 8.
- Whether the organization would participate in the proposed personal carbon trading and commuting system based on answers from Question 9. The results from this question are analysed using our conjoint analysis method for corporate respondents in a similar fashion that worked well for individual responses.

The above questions will be analysed based on the answer to Question 14 using the following filters:

- Small size – specified number of employees to be in range from 1 and 100
- Medium Size – specified number of employees to be in range from 100 and 1000
- Large Size -- specified number of employees to be more than 1000

9.1 Environmental Awareness – Question 2

How important are these initiatives to your organization

Results from question 2 indicate that reduction of employees’ personal carbon footprint is important for 33% of small companies (Figure 53), goes up to 50% for mid-size companies (Figure 54) and is 66% among large organizations (Figure 55). Reduction of corporate carbon footprint is very important for 33% of small organizations, 50% of mid-size organization and 75% of large organizations.

	Very Important	Somewhat Important	Neutral	Not Very Important	Not at All Important	N/A	Response Count
Reducing employees' personal carbon footprint	14.3% (1)	42.9% (3)	28.6% (2)	0.0% (0)	14.3% (1)	0.0% (0)	7
Corporate Social Responsibility	33.3% (2)	66.7% (4)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	6
Increasing environmental awareness among employees	42.9% (3)	42.9% (3)	0.0% (0)	0.0% (0)	14.3% (1)	0.0% (0)	7
Reducing company's carbon footprint	42.9% (3)	42.9% (3)	0.0% (0)	14.3% (1)	0.0% (0)	0.0% (0)	7
Producing "green" products and services	57.1% (4)	14.3% (1)	0.0% (0)	14.3% (1)	0.0% (0)	14.3% (1)	7
	Other (please specify)						0
	answered question						7
	skipped question						0

Figure 53 Environmental Awareness of Small Companies

	Very Important	Somewhat Important	Neutral	Not Very Important	Not at All Important	N/A	Response Count
Reducing employees' personal carbon footprint	28.6% (2)	57.1% (4)	14.3% (1)	0.0% (0)	0.0% (0)	0.0% (0)	7
Corporate Social Responsibility	100.0% (7)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	7
Increasing environmental awareness among employees	83.3% (5)	16.7% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	6
Reducing company's carbon footprint	57.1% (4)	28.6% (2)	14.3% (1)	0.0% (0)	0.0% (0)	0.0% (0)	7
Producing "green" products and services	33.3% (2)	33.3% (2)	0.0% (0)	0.0% (0)	0.0% (0)	33.3% (2)	6
	Other (please specify)						0
	answered question						7
	skipped question						0

Figure 54 Environmental Awareness of Mid-size Companies

	Very Important	Somewhat Important	Neutral	Not Very Important	Not at All Important	N/A	Response Count
Reducing employees' personal carbon footprint	0.0% (0)	64.3% (9)	28.6% (4)	7.1% (1)	0.0% (0)	0.0% (0)	14
Corporate Social Responsibility	71.4% (10)	21.4% (3)	7.1% (1)	0.0% (0)	0.0% (0)	0.0% (0)	14
Increasing environmental awareness among employees	64.3% (9)	28.6% (4)	7.1% (1)	0.0% (0)	0.0% (0)	0.0% (0)	14
Reducing company's carbon footprint	78.6% (11)	14.3% (2)	0.0% (0)	7.1% (1)	0.0% (0)	0.0% (0)	14
Producing "green" products and services	42.9% (6)	28.6% (4)	21.4% (3)	0.0% (0)	0.0% (0)	7.1% (1)	14
	Other (please specify)						2
	answered question						14
	skipped question						0

Figure 55 Environmental Awareness of Large Companies

Further analysis of collected data reveals that 95% of surveyed organizations replied that reducing corporate footprint and corporate social responsibility are either very important or somewhat important. Most organizations also responded that increasing environmental awareness among employees either very important or somewhat important. However, none of the organizations indicated that reducing personal carbon footprint is very important, but some companies in the following industries replied that reducing personal carbon footprint is somewhat important: aviation, outdoor recreation, technology/telecommunications, healthcare, education, financial, transportation, marine transportation, government, travel, manufacturing, insurance and road assistance.

Organizations in the following industries replied that reducing personal carbon footprint is either neutral or not important: insurance, mining, forests products, energy, software, education, retail, and non-profit.

Table 21 summarizes how corporate respondents, based on their company’s size, judged importance of reducing employee’s personal carbon footprint. These results demonstrate that there is a strong support for reduction of employees’ personal carbon footprint among medium-size and large-size organizations.

Importance of Reducing Employees’ Personal Carbon Footprint		
	Very Important	Somewhat Important
Small Size	14.3%	42.9%
Medium Size	28.6%	57.1%
Large Size	0%	64.3%

Table 21 Reducing Employees’ Carbon Footprint Summary by Size

Our survey results shows that increasing environmental awareness among employees is perceived as very important in large organizations. This importance is smaller for medium size companies and the smallest for small-size organizations. This trend can be explained by the emphasis large organizations are placing on training of their human resources. Talking to Environmental Managers from various organizations, it became apparent that medium-size and large employers have a long term perspective and a belief that providing proper training and increasing environmental awareness among their employees will help the organizations to adjust to various environmental and climate change regulations and prosper in the new “green” market landscape in the

future. Small-businesses are very much focused on short term survival or support of rapid growth that often require putting training and environmental awareness as secondary issues.

Importance of Increasing Environmental Awareness among Employees		
	Very Important	Somewhat Important
Small Size	42.9%	42.9%
Medium Size	83.3%	16.7%
Large Size	64.3%	28.6%

Table 22 Increasing Environmental Awareness among Employees

9.2 Carbon Management System – Question 3

Has your company implemented a system for managing corporate carbon credits?

Answers to Question 3 (Figure 56) show that the majority of corporate respondents do not have any system to manage corporate carbon credits in place. Two of the three respondents who have such a system in place are large organizations. This finding is encouraging as our proposed system could fill in the void.

	Check if applicable	Response Count
Developed in-house	100.0% (3)	3
Online web-based system from a vendor	0.0% (0)	0
No system is currently used	100.0% (24)	24
	Other (please specify)	4
	answered question	27
	skipped question	3

Figure 56 Corporate Carbon Footprint System

9.3 Attributes of Carbon Offsets – Question 7

When deciding to buy carbon offsets how important for your organization are the following: price of carbon offsets, Additionality principle, certification by a 3rd party, “green” reputation among stakeholders, positive impact on environment, compliance with social responsibility policies.

Only respondents who previously either purchased carbon offsets or calculated carbon footprint were asked to reply to Question 7. Based on relatively small number of

responses (Figure 57), investigators hesitate to make any far-reaching conclusions, but Additionality principle is not perceived as a strong requirement among respondents. Again, this could be a favourable finding to us, as carbon offsets generated by employees may not meet strict Additionality principle requirements when it comes to emission reduction. Positive impact on environment, certification, green reputation and compliance with social responsibility policies were reported as more important.

	Least Important	Less Important	Neutral	More Important	Most Important	N/A	Response Count
Price of carbon offsets	0.0% (0)	16.7% (1)	50.0% (3)	33.3% (2)	0.0% (0)	0.0% (0)	6
Additionality principle	0.0% (0)	0.0% (0)	40.0% (2)	0.0% (0)	40.0% (2)	20.0% (1)	5
Certification by a 3rd party	0.0% (0)	16.7% (1)	0.0% (0)	33.3% (2)	50.0% (3)	0.0% (0)	6
Green reputation among stakeholders	0.0% (0)	0.0% (0)	50.0% (3)	33.3% (2)	16.7% (1)	0.0% (0)	6
Positive impact on environment	0.0% (0)	0.0% (0)	0.0% (0)	83.3% (5)	16.7% (1)	0.0% (0)	6
Compliance with social responsibility policies	0.0% (0)	16.7% (1)	0.0% (0)	50.0% (3)	33.3% (2)	0.0% (0)	6
	Other (please specify)						2
	answered question						6
	skipped question						24

Figure 57 Survey – Attributes of Carbon Offsets

9.4 Personal Carbon Credits – Question 8

By supporting and rewarding green commuting efforts of your employees and using online system as described in the next question, your company could calculate the amount of emission reductions generated by your employees. Would you consider this

emission reduction effort as a method to reduce your company's corporate carbon footprint?

