2010-2015

UNIVERSITY OF BRITISH COLUMBIA **VANCOUVER CAMPUS**

a place of mind

Climate Action Plan

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Buildings, Land Use and Infrastructure Working Group

Suzanne Poohkay, Director, Infrastructure Planning
John Metras, Managing Director, Infrastructure Development
Dan Leslie, Associate Director, Building Operations and Maintenance
Alan Walker, Associate Director, Resource Services
David Smith, Associate Director, Municipal Services
Alison Aloisio, Green Building and Sustainable Community Planning Advisor
Dianna Colnett, Manager, Long Range Planning, Campus and Community Planning
Al Poettcker, President and CEO, UBC Properties Trust

Business Travel and Procurement Working Group

Vicki Wakefield, Manager, Logistics and Sustainability, Supply Management
Lee Ferrari, Supervisor, Resource Services, Land and Building Services
Kevin Labadie, Manager, Information Systems, Supply Management
Kerry Boultbee, Senior Retail Floor Supervisor, UBC Bookstore
Jennifer Brunt, Manager, Campus Mail Service
Connie Fabro, Travel Manager
Dave Adel, Procurement Officer, UBC Okanagan
Maria Gutierrez, Procurement Officer, Supply Management
Peter Nemetz, Professor, Sauder School of Business
Jenny Lum, Associate Director, Budgeting & Financial Reporting

Energy Working Group

David Woodson, Managing Director, Building Operations
Orion Henderson, Associate Director, Climate and Energy
John Meech, Professor, Director CERM-3
John Grace, Professor, Chemical and Biological Engineering
Stefan Storey, PhD Student, Institute for Resources, Environment and Sustainability
John Robinson, Professor, IRES and Geography
Nima Atabaki, Instructor, Mechanical Engineering
Jeff Giffin, Manager, Special Projects, Utilities

Fleets and Fuel Use Working Group

Lee Ferrari, Supervisor, Resource Services, Land and Building Services
Jerry Maedel, GIS/RS Systems Analyst,
Tony Mahon, Director, Campus Security
Marcel Veronesi, Facilities Coordinator, Earth and Ocean Sciences

Steve Rogak, Associate Professor, Mechanical Engineering

Food Working Group

Andrew Parr, Managing Director, Housing, Conferences and Food Operations
Ayrin Ferguson, Manger, Human Resources and Administration, Food Services
Alejandro Rojas, Assistant Professor, Agroecology
Andrew Riseman, Associate Professor, Agroecology
Tegan Adams, Graduate Student, Land and Food Systems
Carolina Guimaraes, Sustainability Coordinator, Alma Mater Society
Joyce Shen, Sustainability Coordinator, Alma Mater Society
Mark Bomford, Manager, UBC Farm

Housing, Conference, Athletics and Recreation Working Group

David Kiloh, Director, Facilities, Housing and Conferences
Kavie Toor, Associate Director, Facilities, Athletics and Recreation
Ilan Vertinsky, Professor, International Business Studies, Sauder School of Business

Transportation Working Group

Carole Jolly, Director, TREK Program
Tyler Stangier, Facilities Manager, UBC Parking
Larry Frank, Associate Professor, School of Community and Regional Planning
Andrew Devlin, Graduate Student, Resource Management, Environment and Sustainability
David Creese, Faculty Member and Vancouver Area Cycling Coalition Representative

Technical Advisory Committee

Chair: James Tansey, Sauder School of Business and IRES
Hisham Zerriffi, Lui Institute for Global Issues
Douw Steyn, Earth and Ocean Sciences
Alejandro Rojas, Land and Food Systems
David Woodson, Managing Director Building Operations
Orion Henderson, Associate Director, Climate and Energy
Liz Ferris, Coordinator, Climate Action
Alexandre Vigneualt, PhD Candidate, Chemical and Biological Engineering
Milind Kandlikar, Institute of Asian Research

Operations Working Group of the President's Advisory Council on Sustainability

Charlene Easton, Director of Sustainability
Julie Stockton, Director, Organizational Development and Learning, Human Resources
Al Poettcker, President and CEO, UBC Properties Trust
Leanne Bilodeau, Manager, Workplace Health and Sustainability, UBC Okanagan
Nancy Knight, Associate VP, Campus and Community Planning
John Metras, Managing Director, Infrastructure Development
David Woodson, Managing Director, Building Operations
Peter Smailes, Treasurer, Treasury
Andrew Parr, Managing Director, Housing, Conferences and Food Operations
Larry Berglund, Director, Supply Management
David Farrar, Provost and VP Academic,
Alaa Abd-El-Aziz, Provost, UBC Okanagan