Results from Question 8 show that 60% of respondents from small business indicated that they would consider emission reduction effort by employees as a method to reduce corporate carbon footprint. Such support can be found in 100% of medium size companies and in 89% of large organizations. Support from all respondents is at 84% (Figure 58).

		Response Percent	Response Count
Yes		87.5%	21
No		12.5%	3
Other (please specify)			6
		answered question	24
		skipped question	6

Figure 58 Support for Personal Emission Reduction

9.5 Conjoint Analysis – Question 9

Please consider the following HYPOTHETICAL situation. To encourage your employees to move away from driving alone to work, your company creates an online system to keep track of your employees' commuting routines and provide evidence to support tradable carbon credits. Employees are offered reward points for taking alternative transportation to work (valued at \$1, \$2 or \$3), but are asked to verify their commuting routine:

a) *Approval system -- one option is for a supervisor to approve employees' commuting routines by verifying submitted commuting reports with a co-rider, bus ticket, or fellow cyclist;*

b) *GPS-tracking – another option is to use GPS-enabled device to track the distance travelled;*

c) *Honour system – alternatively employees are trusted and no verification is necessary, similar to the honour system that works well for brewing departmental morning coffee in many organizations.*

Please rate your preferred combination of reward points and level of verification.

[Rewards / Verification]

We asked individual respondents the same question. Later we will compare results from corporate respondents with results from individual respondents to find out common verification method that is acceptable to both individual commuters and their employers. This analysis was done for companies of all sizes to have the largest possible sample and the results are shown in Table 23, Table 24 and Table 25.

<i>Regression Statistics</i>	
Multiple R	0.92694799
R Square	0.859232577
Adjusted R Square	0.848463377
Standard Error	1.088979715
Observations	243

Table 23 Regression Statistics – Verification Method by Corporate Respondents

X Variable 1 - Reward \$1	2.053497942
X Variable 2 - Reward \$2	1.95473251
X Variable 3 - Reward \$3	1.806584362
X Variable 4 - Honour System	1.197530864
X Variable 5 - Approval System	0.827160494
X Variable 6 - GPS Tracking	0
Importance - Rewards	0.170940171
Importance- Verification	0.755844156

Table 24 Regression Summary – Verification Method by Corporate Respondents

REWARD POINT\REPORTING TIME	HONOUR SYSTEM (1.2)	APPROVAL SYSTEM (0.8)	GPS-TRACKING (0)
\$1 PER DAY (2.0)	1 (2.0+1.2 = 3.2)	4 (2.0+0.8 =2.8)	7(2.0 +0 =2.0)
\$2 PER DAY (1.9)	2 (1.9+1.2 =3.1)	5 (1.9+0.8 =2.7)	8 (1.9 +0 = 1.9)
\$3 PER DAY (1.8)	3 (1.8 + 1.2 =3.0)	6 (1.8 + 0.8 = 2.6)	9 (1.8 + 0 = 1.8)

Table 25 Corporate Conjoint Analysis – Verification Utility Values

It is worth noting that verification attribute has very high importance of 75% for our corporate respondents in comparison to individual respondents who valued importance of verification attribute at 61%.

By comparing utility values of corporate and individual respondents (Table 26, Table 27, Figure 59), we may conclude that the values for reward points are reversed. The lowest amount of reward points has the highest utility for corporate respondents and the lowest utility for individuals. It is interesting to note that the differences in reward levels made very little difference in preference. Verification method based on the honour

system is surprisingly rated as a preferred method by both individual and corporate respondents. An interesting conclusion from results of both conjoint calculations is the fact that GPS-tracking is the least preferred option for both corporate and individual respondents.

Reward Points	Verification Level
\$1/day (2.0)	Honour System (1.2)
\$2/day (1.9)	Approval System (0.8)
\$3/day (1.8)	GPS Tracking (0)

Table 26 Corporate Respondents – Utilities of Reward Points and Verification

Reward Points	Verification Level
\$1/day (2.4)	Honour System (0.8)
\$2/day (2.6)	Approval System (0.4)
\$3/day (2.9)	GPS Tracking (0)

Table 27 Individual Respondents – Utilities of Reward Points and Verification

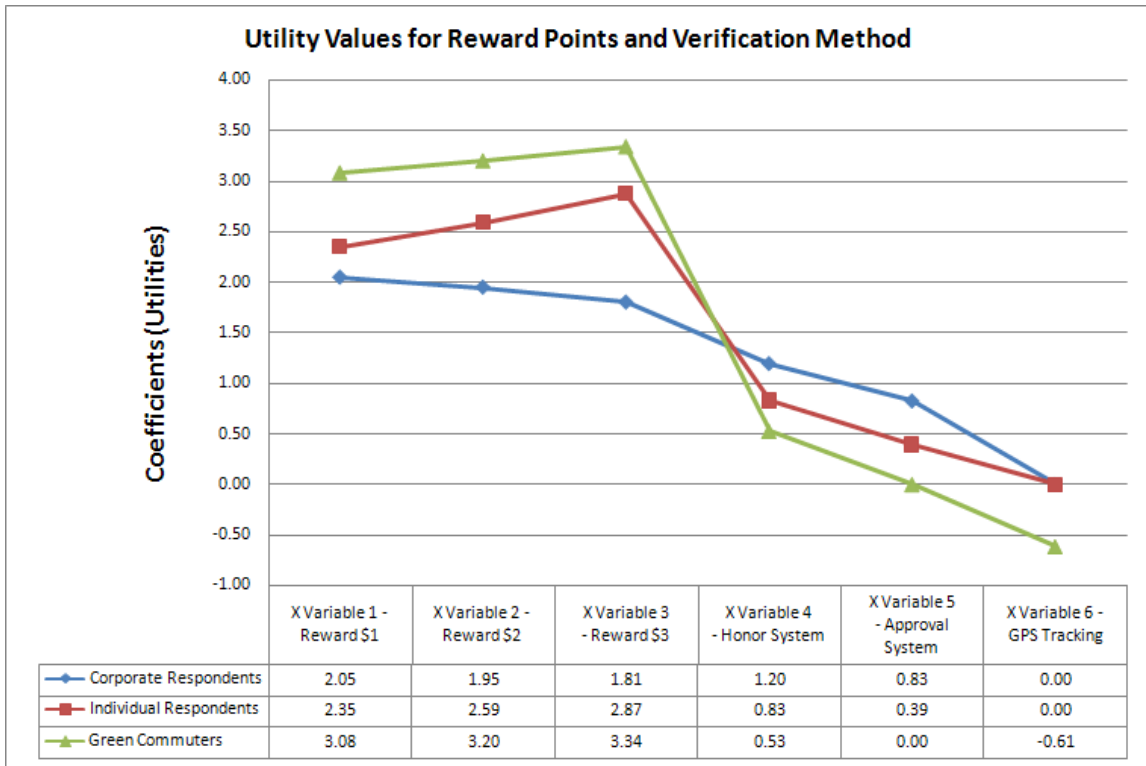


Figure 59 Utility Values for Rewards and Verification

9.6 Corporate Survey – Summary

Our corporate survey has provided results that are very valuable to understanding potential corporate market for our proposed personal carbon trading system:

- Small-size companies have limited budgets to purchase carbon offsets and to participate in the proposed trading system.
- Companies emitting large amounts of pollutions as part of their business operations (Emitters) are expected to be regulated and their main challenge is to cope with the recently introduced cap-and-trade system by the Government of British Columbia.

- Organizations that have operations in other jurisdictions must comply with many, sometimes overlapping regulatory policies established by federal, state or provincial governments and governmental agencies. Emitters expect to be under very rigid requirements of carbon-offset verification. One such requirement is a definition of factory's boundary where offsets have to be generated, so employees commuting to a factory from outside the factory's boundary would create voluntary offsets that may not be used within the facility. Additionally, voluntary offsets generated by employees may not meet high verifications and registration standards of regulatory carbon offsets that the factory needs to generate and trade. Because of high regulation, emitting companies will not be interested in using personal carbon credits of their employees as a source of offsets that could be applied against their own corporate carbon footprint.
- Provincial Crown Corporations will be regulated and their main challenge is to comply with the provincial legislation to become carbon neutral by 2012. Those companies may be interested in utilizing personal carbon credits of their employees in the future, but today their main goal is compliance with the new legislation.
- Ninety percent of surveyed organizations responded that they would consider using personal carbon credits generated by their employees as a source of carbon offsets to reduce their own corporate footprint. This information is encouraging and presents opportunity to develop and implement a system that would allow employers to tap into this source of carbon offsets.