Mona Maghsoodi, President, Graduate Student Society,
Joyce Shen, Sustainability Coordinator, Alma Mater Society
Erica Frank, Professor, University Neighbourhood Association
Ian Burgess, Comptroller
Les Lavkulich, Professor Emeritus, IRES
James Tansey, Assistant Professor, Sauder School of Business
Sheldon Green, Head, Mechanical Engineering

UBC Sustainability Office Staff
Alison Aloisio, Green Building and Sustainable Community Planning Advisor
Charlene Easton, Director of Sustainability
Liz Ferris, Climate Action Coordinator
Amanda Fetterly, Manager, Communications
Orion Henderson, Associate Director, Climate and Energy
Lillian Zaremba, Climate and Energy Engineer

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The Sheltair Group (now Stantec) assisted in the development of the Climate Action Plan.


Photo credit: iStock

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The following Technical Reports accompany the Climate Action Plan:

Technical Report #1 – Climate Action Plan Process
Technical Report #2 – Emissions Inventory Detail
Technical Report #3 – Emissions Monitoring Requirements
Technical Report #4 – Targets Derivation
Technical Report #5 – Action Implementation Matrix
Technical Report #6 – Cost Curve Assumptions
Technical Report #7 – Management System Scoping

VISION FOR CLIMATE ACTION

Confronting the challenge of climate change, the University of British Columbia will advance solutions on campus that eliminate emissions, will accelerate efforts to respond to the impacts of climate change, and will partner locally and globally to demonstrate leadership and accountability to future generations.

In pursuit of our vision, we will:

Become a net positive energy producer by 2050. We will go beyond carbon neutral through aggressive conservation, deployment of renewable technologies and by re-designing how we conduct our business.

Partner for change. We will drive technological and behavioral change through innovative research and teaching and by using our global profile to establish partnerships that allow us to learn and share solutions with others.

Use the campus as a living laboratory. We will use our unique position – as an educational and research institution, a landowner, a tenant, a utility, a community, a forester, and a farmer – to provide integrated learning opportunities that result in the development and implementation of climate change solutions.

Account for the full costs of our decisions. We will incorporate consideration of social, environmental and economic impacts in our decision making to increase the resiliency of our communities and lead change towards a sustainable, low carbon future.

INTRODUCTION

There is increasing evidence that emissions of carbon dioxide and other greenhouse gases (GHGs) are destabilizing the Earth's climate and impacting the ecology of the planet. Conclusions of the 2007 Intergovernmental Panel on Climate Change (IPCC) are that human-caused contributions to climate change are *"more likely than not"* and the expectation is that the human-caused impact in the future is *"virtually certain."*

There is also a growing economic impetus for action to reduce energy use and emissions of GHGs. In 2005, the UK government commissioned an independent economic review called the Stern Review, which assessed the potential economic impacts of climate change and costs of stabilizing atmospheric carbon levels.[1] The report concluded that climate change is expected to have serious negative impacts on global economic growth and development and that the *"costs of stabilizing the climate are significant but manageable; delay would be dangerous and much more costly"*. This is a significant conclusion highlighting that deferring action will be more costly than initiating action immediately.

The business case for reducing GHG emissions by reducing energy consumption has been based on the cost effectiveness of various conservation actions. Today in British Columbia, there are more direct costs associated with GHG emissions including a carbon tax (initially $10 per tonne in 2008, rising to $30 per tonne by 2012) and a requirement for public sector organizations (including UBC) to become carbon neutral through acquisition of carbon offsets beginning in 2010.[2] The estimated net present value of the carbon tax and offset purchases over the next 25 years is approximately $50 million.