- A couple of large organizations are planning to develop a system to manage their carbon offsets, but most companies we surveyed do not have such a system in place and our proposed system could fill the vacuum.
- For most companies, the Additionality principle of carbon offsets is not a strong requirement. This finding is also encouraging, as personal carbon offsets generated by employees may not meet the Additionality principle. Our proposed system would be offered to both the employees who currently use “green” commuting options and the employees who would be motivated to leave their cars and not drive alone to work because of enrolling in our system.
- Based on the survey data and interviews, we can define our target market as medium-size (100-1000) and large organizations (1000+) that are not in energy and mining sectors and are not impacted by cap-and-trade system recently introduced by the Government of British Columbia.
- Due to limited sample size (30 responses), further definition and analysis of a target market will be done by researching current literature and academic papers.

10: APPENDICES

10.1 Appendix A – Carbon Market

	2,006	2,007
	Volume [MtCO ₂ e]	Volume [MtCO ₂ e]
Primary Clean Development Mechanism	537	551
Secondary Clean Development Mechanism	25	240
Joint Implementation	16	41
Other Compliance and Voluntary Transactions	33	42
Total	611	847

Figure 60 Carbon Market, Volumes per Project at Glance

	2,006	2,007
	Value [U\$ Millions]	Value [U\$ Millions]
Primary Clean Development Mechanism	5,804	7,426
Secondary Clean Development Mechanism	445	5,451
Joint Implementation	141	499
Other Compliance and Voluntary Transactions	146	265
Total	6,536	13,641

Figure 61 Carbon Market at Glance – Values per Project

10.2 Appendix B – Email to Individual Respondents

We are Management of Technology MBA students at Simon Fraser University School of Business doing market research for our final thesis project. The purpose of the research is to understand public perceptions about environment, commuting preferences and awareness of personal carbon credits.

Participation in this survey is voluntary. Identity of respondents will be kept confidential and only aggregate results will be reported. No one will contact respondents further for sales purposes.

http://www.surveymonkey.com/s.aspx?sm=fgMi3AXTM9vaonsgJeUwiQ_3d_3d

Thank you for your participation!

Regards,
John Turner and Jacek Gorwa
MOT MBA Candidates

Figure 62 – Email to Individual Respondents

10.3 Appendix C – Email to Corporate Respondents

We are Management of Technology MBA students at Simon Fraser University School of Business doing market research for our final thesis project. The purpose of the research is to understand the actions various organizations in British Columbia take to become socially responsible, learn about the effort they make to reduce and calculate their corporate carbon footprint and the support they offer to green commuting efforts undertaken by their employees.

Participation in this survey is voluntary. Identity of respondents will be kept confidential and only aggregate results will be reported. No one will contact respondents further for sales purposes. This survey is sponsored by SFU and supported by a research grant from MITACS.

<http://www.surveymonkey.com/s.aspx?sm=vTAwIGbU6Q9aMoeSl9RBfg%3d%3d>

Thank you for your participation!

Regards,
John Turner and Jacek Gorwa
MOT MBA Candidates

Figure 63 – Email to Corporate Respondents

Individual Environmental Awareness and Commuting Survey

43%

2. How many kilometers is your daily commute?

Distance

One-way commute

3. What is your regular mode of transportation to work?

Number of days per week

Drive alone

Carpool

Ride mass transit

Bicycle

Walk

Telecommute

Other (please specify)

4. How do each of the following reasons influence your regular transportation mode choice?

	Strongly Disagree	Disagree	Agree	Agree Somewhat	Strongly Agree	N/A
Alternative transportation not available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alternative transportation too expensive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Convenience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Family responsibility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More socially responsible alternative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More suited for my work hours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prefer to drive alone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shorter travel time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify)	<input type="text"/>					

Figure 65 – Individual Survey – Question 2-4

5. If you drive your own vehicle to work, to what extent would the following incentives encourage you to use an alternative transportation mode?

	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive
Discount passes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cash reward points	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial savings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tax benefits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Free parking for carpools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Showers/lockers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bike racks on transit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify)	<input type="text"/>				

Figure 66 – Individual Survey – Question 5

Individual Environmental Awareness and Commuting Survey

57%

6. Please consider the following HYPOTHETICAL situation.

To encourage you to move away from driving alone to work, your employer creates an online system to keep track of your commuting routine. You are offered reward points for taking alternative transportation to work (valued at \$1, \$2 and \$3), but you are asked to record your commuting habits using the newly established online system on a daily or weekly basis.

Please rate your preferred combination of reward points, level of verification, and the time it takes to report your commuting data.

[Rewards | Reporting Time]

	1. Definitely Would Not Participate	2. Would Not Participate	3. Undecided	4. Would Participate	5. Definitely Would Participate
\$1/day 5 min/weekly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$3/day 5 min/weekly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$3/day 15 min/weekly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$1/day 15 min/weekly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$2/day 5 min/weekly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$2/day 15 min/weekly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 67 – Individual Survey – Question 6

7. Please consider the following HYPOTHETICAL situation.

To encourage you to move away from driving alone to work, your employer creates an online system to keep track of your commuting routine. You are offered reward points for taking alternative transportation to work (valued at \$1, \$2 and \$3), but you are asked to verify your commuting routine:

- a) Approval system -- one option is for your supervisor at work to approve your commuting routine using the newly established online system verifying your report with a co-rider, bus ticket or fellow cyclist.
- b) GPS-tracking -- another option is to use GPS-enabled device to track the distance traveled.
- c) Honor system -- alternatively your employer trusts you and no verification is necessary, similar to the honor system that works well for brewing departmental morning coffee in many organizations.

Please rate your preferred combination of reward points and the level of verification.

[Rewards | Verification]

	1. Definitely Would Not Participate	2. Would Not Participate	3. Undecided	4. Would Participate	5. Definitely Would Participate
\$1/day Honor system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$3/day Honor system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$1/day Approval system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$2/day Honor system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$1/day GPS-tracking system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$3/day GPS-tracking system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$3/day Approval system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$2/day Approval system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$2/day GPS-tracking system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 68 – Individual Survey – Question 7

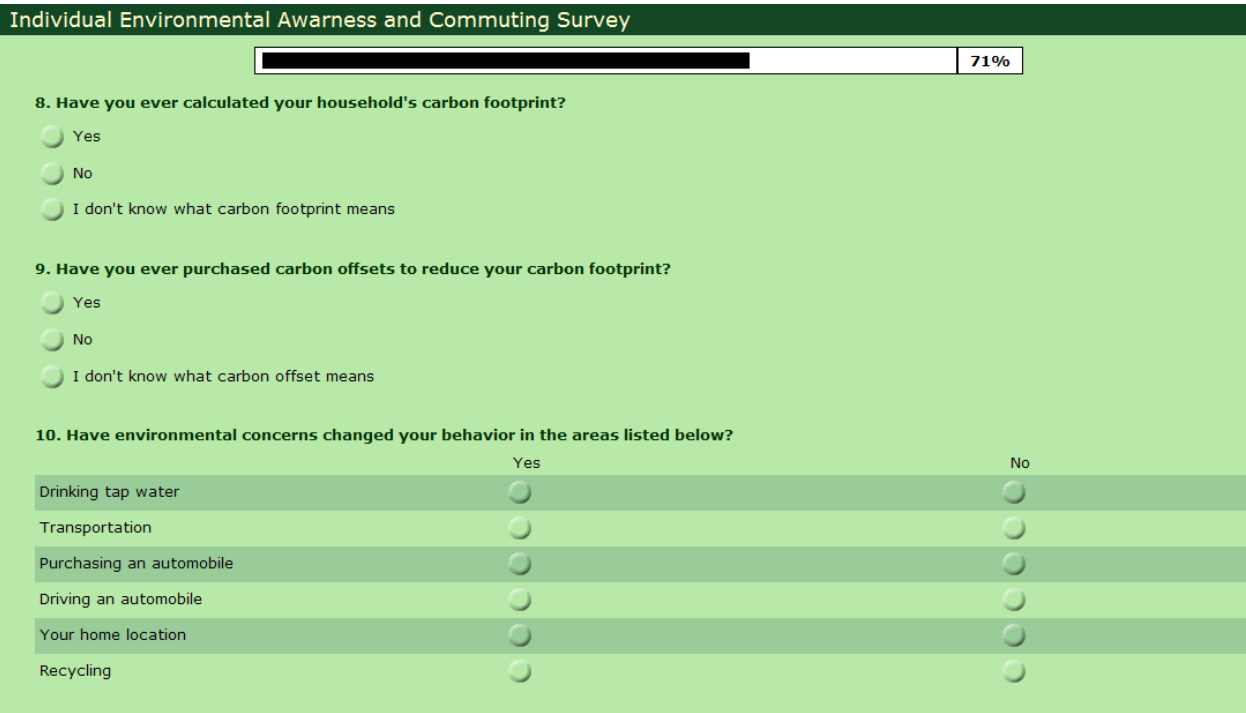


Figure 69 – Individual Survey – Question 8-10

Individual Environmental Awareness and Commuting Survey



11. Gender

- Female
- Male

12. Age Group

- 16-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65 or more

13. Education

- High School or less
- College Diploma or Certificate
- Bachelor Degree
- Masters Degree or more