A Climate for Change

In 1997, UBC became the first University in Canada to adopt a sustainable development policy and a year later, opened Canada's first Sustainability Office. In 2005, UBC's commitment to sustainability was articulated in its vision statement:

> *"The University of British Columbia, aspiring to be one of the world's best universities, will prepare students to become exceptional global citizens, promote the values of a civil and sustainable society, and conduct outstanding research to serve the people of British Columbia, Canada, and the world."*

UBC is at the forefront of sustainability and has recognized not just the environmental and economic imperative for action,

[1] see http://www.hm-treasury.gov.uk/sternreview_index.htm

[2] This is required by the Greenhouse Gas Reductions Target Act, GHGRTA (Bill 44, 2007). "Carbon neutral" means implementing measures to reduce emissions and applying emission offsets to net the remaining emissions to zero.

but also the social change required to address the climate challenge. The societal response will require unprecedented human ingenuity and collaboration, as well as significant restructuring of the way we conduct our business. To that end, UBC has created plans and strategies at various levels of the organization to guide decision-making and action on the UBC Vancouver Campus.

The Sustainability Academic Strategy (SAS) was developed to foster new forms of sustainability learning and research, and associated collaboration and partnerships – with operations and community – to advance a sustainable campus. The SAS complements the operational sustainability strategy, "*Inspirations and Aspirations*" and the Climate Action Plan. All of these documents are central elements of the UBC Strategic Plan (see Figure 1).

These plans are a direct result of **UBC Policy 5: Sustainable Development**, which articulates UBC's position on and commitment to sustainability. One of the stated purposes of Policy 5 is to *"ensure the integration of ecological, economic and social considerations at all levels of strategic planning and operations within the University."* The policy requires that action plans and targets be developed for all units to improve performance in key sustainability areas.

The Climate Action Plan (CAP) focuses on climate change mitigation strategies for the UBC Vancouver Campus. The plan was developed in collaboration with staff, faculty, students and the UBC community. The process for developing the plan is described in CAP Technical Report #1.[3]

Figure 1: Relationship of UBC Plans and Strategies

[3] UBC recognizes that mitigation and adaptation efforts are complementary elements of a comprehensive response to climate change. A companion document to this plan, *"UBC and Climate Change,"* presents an overview of projected climate-related impacts at the UBC Vancouver Campus, and identifies recommendations for further action. Moving forward, efforts will be made to align UBC's mitigation and adaptation responses to climate change. UBC Okanagan is also developing a parallel plan to guide mitigation efforts on its campus.

UBC Vancouver Grows, Emissions Decline

Since 2001, UBC has implemented several measures to reduce energy and water consumption and GHG emissions. **ELECTrek**, a lighting retrofit of 42 core academic buildings, reduced electricity consumption by 16GWh/year.

In a period of intensive growth for UBC Vancouver, the **ECOTrek** program – an energy and water conservation retrofit of nearly 300 Core Academic buildings – resulted in the following substantial reductions:

- electricity consumption reduced by 20 GWh per year;
- steam production reduced by 1.5 million lbs per year;
- water consumption reduced by 1.3 million m^3 per year;
- GHG emissions reduced by 11,000 tonnes CO_2e per year.

Before ECOTrek, Core Academic buildings accounted for 82% of institutional energy use (while comprising 58% of floor space). By tackling energy use in Core Academic buildings, ECOTrek addressed the majority of energy consumption at UBC Vancouver. The program was successful in demonstrating that despite significant increases in both building floor space and student enrollment, energy savings and reductions in water consumption and GHG emissions are possible.

Table 1 highlights reductions achieved in Core Academic buildings during the period from 1990 to 2007, including a 6% reduction in GHG emissions.

Table 1: Energy and Emissions from Core Academic Buildings (1990 - 2007)

	1990	2007	Change (%)
Floor Space (square meters)	546,471	735,379	+ 35 %
Student Enrollment (full-time equivalent)	25,440	37,589	+ 48 %
Energy Consumption (GJ)	1,334,854	1,396,677	+ 5 %
Water Consumption (m^3)	4,804,207	2,530,882	- 47 %
GHG Emissions (tonnes of CO_2e)	51,801	48,808	- 6 %

Notes: 1990 Energy and Emissions profiles have been estimated from best available records.

These early results highlight that it is possible for UBC to achieve its growth targets AND its GHG emissions reduction targets. This can be accomplished by continually improving the energy efficiency of buildings and by decoupling energy use from GHG emissions through a clean, renewable energy supply.

Organizational Commitment

UBC's commitment to climate action was formalized in 2008, when UBC partnered with five other BC universities to write and sign the ***University and College Presidents' Climate Statement of Action for Canada***[4].