14. Income Range

- \$40,000 or less
- \$40,000 - \$60,000
- \$60,000 - \$75,000
- \$75,000 - \$100,000
- \$100,000 or more

Figure 70– Individual Survey – Question 11-14

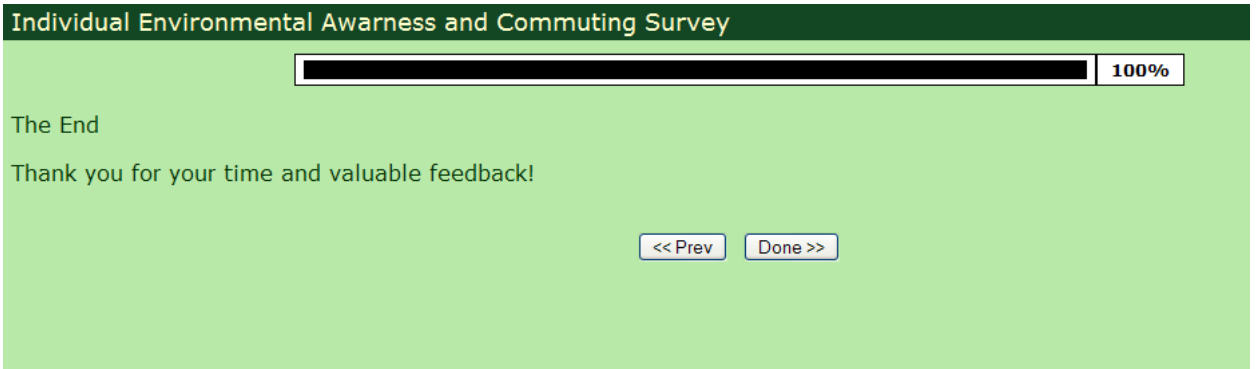


Figure 71 – Individual Survey – Last Page

10.5 Appendix E – Individual Surveys – Responses

2. How many kilometers is your daily commute?									
Distance									
	0-5 KM	6-10 KM	11-20 KM	21-30 KM	31-50 KM	50-100 KM	100 KM or more	N/A	Response Count
One-way commute	32.2% (39)	21.5% (26)	17.4% (21)	10.7% (13)	7.4% (9)	5.0% (6)	2.5% (3)	3.3% (4)	121
	<i>answered question</i>								121
	<i>skipped question</i>								4

Figure 72 Individual Survey – Commuting Distance

3. What is your regular mode of transportation to work?										
Number of days per week										
	1	2	3	4	5	6	7	Occasionally	N/A	Response Count
Drive alone	11.6% (10)	10.5% (9)	9.3% (8)	9.3% (8)	37.2% (32)	1.2% (1)	5.8% (5)	4.7% (4)	10.5% (9)	86
Carpool	8.3% (4)	6.3% (3)	10.4% (5)	2.1% (1)	6.3% (3)	0.0% (0)	2.1% (1)	8.3% (4)	56.3% (27)	48
Ride mass transit	6.3% (4)	7.9% (5)	0.0% (0)	9.5% (6)	22.2% (14)	1.6% (1)	6.3% (4)	9.5% (6)	36.5% (23)	63
Bicycle	4.9% (2)	4.9% (2)	4.9% (2)	0.0% (0)	4.9% (2)	0.0% (0)	0.0% (0)	7.3% (3)	73.2% (30)	41
Walk	8.5% (4)	6.4% (3)	6.4% (3)	2.1% (1)	10.6% (5)	0.0% (0)	6.4% (3)	10.6% (5)	48.9% (23)	47
Telecommute	5.1% (2)	5.1% (2)	0.0% (0)	2.6% (1)	15.4% (6)	0.0% (0)	2.6% (1)	15.4% (6)	53.8% (21)	39
								Other (please specify)		10
								answered question		119
								skipped question		6

Figure 73 Individual Survey – Mode of Transportation

4. How do each of the following reasons influence your regular transportation mode choice?							
	Strongly Disagree	Disagree	Agree	Agree Somewhat	Strongly Agree	N/A	Response Count
Prefer to drive alone	21.0% (25)	30.3% (36)	16.0% (19)	8.4% (10)	9.2% (11)	15.1% (18)	119
Alternative transportation not available	17.4% (21)	24.0% (29)	10.7% (13)	14.0% (17)	24.0% (29)	9.9% (12)	121
Alternative transportation too expensive	12.2% (15)	35.8% (44)	13.8% (17)	16.3% (20)	10.6% (13)	11.4% (14)	123
More suited for my work hours	5.8% (7)	10.8% (13)	20.0% (24)	23.3% (28)	29.2% (35)	10.8% (13)	120
Family responsibility	14.2% (17)	15.0% (18)	18.3% (22)	9.2% (11)	18.3% (22)	25.0% (30)	120
Shorter travel time	5.9% (7)	8.4% (10)	21.0% (25)	14.3% (17)	40.3% (48)	10.1% (12)	119
Convenience	3.3% (4)	7.3% (9)	22.8% (28)	13.8% (17)	50.4% (62)	2.4% (3)	123
More socially responsible alternative	11.6% (14)	29.8% (36)	21.5% (26)	10.7% (13)	13.2% (16)	13.2% (16)	121
					Other (please specify)		19
					<i>answered question</i>		125
					<i>skipped question</i>		0

Figure 74 Individual Survey – Influenced Mode of Choice

5. If you drive your own vehicle to work, to what extent would the following incentives encourage you to use an alternative transportation mode?						
	Very Weak Incentive	Weak Incentive	Normal Incentive	Strong Incentive	Very Strong Incentive	Response Count
Discount passes	20.6% (21)	24.5% (25)	23.5% (24)	16.7% (17)	14.7% (15)	102
Cash reward points	22.4% (22)	21.4% (21)	26.5% (26)	16.3% (16)	13.3% (13)	98
Financial savings	10.8% (11)	8.8% (9)	31.4% (32)	30.4% (31)	18.6% (19)	102
Tax benefits	15.8% (16)	9.9% (10)	33.7% (34)	30.7% (31)	9.9% (10)	101
Free parking for carpools	22.2% (22)	21.2% (21)	23.2% (23)	24.2% (24)	9.1% (9)	99
Showers/lockers	40.8% (40)	27.6% (27)	13.3% (13)	12.2% (12)	6.1% (6)	98
Bike racks on transit	38.8% (38)	26.5% (26)	16.3% (16)	11.2% (11)	7.1% (7)	98
				Other (please specify)		20
				<i>answered question</i>		104
				<i>skipped question</i>		21

Figure 75 Individual Survey -- Influence Use of Alternate Transportation

6. Please consider the following HYPOTHETICAL situation. To encourage you to move away from driving alone to work, your employer creates an online system to keep track of your commuting routine. You are offered reward points for taking alternative transportation to work (valued at \$1, \$2 and \$3), but you are asked to record your commuting habits using the newly established online system on a daily or weekly basis. Please rate your preferred combination of reward points, level of verification, and the time it takes to report your commuting data. [Rewards | Reporting Time]