The Statement of Action commits UBC to:

- Exercise leadership by reducing emissions of greenhouse gases;
- Develop measurable targets for emissions reduction;
- Develop achievable and practical plans to achieve reduction targets;
- Establish rigorous assessment and measurement procedures, and;
- Fully disclose and be accountable for its actions.

This plan is being produced as part of UBC's efforts to set targets to reduce our emissions, and transparently report out on our progress.

[4] http://www.sustain.ubc.ca/pdfs/climate_action_statement.pdf

Provincial Requirement

The Province of British Columbia has legislated province-wide GHG emissions reduction targets in the Greenhouse Gas Reductions Target Act, GHGRTA (Bill 44, 2007). The target levels are 6% below 2007 levels by 2012; 18% below 2007 levels by 2016; 33% below 2007 levels by 2020, and; 80% below 2007 levels by 2050.

The GHGRTA also requires that all public sector organizations (PSOs), including UBC, be **carbon neutral** in their operations beginning in 2010 and thereafter. PSOs must do this by compiling an emissions inventory, implementing reduction measures to reduce emissions and then purchasing offsets for any remaining emissions. The combination of reductions and offsets will effectively net the total emissions to zero.[5]

[5] GHGRTA requirements are discussed in further detail in the Energy and Emissions Inventory Section of this document. Other requirements established by the Province include a policy statement that all new government buildings will be required to meet the LEED® Gold standard, and that all public sector organizations must purchase offsets through the Pacific Carbon Trust.

The Cost of Inaction

Taking action is often envisioned as being expensive - adding costs to UBC's operations. In fact, UBC will be required to spend extensive sums in the coming years to maintain the status quo, including:

- Estimated capital costs of approximately $18 million will be required in the next few years to maintain and upgrade the boiler plant and steam and electricity distribution systems. This is money that will have to be spent if no action is taken.
- The cost of paying the provincial carbon tax and procuring offsets for the next 25 years has a net present value of another $50 million.
- The cost of purchasing fuel for the next 25 years is in the range of $100 million.[6]

The implication is clear – the **status quo is already expensive!** Taking action provides an opportunity to avoid some of these costs and divert the funds towards making a transition to a renewable energy system.

Table 2: Status Quo Costs for Capital, Energy, and Carbon [7]

Item	Cost (millions of dollars $)
Capital Costs	
Boiler Replacement (within 7- 10 years)	$12
Steam System Upgrades	$0.75
Seismic Upgrade to Boiler Plant	$5
Electrical Services	$0.30
Total Capital Costs	**$18**
Carbon Costs (NPV of 25 years of operations)	
BC Carbon Tax	$25.5
Offset Purchases	$24.5
Total Costs for Carbon Tax and Offsets	**$50**

[6] Capital costs from the Alternative Energy Study Project (draft report). Energy NPV is for 25 years, discounted at 6%. The energy costs are using 2008 consumption levels and costs only and do not include forecasted growth or price changes or cost to operate facilities. These values are provided for demonstration purposes only. Carbon NPV based on forecasted BAU emissions.

[7] Capital costs were taken from the Alternative Energy Study Project (AESP) Phase One, Step One Report. This table does not include staffing or other operational costs beyond energy, carbon taxes, and offset costs. Values for energy have not been inflated and so may under represent the actual cost.

ENERGY AND EMISSIONS INVENTORY

An energy and GHG emissions inventory is simply a tabulation of all the energy consumption and GHG emissions from UBC operations. While simple in principle, an inventory can be cumbersome to define boundaries (what's in and what's out?), and responsibilities (who do emissions belong to?).[8]

As part of the implementation of the Greenhouse Gas Reduction Targets Act, GHGRTA (Bill 44, 2007), the Province has stipulated that boundaries be defined by operational control (i.e. any property over which UBC has operational control – owned, leased or equity shared). The Province is developing a system called SMARTTool to assist public sector organizations in meeting their reporting requirements.

The GHG Protocol divides emissions into three different scopes.

Scope 1: Direct Emissions are those that occur on site, through the direct activities of the facility operator. This includes:

- Stationary Combustion: Use of fossil fuels to produce heat, steam or electricity in UBC owned or controlled boilers, furnaces, and generators
- Mobile Combustion: Use of fossil fuels to transport employees, goods and materials in UBC owned or controlled (e.g., leased) modes of transport. This does not include business travel by employees or employee commuting.
- Fugitive Sources: Intentional or unintentional releases of emissions from operations (e.g., methane leakages from gas transport, etc)[9]

Scope 2: Indirect Emissions that occur elsewhere than at UBC, through the provision of energy to the campus. This is currently solely from electricity consumption (where the GHG emissions are produced "somewhere else"), but could include purchased heat or electricity produced nearby.

Scope 3: Optional Emissions are those that occur in the supply chain or indirectly through UBC activities. These emissions occur through the provision of goods and services to UBC. UBC may influence these emissions through its practices[10].

[8] Commonly used GHG protocols are ISO 14064 and the Corporate Accounting and Reporting Standard (The GHG Protocol) developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). In North America, The Climate Registry is developing reporting protocols which incorporate many of the features of these two international protocols.

[9] The GHGRTA is expected to require an inventory of fugitive emissions for 2010.

[10] Emissions from these activities do not officially reside on the organization's "ledger", though many recognize their influence and strive to reduce these 'induced' impacts. The GHGRTA requires that all PSOs track paper consumption as a Scope 3 emission and include it in their inventory for becoming carbon neutral.

The choice to report certain scope 3 emissions is voluntary, and reflects an organization's values and desire to show leadership. As a leading institution, UBC is monitoring, reporting and exploring how to affect change for a number of scope 3 emissions sources including:

- Embodied energy associated with new construction, existing buildings and infrastructure;
- Emissions resulting from the food system on campus;
- Purchasing of goods and services;
- Commuting to-and-from campus, and;
- Travel associated with UBC operations, teaching, and academic activities.

2008 Inventory Results

The GHG emissions inventory indicates that the majority of campus emissions arise from the operation of campus buildings (Table 3). The bulk of these emissions occur at the steam plant where natural gas is consumed to make steam for the district energy system.

UBC wants to take action beyond the regulatory requirement and so has inventoried (or estimated) a number of scope 3 emissions. These provide insight into the "induced" impact that UBC has in the economy as a result of it activities. These particular scope 3 emissions have been identified by either the TAC (Technical Advisory Committee), the Stakeholder Working Groups or participants in the visioning sessions.

Table 3: UBC Vancouver Campus GHG Emissions Inventory (2008)

Scope	Component [a]	GHG Emissions (tonnes of CO_2e/year)	Offset Purchase Required?	Carbon Tax paid on this emission?
1 & 2	Core Buildings	46,400	Yes	Natural Gas
	Ancillary Buildings [b]	13,500	Yes	Natural Gas
	TRIUMF [c]	530	Yes	No
	Fleet	1,500	Yes	Gasoline and Diesel
3	Paper	850	Yes	No
	Staff and Faculty Travel [d]	13,600	No	No
	Solid Waste[e]	1,800	No	No
	Commuting [f]	29,100	No	No
	Building Lifecycle [f]	10,200	No	No
Total Emissions Eligible to be Offset [g]		62,780		

Notes:
[a] Other components have been identified but methodologies are not yet in place. These include: fugitive emissions (Scope 1. refrigerants and research gases; required by GHGRTA to be inventoried for 2010), and Food and Procurement (Scope 3, these emissions will require research into the Life Cycle impacts of the procurement chain).
[b] Ancillary buildings include student housing, conference and athletics facilities.
[c] TRIUMF is 1/6 owned by UBC. This inventory includes 1/6 of the facility's estimated emissions
[d] Figure taken from 2006 inventory. Staff and faculty travel was not

measured in the 2008 inventory due to the large margin of error in the methodology.
[e] This is a demonstrative value from the 2008 inventory. The actual requirement for offsets for each year will be determined based on the actual year's inventory.
[f] These emissions have been estimated from published conversion factors and not estimated from on campus consumption data. Improvements to systems and methodologies may allow for other components to be included in future inventories. International student travel, food, and procurement systems have been identified as desired scope 3 emissions to include in future inventories.
[g] Values may not sum precisely due to rounding

Other Campuses and Sites

The inventory shown applies solely to the UBC Vancouver Campus. The GHGRTA requires an inventory of all UBC operations. Facilities that will need to be inventoried for 2010 (to complete the SMARTTool reporting) that are not part of this inventory or the Climate Action Plan include:

- UBC Okanagan Campus (UBC-O) located in Kelowna[11];
- UBC Robson Square – leased facility space in downtown Vancouver;
- Great Northern Way campus – joint venture between Emily Carr, BCIT and SFU;
- The UBC Research Forests (Malcolm Knapp, Alex Fraser and Aleza Lake)[12];
- Other off campus buildings owned or leased by UBC;
- Joint venture activities not on the UBC Vancouver Campus[13];
- Loon Lake Research and Education Center.