	1. Definitely Would Not Participate	2. Would Not Participate	3. Undecided	4. Would Participate	5. Definitely Would Participate	Response Count
\$1/day 5 min/weekly	22.8% (28)	13.8% (17)	25.2% (31)	29.3% (36)	8.9% (11)	123
\$3/day 5 min/weekly	11.5% (14)	1.6% (2)	19.7% (24)	33.6% (41)	33.6% (41)	122
\$3/day 15 min/weekly	19.2% (23)	10.0% (12)	25.8% (31)	24.2% (29)	20.8% (25)	120
\$1/day 15 min/weekly	32.5% (39)	18.3% (22)	19.2% (23)	21.7% (26)	8.3% (10)	120
\$2/day 5 min/weekly	15.3% (19)	6.5% (8)	20.2% (25)	37.9% (47)	20.2% (25)	124
\$2/day 15 min/weekly	23.0% (28)	9.8% (12)	27.9% (34)	23.8% (29)	15.6% (19)	122
	<i>answered question</i>					125
	<i>skipped question</i>					0

Figure 76 Individual Survey -- Reward Points and Reporting Time

7. Please consider the following HYPOTHETICAL situation. To encourage you to move away from driving alone to work, your employer creates an online system to keep track of your commuting routine. You are offered reward points for taking alternative transportation to work (valued at \$1, \$2 and \$3), but you are asked to verify your commuting routine: a) Approval system -- one option is for your supervisor at work to approve your commuting routine using the newly established online system verifying your report with a co-rider, bus ticket or fellow cyclist. b) GPS-tracking -- another option is to use GPS-enabled device to track the distance traveled. c) Honor system -- alternatively your employer trusts you and no verification is necessary, similar to the honor system that works well for brewing departmental morning coffee in many organizations. Please rate your preferred combination of reward points and the level of verification. [Rewards | Verification]

	1. Definitely Would Not Participate	2. Would Not Participate	3. Undecided	4. Would Participate	5. Definitely Would Participate	Response Count
\$1/day Honor system	16.7% (20)	16.7% (20)	22.5% (27)	25.0% (30)	19.2% (23)	120
\$3/day Honor system	12.4% (15)	5.0% (6)	14.9% (18)	30.6% (37)	37.2% (45)	121
\$1/day Approval system	22.9% (27)	19.5% (23)	30.5% (36)	17.8% (21)	9.3% (11)	118
\$2/day Honor system	13.7% (16)	10.3% (12)	23.1% (27)	28.2% (33)	24.8% (29)	117
\$1/day GPS-tracking system	32.5% (39)	20.0% (24)	27.5% (33)	13.3% (16)	6.7% (8)	120
\$3/day GPS-tracking system	28.6% (34)	12.6% (15)	23.5% (28)	20.2% (24)	15.1% (18)	119
\$3/day Approval system	16.0% (19)	9.2% (11)	21.8% (26)	35.3% (42)	17.6% (21)	119
\$2/day Approval system	18.5% (22)	15.1% (18)	26.9% (32)	27.7% (33)	11.8% (14)	119
\$2/day GPS-tracking system	29.9% (35)	19.7% (23)	20.5% (24)	19.7% (23)	10.3% (12)	117
	<i>answered question</i>					122
	<i>skipped question</i>					3

Figure 77 Individual Survey – Reward Points and Verification Method


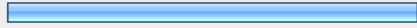

8. Have you ever calculated your household's carbon footprint?			
		Response Percent	Response Count
Yes		16.8%	21
No		70.4%	88
I don't know what carbon footprint means		12.8%	16
<i>answered question</i>			125
<i>skipped question</i>			0

Figure 78 Individual Survey – Carbon Footprint Calculation


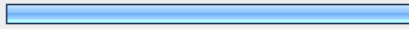
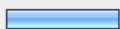
9. Have you ever purchased carbon offsets to reduce your carbon footprint?			
		Response Percent	Response Count
Yes		11.2%	14
No		69.6%	87
I don't know what carbon offset means		19.2%	24
<i>answered question</i>			125
<i>skipped question</i>			0

Figure 79 Individual Survey – Carbon Footprint Purchase

10. Have environmental concerns changed your behavior in the areas listed below?			
	Yes	No	Response Count
Drinking tap water	51.6% (64)	48.4% (60)	124
Transportation	56.8% (71)	43.2% (54)	125
Purchasing an automobile	58.5% (72)	41.5% (51)	123
Driving an automobile	56.0% (70)	44.0% (55)	125
Your home location	36.1% (44)	63.9% (78)	122
Recycling	91.9% (113)	8.1% (10)	123
	<i>answered question</i>		125
	<i>skipped question</i>		0

Figure 80 Individual Survey – Environmental Concerns

11. Gender			Response Percent	Response Count
Female			52.0%	65
Male			48.0%	60
			<i>answered question</i>	125
			<i>skipped question</i>	0

Figure 81 Individual Survey – Gender

12. Age Group			Response Percent	Response Count
16-24			11.4%	14
25-34			45.5%	56
35-44			20.3%	25
45-54			16.3%	20
55-64			5.7%	7
65 or more			0.8%	1
			<i>answered question</i>	123
			<i>skipped question</i>	2

Figure 82 Individual Survey – Age


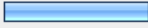
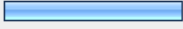
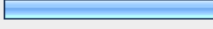
13. Education			
		Response Percent	Response Count
High School or less		8.8%	11
College Diploma or Certificate		24.8%	31
Bachelor Degree		30.4%	38
Masters Degree or more		36.0%	45
<i>answered question</i>			125
<i>skipped question</i>			0

Figure 83 Individual Survey – Education

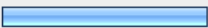
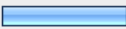


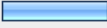
14. Income Range			
		Response Percent	Response Count
\$40,000 or less		35.0%	43
\$40,000 - \$60,000		21.1%	26
\$60,000 - \$75,000		12.2%	15
\$75,000 - \$100,000		13.8%	17
\$100,000 or more		17.9%	22
<i>answered question</i>			123
<i>skipped question</i>			2

Figure 84 Individual Survey – Income Range

Corporate Environmental Awareness and Commuting Survey

████████████████████ 44%

3. Has your company implemented a system for managing corporate carbon credits?

Check if applicable

Developed in-house

Online web-based system from a vendor

No system is currently used

Other (please specify)

4. Has your organization calculated its carbon footprint?

Yes

No

Other (please specify)

5. Has your organization ever purchased a carbon offset to reduce emissions?

Yes

No

Other (please specify)

Figure 87 – Corporate Survey – Question 3-5

Corporate Environmental Awareness and Commuting Survey

56%

6. How many carbon retailers is your company dealing with?

- 1
- 2-5
- 6-10
- 10 or more
- N/A
- None

Other (please specify)

7. When deciding to buy carbon offsets how important for your organization are the following?

	Least Important	Less Important	Neutral	More Important	Most Important	N/A
Price of carbon offsets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Additionality principle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Certification by a 3rd party	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green reputation among stakeholders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Positive impact on environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Compliance with social responsibility policies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify)

Figure 88 – Corporate Survey – Question 6-7

Corporate Environmental Awareness and Commuting Survey

67%

8. By supporting and rewarding green commuting efforts of your employees and using online system as described in the next question, your company could calculate the amount of emission reductions generated by your employees. Would you consider this emission reduction effort as a method to reduce your company's corporate carbon footprint?

Yes

No

Other (please specify)

9. Please consider the following HYPOTHETICAL situation.

To encourage your employees to move away from driving alone to work, your company creates an online system to keep track of your employees' commuting routines and provide evidence to support tradeable carbon credits. Employees are offered reward points for taking alternative transportation to work (valued at \$1, \$2 or \$3), but are asked to verify their commuting routine:

- a) Approval system -- one option is for a supervisor to approve employees' commuting routines by verifying submitted commuting reports with a co-rider, bus ticket, or fellow cyclist.
- b) GPS-tracking -- another option is to use GPS-enabled device to track the distance traveled.
- c) Honor system -- alternatively employees are trusted and no verification is necessary, similar to the honor system that works well for brewing departmental morning coffee in many organizations.

Please rate your preferred combination of reward points and level of verification.

[Rewards | Verification]

	1. Definitely Would Not Participate	2. Would Not Participate	3. Undecided	4. Would Participate	5. Definitely Would Participate
\$1/day Honor system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$1/day GPS-tracking system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$3/day Honor system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$2/day Honor system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$1/day Approval system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$3/day GPS-tracking system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$3/day Approval system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$2/day GPS-tracking system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
\$2/day Approval system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 89 – Corporate Survey – Question 8-9

10. What issues have to be addressed to successfully implement online commuting management system as described in the previous question to track commuting metrics of your employees and to calculate amount of emission reductions?