Photo credit: iStock

[11] UBCO is a separate reporting unit in the SMARTTool and will be preparing its own climate action plan.

[12] While the operational energy consumption of UBC Research Forest activities are not included in the inventory, the fleet inventory estimate does include Department of Forestry vehicles which conduct work within the research forest (as well as elsewhere).

[13] For example the Bamfield Marine Research station is jointly owned by the non-profit Western Canadian Universities Marine Sciences Society (WCUMSS) consisting of five Western Canadian Universities. By comparison, the TRIUMF facility is located on the UBC Vancouver Campus, but is only 1/6th owned by UBC, so the 2008 inventory includes a 1/6th share of the facility's energy consumption.

Inventory by Fuel Type

The inventory can be broken out by the fuel type to help interpret the GHG emissions source (see Table 4). Energy is purchased in a variety of units – kilowatt hours (kWh) of electricity, litres (L) of fuel, etc. By far, the largest source of emissions is from natural gas consumption, and the bulk of this is consumed at the steam plant.

Table 4: Historical Energy Consumption and GHG Emissions by Fuel Source for UBC Vancouver Campus

Energy consumption by fuel source (Scope 1 & 2 only)							
Item	**Units**	**1990 [a]**	**1994 [a]**	**2000**	**2006**	**2007**	**2008**
Electricity	kWh	127,986,500	144,788,500	157,990,900	181,531,500	184,360,100	193,018,000
Natural Gas	GJ	129,300	126,200	142,900	124,900	132,700	152,400
Natural Gas (for steam)	GJ	906,600	889,100	872,100	993,900	949,700	960,800
Heating Oil	GJ	57,100	14,000	111,200	6,000	0	7,300
Gasoline	L	601,100	601,100	601,100	601,100	601,100	530,500
Biodiesel	L	243,100	243,100	243,100	243,100	243,100	104,400
Total [b]	**GJ**	**1,584,000**	**1,581,000**	**1,726,000**	**1,809,000**	**1,777,000**	**1,838,000**
GHG emissions by fuel source							
Item	**Units**	**1990 [a]**	**1994 [a]**	**2000**	**2006**	**2007**	**2008**
Total	tonnes CO2e / yr	60,660	56,880	64,250	62,270	60,070	61,870
Electricity	tonnes CO2e / yr	2,810	3,190	3,480	3,990	4,060	4,250
Natural Gas	tonnes CO2e / yr	6,450	6,300	7,140	6,240	6,620	7,620
Natural Gas (for Steam)	tonnes CO2e / yr	45,260	44,400	43,540	49,630	47,420	47,970
Heating Oil	tonnes CO2e / yr	4,170	1,020	8,120	440	0	540
Gasoline	tonnes CO2e / yr	1,430	1,430	1,430	1,430	1,430	1,260
Biodiesel	tonnes CO2e / yr	540	540	540	540	540	230
Total [b]	**tonnes CO2e / yr**	**60,660**	**56,880**	**64,250**	**62,270**	**60,070**	**61,870**

Notes:
[a] Values for 1990 and 1994 are approximate estimates. Detailed inventory information cannot be compiled due to lack of available data.
[b] Values may not sum precisely due to rounding

Forecast

Energy consumption and GHG emissions were forecast to 2020 under a **business-as-usual scenario** using building floor space projections.

Emissions from 2008 to 2020 were estimated using projections for academic and student residential floor space, including new buildings identified for development between 2010 and 2012. Between 2008 and 2020 it is predicted that UBC could add an additional 100,000 square metres of academic floor space and 350,000 square metres of student residential floor space. Estimates of energy intensities for the different types of space categories were used to define the new construction energy usage.

Emissions from UBC fleets were held constant at 2008 levels in anticipation of fleet management activities.

Under a business-as-usual scenario, emissions are forecast to increase by 20% from almost 62,000 tonnes CO_2e to almost 77,000 tonnes of CO_2e (Figure 2).

A detailed energy and GHG emissions inventory and business as usual forecast to 2020 is provided in CAP Technical Report #2. Guidance on GHG emissions monitoring (i.e. data collection) is provided in CAP Technical Report #3.

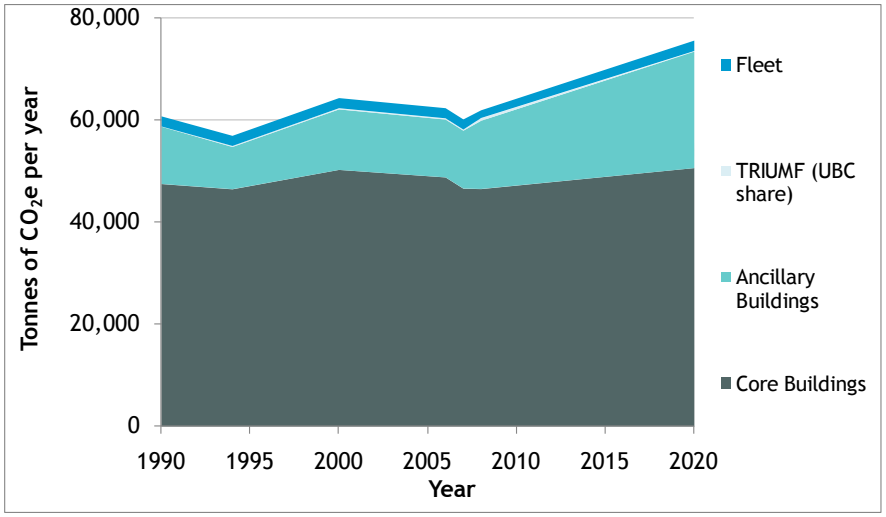


Figure 2: Campus-wide Scope 1 and 2 GHG Emissions (1990 to 2020)

Carbon Neutrality

The commitment to become carbon neutral starts in 2010. Carbon neutrality means that through a combination of emissions reductions, and the purchase of 'carbon offset credits', that the effective target for UBC is a 100% emissions reduction beginning in 2010.

A carbon offset is generated through a specific project that reduces carbon emissions, or removes carbon from the atmosphere. A project must be verified against a range of criteria, but a key requirement is that an offset project must be above and beyond standard practices.

UBC is mandated by the GHGRTA (Bill 44) to purchase carbon offsets through the Pacific Carbon Trust, which will ensure that all offsets are generated within British Columbia.

UBC will start at 100% offsets in 2010, reducing the proportion of reductions achieved through offsets, as it meets its GHG emissions reduction targets for 2015 and 2020 – eventually getting to net zero by 2050 (see Figure 3).

The requirement for carbon neutrality defines that all GHG emissions will either be reduced or offset – essentially making the overall target of 100% reduction. The objective of setting targets for reduction is to define what portion of carbon neutrality will be achieved through reductions, and what remaining portion will be achieved through offsets.

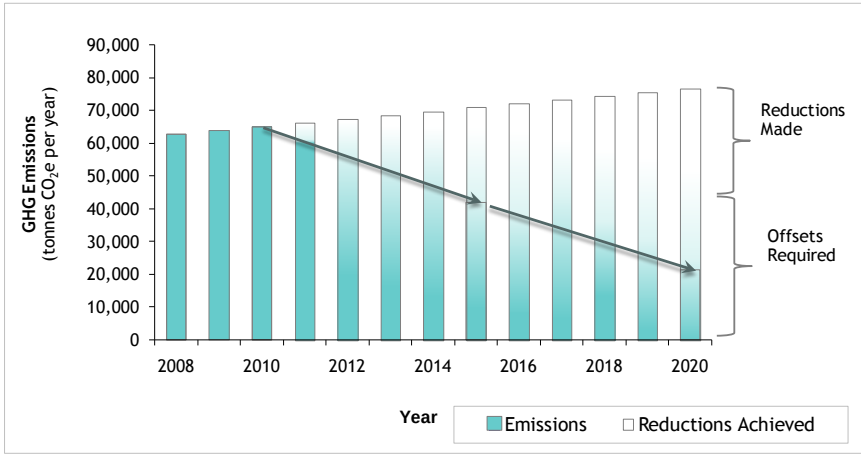


Figure 3: Carbon Neutrality through Emissions Reductions and Offsets

Cost Implications of the Forecast

Employing a 'business-as-usual' approach tells us that UBC's carbon liability – the amount it will pay for offsets and the carbon tax (which was around $289,000 in 2008) will increase to an estimated $721,000 for 2009. Beginning in 2010 when carbon offsets must be purchased, and with the continued increase of the carbon tax[14], the annual liability will be over $3.3 million by 2013 (see Table 5).