	Least Important	Less Important	Important	Very Important	Most Important	N/A
Data confidentiality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
System security, reliability and availability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cost of development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ongoing technical support costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ongoing cost of incentives and rewards	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of sufficient carbon credit benefits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Complexity of carbon credit verification	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (please specify)	<input type="text"/>					

Figure 90 – Corporate Survey – Question 10

Corporate Environmental Awareness and Commuting Survey

78%

11. How many employees are taking public transportation, carpooling, biking or walking to work?

- 0-10%
- 10-25%
- 25-50%
- 50-75%
- 75-100%
- Unknown

12. How is your organization rewarding its employees for taking public transit, carpooling, biking or walking to work?

- No rewards
- Discount transit passes
- Cash reward points
- Premium parking space
- Free bike locker

Other (please specify)

Figure 91 – Corporate Survey – Question 1 1-12

Corporate Environmental Awareness and Commuting Survey

89%

13. Industry

14. Number of employees

1-10

10-100

100-1,000

1,000-10,000

10,000 or more

Figure 92 – Corporate Survey – Question 13-14

Corporate Environmental Awareness and Commuting Survey

100%

The End

Thank you for your time and valuable feedback!

<< Prev Done >>

Figure 93 – Corporate Survey – Last Page

10.7 Appendix G – Corporate Survey – Results

2. How important are these initiatives to your organization?							
	Very Important	Somewhat Important	Neutral	Not Very Important	Not at All Important	N/A	Response Count
Reducing employees' personal carbon footprint	13.3% (4)	56.7% (17)	23.3% (7)	3.3% (1)	3.3% (1)	0.0% (0)	30
Corporate Social Responsibility	69.0% (20)	27.6% (8)	3.4% (1)	0.0% (0)	0.0% (0)	0.0% (0)	29
Increasing environmental awareness among employees	62.1% (18)	31.0% (9)	3.4% (1)	0.0% (0)	3.4% (1)	0.0% (0)	29
Reducing company's carbon footprint	63.3% (19)	23.3% (7)	6.7% (2)	6.7% (2)	0.0% (0)	0.0% (0)	30
Producing "green" products and services	44.8% (13)	27.6% (8)	10.3% (3)	3.4% (1)	0.0% (0)	13.8% (4)	29
					Other (please specify)		2
					answered question		30
					skipped question		0

Figure 94 Corporate Survey – Initiatives

3. Has your company implemented a system for managing corporate carbon credits?		
	Check if applicable	Response Count
Developed in-house	100.0% (3)	3
Online web-based system from a vendor	0.0% (0)	0
No system is currently used	100.0% (24)	24
	Other (please specify)	4
	answered question	27
	skipped question	3

Figure 95 Corporate Survey – System

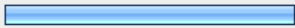

4. Has your organization calculated its carbon footprint?			Response Percent	Response Count
Yes			50.0%	14
No			50.0%	14
Other (please specify)				6
			<i>answered question</i>	28
			<i>skipped question</i>	2

Figure 96 Corporate Survey – Carbon Footprint Calculation


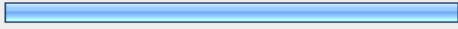
5. Has your organization ever purchased a carbon offset to reduce emissions?			Response Percent	Response Count
Yes			21.4%	6
No			78.6%	22
Other (please specify)				7
			<i>answered question</i>	28
			<i>skipped question</i>	2

Figure 97 Corporate Survey – Carbon Offset Purchase

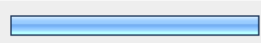

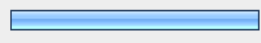
6. How many carbon retailers is your company dealing with?			
		Response Percent	Response Count
1		42.9%	3
2-5		14.3%	1
6-10		0.0%	0
10 or more		0.0%	0
N/A		42.9%	3
None		0.0%	0
	Other (please specify)		1
	answered question		7
	skipped question		23

Figure 98 Corporate Survey – Carbon Retailers

7. When deciding to buy carbon offsets how important for your organization are the following?							
	Least Important	Less Important	Neutral	More Important	Most Important	N/A	Response Count
Price of carbon offsets	0.0% (0)	16.7% (1)	50.0% (3)	33.3% (2)	0.0% (0)	0.0% (0)	6
Additionality principle	0.0% (0)	0.0% (0)	40.0% (2)	0.0% (0)	40.0% (2)	20.0% (1)	5
Certification by a 3rd party	0.0% (0)	16.7% (1)	0.0% (0)	33.3% (2)	50.0% (3)	0.0% (0)	6
Green reputation among stakeholders	0.0% (0)	0.0% (0)	50.0% (3)	33.3% (2)	16.7% (1)	0.0% (0)	6
Positive impact on environment	0.0% (0)	0.0% (0)	0.0% (0)	83.3% (5)	16.7% (1)	0.0% (0)	6
Compliance with social responsibility policies	0.0% (0)	16.7% (1)	0.0% (0)	50.0% (3)	33.3% (2)	0.0% (0)	6
Other (please specify)							2
answered question							6
skipped question							24

Figure 99 Corporate Survey – Carbon Offsets Attributes



8. By supporting and rewarding green commuting efforts of your employees and using online system as described in the next question, your company could calculate the amount of emission reductions generated by your employees. Would you consider this emission reduction effort as a method to reduce your company's corporate carbon footprint?			
		Response Percent	Response Count
Yes		87.5%	21
No		12.5%	3
Other (please specify)			6
answered question			24
skipped question			6

Figure 100 Corporate Survey – Personal Carbon Credits

9. Please consider the following HYPOTHETICAL situation. To encourage your employees to move away from driving alone to work, your company creates an online system to keep track of your employees' commuting routines and provide evidence to support tradeable carbon credits. Employees are offered reward points for taking alternative transportation to work (valued at \$1, \$2 or \$3), but are asked to verify their commuting routine: a) Approval system -- one option is for a supervisor to approve employees' commuting routines by verifying submitted commuting reports with a co-rider, bus ticket, or fellow cyclist. b) GPS-tracking -- another option is to use GPS-enabled device to track the distance traveled. c) Honor system -- alternatively employees are trusted and no verification is necessary, similar to the honor system that works well for brewing departmental morning coffee in many organizations. Please rate your preferred combination of reward points and level of verification. [Rewards | Verification]

	1. Definitely Would Not Participate	2. Would Not Participate	3. Undecided	4. Would Participate	5. Definitely Would Participate	Response Count
\$1/day Honor system	11.1% (3)	0.0% (0)	37.0% (10)	37.0% (10)	14.8% (4)	27
\$1/day GPS-tracking system	48.1% (13)	22.2% (6)	22.2% (6)	7.4% (2)	0.0% (0)	27
\$3/day Honor system	11.1% (3)	25.9% (7)	44.4% (12)	3.7% (1)	14.8% (4)	27
\$2/day Honor system	7.7% (2)	15.4% (4)	50.0% (13)	11.5% (3)	15.4% (4)	26
\$1/day Approval system	14.8% (4)	14.8% (4)	44.4% (12)	22.2% (6)	3.7% (1)	27
\$3/day GPS-tracking system	40.7% (11)	33.3% (9)	18.5% (5)	3.7% (1)	3.7% (1)	27
\$3/day Approval system	22.2% (6)	14.8% (4)	48.1% (13)	7.4% (2)	7.4% (2)	27
\$2/day GPS-tracking system	40.7% (11)	33.3% (9)	18.5% (5)	3.7% (1)	3.7% (1)	27
\$2/day Approval system	14.8% (4)	18.5% (5)	44.4% (12)	14.8% (4)	7.4% (2)	27
	<i>answered question</i>					27
	<i>skipped question</i>					3

Figure 101 Corporate Survey – Reward Points and Verification Method

10. What issues have to be addressed to successfully implement online commuting management system as described in the previous question to track commuting metrics of your employees and to calculate amount of emission reductions?							
	Least Important	Less Important	Important	Very Important	Most Important	N/A	Response Count
Data confidentiality	7.4% (2)	22.2% (6)	22.2% (6)	33.3% (9)	11.1% (3)	3.7% (1)	27
System security, reliability and availability	3.7% (1)	11.1% (3)	22.2% (6)	44.4% (12)	14.8% (4)	3.7% (1)	27
Cost of development	0.0% (0)	0.0% (0)	37.0% (10)	37.0% (10)	22.2% (6)	3.7% (1)	27
Ongoing technical support costs	0.0% (0)	11.1% (3)	33.3% (9)	37.0% (10)	14.8% (4)	3.7% (1)	27
Ongoing cost of incentives and rewards	0.0% (0)	7.4% (2)	29.6% (8)	40.7% (11)	14.8% (4)	7.4% (2)	27
Lack of sufficient carbon credit benefits	0.0% (0)	19.2% (5)	34.6% (9)	23.1% (6)	11.5% (3)	11.5% (3)	26
Complexity of carbon credit verification	0.0% (0)	15.4% (4)	34.6% (9)	26.9% (7)	7.7% (2)	15.4% (4)	26
					Other (please specify)		6
					answered question		27
					skipped question		3

Figure 102 Corporate Survey – System Issues

11. How many employees are taking public transportation, carpooling, biking or walking to work?			
		Response Percent	Response Count
0-10%		25.0%	7
10-25%		32.1%	9
25-50%		7.1%	2
50-75%		3.6%	1
75-100%		7.1%	2
Unknown		25.0%	7
		<i>answered question</i>	28
		<i>skipped question</i>	2

Figure 103 Corporate Survey – Green Commuters

12. How is your organization rewarding its employees for taking public transit, carpooling, biking or walking to work?			
		Response Percent	Response Count
No rewards		50.0%	13
Discount transit passes		30.8%	8
Cash reward points		0.0%	0
Premium parking space		7.7%	2
Free bike locker		11.5%	3
		Other (please specify)	8
		<i>answered question</i>	26
		<i>skipped question</i>	4

Figure 104 Corporate Survey – Rewarding Employees for Green Commuting


13. Industry				Response Count
	1. University	13. educational institution		
	2. Insurance, travel, road assistance.	14. Financial Institution		
	3. Manufacturing	15. Financial Institution		
	4. Software.	16. Education		24
	5. Energy	17. Insurance	<i>answered question</i>	24
	6. Fitness	18. education	<i>skipped question</i>	6
	7. Travel	19. Healthcare		
	8. government	20. Technology/Telecommunications		
	9. transportation	21. Retail		
	10. Marine Transportation	22. Outdoor recreation Industry		
	11. Forest Products	23. Aviation		
	12. Mining	24. non-profit		

Figure 105 Corporate Survey – Industry






14. Number of employees				Response Percent	Response Count
1-10				10.7%	3
10-100				14.3%	4
100-1,000				25.0%	7
1,000-10,000				42.9%	12
10,000 or more				7.1%	2
				<i>answered question</i>	28
				<i>skipped question</i>	2

Figure 106 Corporate Survey – Number of Employees

10.8 Appendix H – Ethics Approval

Hello Jacek,

Your application has been categorized as 'minimal risk'" and approved by the Director, Office of Research Ethics, on behalf of the Research Ethics Board in accordance with University policy R20.0, <http://www.sfu.ca/policies/research/r20-01.htm>.

The Board reviews and may amend decisions made independently by the Director, Chair or Deputy Chair, at their regular monthly meetings.

This attachment uses Adobe 8.0 and you may download the Adobe reader 8.0 without charge at:

<http://www.softpedia.com/get/Office-tools/PDF/Adobe-Reader.shtml>

Please acknowledge receipt of this Status Notification by email to:
dore@sfu.ca.

You should get a letter shortly. Note: All letters are sent to the PI addressed to the Department, School or Faculty of Simon Fraser University, as it is shown in the application. Graduate Students should check their Graduate Student Mailbox. Letters sent to Undergraduate Students will be sent to their Faculty Supervisor.

If it necessary to directly contact the Director, Office of Research Ethics please note the email address below.

Good luck with the project

Hal Weinberg, Ph.D.
Director, Office of Research Ethics
hal_weinberg@sfu.ca

Figure 107 – Ethics Approval

10.9 Appendix I – Facebook Ad

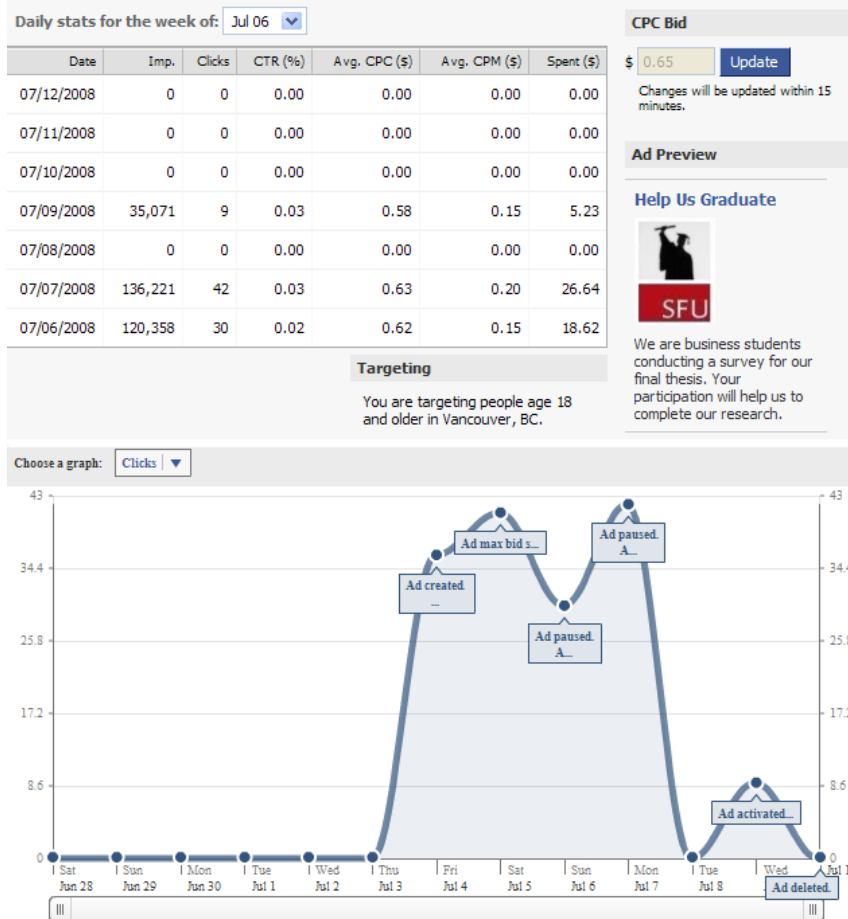


Figure 108 – Facebook Ad

10.10 Appendix J – Regression Analysis

SUMMARY OUTPUT									
<i>Regression Statistics</i>									
Multiple R	0.924779514								
R Square	0.855217149								
Adjusted R Square	0.851788489								
Standard Error	1.315702364								
Observations	714								
<i>ANOVA</i>									
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>				
Regression	5	7259.938375	1451.987675	1048.473922	0				
Residual	710	1229.061625	1.731072711						
Total	715	8489							
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>	
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1 - Reward \$1	-0.483193277	0.120610238	-4.006237658	6.82027E-05	-0.719988657	-0.246397897	-0.719988657	-0.246397897	
X Variable 2 - Reward \$2	0	0	65535	#NUM!	0	0	0	0	0
X Variable 3 - Reward \$3	0.25210084	0.120610238	2.090210952	0.036954012	0.01530546	0.48889622	0.01530546	0.48889622	
X Variable 4 - Reporting 5min	3.460784314	0.098477847	35.14276989	1.5979E-157	3.267441696	3.654126932	3.267441696	3.654126932	
X Variable 5 - Reporting 15min	3.026610644	0.098477847	30.73392381	1.4472E-132	2.833268026	3.219953262	2.833268026	3.219953262	
Importance - Rewards	0.628742515								
Importance - Reporting Time	0.371257485								

Figure 109 Regression Results – Reporting Time by Individuals

SUMMARY OUTPUT									
<i>Regression Statistics</i>									
Multiple R	0.916853								
R Square	0.840619								
Adjusted R Square	0.838145								
Standard Error	1.326224								
Observations	1071								
<i>ANOVA</i>									
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>				
Regression	6	9889.044	1648.174	1124.476535	0				
Residual	1066	1874.956	1.758871						
Total	1072	11764							
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>	
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1 - Reward \$1	2.349206	0.090616	25.92471	2.6892E-115	2.171399421	2.527013277	2.171399421	2.527013277	
X Variable 2 - Reward \$2	2.592904	0.090616	28.61404	4.479E-134	2.4150969	2.770710756	2.4150969	2.770710756	
X Variable 3 - Reward \$3	2.873016	0.090616	31.70522	6.1715E-156	2.695208945	3.050822801	2.695208945	3.050822801	
X Variable 4 - Honor System	0.829132	0.099265	8.352676	2.05662E-16	0.634353922	1.023909384	0.634353922	1.023909384	
X Variable 5 - Approval System	0.392157	0.099265	3.95059	8.30853E-05	0.197379132	0.586934594	0.197379132	0.586934594	
X Variable 6 - GPS Tracking	0	0	65535	#NUM!	0	0	0	0	0
Importance - Rewards	0.387164								
Importance - Verification	0.612836								

Figure 110 Regression Results – Verification Method by Individuals

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.945168162							
R Square	0.893342854							
Adjusted R Square	0.884621157							
Standard Error	1.248903724							
Observations	270							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	5	3475.103704	695.0207407	556.9931531	5.6029E-138			
Residual	266	414.8962963	1.559760512					
Total	271	3890						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1 - Reward \$1	0	0	65535	#NUM!	0	0	0	0
X Variable 2 - Reward \$1	0.4111111111	0.186175575	2.208190366	0.028084207	0.044545876	0.777676346	0.044545876	0.777676346
X Variable 3 - Reward \$3	0.5222222222	0.186175575	2.804998573	0.005402959	0.155656987	0.888787457	0.155656987	0.888787457
X Variable 4 - Reporting 5min	3.407407407	0.15201172	22.41542559	3.18259E-63	3.108108146	3.706706668	3.108108146	3.706706668
X Variable 5 - Reporting 15 min	3.125925926	0.15201172	20.56371652	6.78177E-57	2.826626665	3.425225187	2.826626665	3.425225187
Importance - Rewards	0.649769585							
Importance- Reporting Time	0.350230415							

Figure 111 Regression Results – Reporting Time by Green Commuters

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.927572895							
R Square	0.860391476							
Adjusted R Square	0.85399539							
Standard Error	1.302533145							
Observations	405							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	6	4182.362963	697.0604938	493.0309116	8.463E-181			
Residual	400	678.637037	1.696592593					
Total	406	4861						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1 - Reward \$1	3.081481481	0.144725905	21.29184463	8.40131E-68	2.79696305	3.365999913	2.79696305	3.365999913
X Variable 2 - Reward \$2	3.2	0.144725905	22.11076173	2.35714E-71	2.915481568	3.484518432	2.915481568	3.484518432
X Variable 3 - Reward \$3	3.340740741	0.144725905	23.08322578	1.48744E-75	3.056222309	3.625259173	3.056222309	3.625259173
X Variable 4 - Honor System	0.525925926	0.158539286	3.317322416	0.000991999	0.2142516	0.837600252	0.2142516	0.837600252
X Variable 5 - Approval System	0	0	65535	#NUM!	0	0	0	0
X Variable 6 - GPS Tracking	-0.614814815	0.158539286	-3.877996627	0.000123096	-0.926489141	-0.303140488	-0.926489141	-0.303140488
Importance - Rewards	0.185185185							
Importance- Verification	0.814814815							

Figure 112 Regression Results – Verification Method by Green Commuters

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.92694799							
R Square	0.859232577							
Adjusted R Square	0.848463377							
Standard Error	1.088979715							
Observations	243							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	6	1722.761317	287.1268861	290.546419	5.7571E-106			
Residual	238	282.2386831	1.18587682					
Total	244	2005						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1 - Reward \$1	2.053497942	0.156207419	13.14596939	4.86775E-30	1.745772221	2.361223663	1.745772221	2.361223663
X Variable 2 - Reward \$2	1.95473251	0.156207419	12.51369831	6.05486E-28	1.647006789	2.262458231	1.647006789	2.262458231
X Variable 3 - Reward \$3	1.806584362	0.156207419	11.56529171	7.65537E-25	1.498858641	2.114310083	1.498858641	2.114310083
X Variable 4 - Honor System	1.197530864	0.171116654	6.998330315	2.6161E-11	0.860434226	1.534627502	0.860434226	1.534627502
X Variable 5 - Approval System	0.827160494	0.171116654	4.833898259	2.40226E-06	0.490063856	1.164257132	0.490063856	1.164257132
X Variable 6 - GPS Tracking	0	0	65535	#NUM!	0	0	0	0
Importance - Rewards	0.170940171							
Importance- Verification	0.755844156							

Figure 113 Regression Results – Verification Method by Corporate Respondents

REFERENCE LIST

- Bayon, Ricardo; Hawn, Amanda and Hamilton, Katherine (2007), *Voluntary Carbon Markets*, Earthscan
- Caisse des Depots (2008), “Allowance trading patterns during the EU ETS trail period”, *Mission Climat*
- Coase, Ronald (1960), “The Problem of Social Cost”, *Journal of Law and Economics*
- Ecosystem Marketplace (2007), “State of the Voluntary Carbon Markets, 2007”, ecosystemmarketplace.com
- Ellerman, Denny and Joskow, Paul (2008), “The European Union’s Emissions Trading Scheme in Perspective”, Pew Center on Global Climate Change
- Environmental Audit Committee (2008), “Environmental Audit Report”, House of Commons of the UK
- Environmental Protection Agency (2008), “SO₂ Reductions and Allowance Trading under the Acid Rain Program”, EPA Web Site
- Fezer, Harlod (1937), “Technocracy Study Course”, *Technocracy Magazine*, Series A, number 10
- Hamilton, Katherine, Sjardin, Milo, Marcello, Thomas and Xu, Gordon (2008), “Forging a Frontier: State of the Voluntary Carbon Markets”, Ecosystems Marketplace and New Carbon Finance
- Kapoor, Karan and Ambrosi, Phillippe (2008), “State and Trends of the Carbon Market 2008”, World Bank
- Kim, Mauborgne (2005), *Blue Ocean Strategy*, HBS Press
- Labatt, Sonia, White, Rodney (2007), *Carbon Finance*, John Wiley and Sons
- Lohman, Larry (2006). Carbon Trading, a critical conversation on climate change, privatisation and power, development dialogue no. 48
- Marshall, Alfred (1890), *Principles of Economics*, The Library of Economics and Liberty: Macmillan and Co
- Montgomery, David W. (1972), “Markets in licenses and efficient pollution control programs”, *Journal of Economic Theory*, Volume 5, Issue 3, Pages 395-418
- New Carbon Finance (2007), “Fundamentals point to higher carbon prices”, newcarbonfinance.com

- Pigou, Arthur (1912), *Wealth and Welfare*, The Library of Economics and Liberty: Macmillan and Co
- Pizer, William (2002), “Combining Price and Quantity Controls to Mitigate Global Climate Change”, *Journal of Public Economics*, Vol. 85, No. 3, pp. 409-434
- Point Carbon (2008), “Post-2012 is now”, *Annual Report*
- Porter, Michael (1980), *Competitive Strategy*, Free Press
- Reuters News (2008), “Carbon’s correlation to energy prices strengthens”, Reuters
- Smith, S.M (2005), “Conjoint Analysis Tutorial”, Social Science Research Network
- Schmalensee, Joskow, Ellerman, Montero, Bailey, (1998), “An Interim Evaluation of Sulphur Dioxide Emissions Trading”, *The Journal of Economic Perspectives*, Vol. 12, No. 3, pp. 53-68
- Sir Nicholas Stern (2006), *The Stern Review on the Economics of Climate Change*, UK Government
- United Nations (1998), “Kyoto Protocol to the United Nations Framework Convention on Climate Change”
- UK Department of Environment, Food and Rural Affairs (2006), “Appraisal of Years 1-4 of the UK Emissions Trading Scheme”
- Weitzman, Martin (1974), “Is the Price System or Rationing More Effective in Getting a Commodity to Those Who Need It Most?”, *Bell Journal of Economics*, The RAND Corporation, Vol. 8(2), pages 517-524
- World Bank (2006), “State and Trends of the Carbon Market 2006”, World Bank Institute
- Yohe, Gary (1978), “Fixing Global Carbon Emissions: Choosing the Best Target Year”, *Energy Policy*