Over the next 25 years, the net present value of the carbon tax and the cost of offsets under a business-as-usual scenario is $25.5 million and $24.5 million, respectively.

Table 5: Forecasted Carbon Tax and Offset Liabilities for UBC Vancouver Campus (2008 - 2013)

	2009	2010	2013
Carbon Taxes			
Carbon Taxable tonnes	57,700	57,700	58,200
Carbon Tax Rate ($/t annual Ave)[a]	$ 12.50	$ 17.50	$ 30.00
Carbon Tax Due	$ 721,200	$ 1,000,000	$ 1,745,000
Offsets			
Offset Tonnage Required	62,100	61,440	62,800
Offset Cost ($ / tonne CO2e) [b]	$ -	$ 25.00	$ 25.50
Offset Cost	$ -	$1,536,000	$1,601,000
Annual Costs			
Annual total cost of Carbon Tax and Offsets	$ 721,200	$2,534,000	$3,346,000

Notes:
[a]) Increases in the carbon tax occur on July 1 of each year from $10 per tonne on July 1 2008 to $20 per tonne on July 1, 2012. The carbon tax rate shown is the annual average for the calendar year.
[b] The cost of offsets is currently unknown. A value of $25 per tonne is used as this is the value currently estimated by the provincial government for offsetting its ministerial travel. No inflation has been included.

[14] The carbon tax was established at $10.00 per tonne starting on July 1, 2008 and increases by $5 per tonne each July 1 until it reaches $30 per tonne in 2012. 2013 is the first complete year with the carbon tax at its maximum forecasted value. Offsets are estimated at $25 per tonne.

Campus Reduction Targets

The following GHG emissions reduction targets are proposed as campus-wide targets and include Scope 1 and Scope 2 emissions, as well as paper.[15]

33% below 2007 levels by 2015

The transition has begun towards a campus where the growing energy needs are met, but emissions are reduced. This target will be achieved through aggressive conservation and demand-side management activities (i.e. continuous commissioning program); conversion from a steam-based to a hot water heating system; implementation of a biomass gasification cogeneration system (i.e. UBC Bioenergy Research and Demonstration Project), and; fleet management activities, including a transition to a low emission fleet. These activities will be complemented by programs and initiatives aimed at encouraging energy conservation behaviours amongst the campus community.

66% below 2007 levels by 2020

The conversion to a sustainable energy system on campus is well underway and energy use is becoming 'decoupled' from GHG emissions through the deployment of renewable technologies. This target will be met through fuel switching from natural gas to renewable sources.

100% below 2007 levels by 2050, "Net Positive Campus"

Scope 1 and Scope 2 GHG emissions from campus activities have been eliminated through the implementation of an ultra low carbon energy supply system. Residual emissions have been negated through the export of energy to a portion of the UBC community (i.e. commercial and residential tenants). Efforts to reduce campus-wide emissions and contribute to energy and emissions reductions elsewhere in our community have resulted in a net positive campus.[16]

It is important to note that these are GHG emissions reduction targets and not energy reduction targets. While energy conservation is one avenue to GHG reductions, it is not reasonable (nor desirable or possible) to achieve reduction targets solely through conservation. UBC has a mandate to grow its research activities, which tend to be energy intensive. Decoupling energy use from GHG emissions through implementation of renewable energy is a key strategy for achieving the 'net positive campus' target.

The 2020 and 2050 targets are ambitious and have impacts beyond the campus boundaries. They rely on behaviours, technologies and market conditions that may not exist today. Thus UBC will review the 2020 target as 2015 approaches.

CAP Technical Report #4 provides an explanation of the derivation of these targets (and of sub-sector targets outlined in the following section).

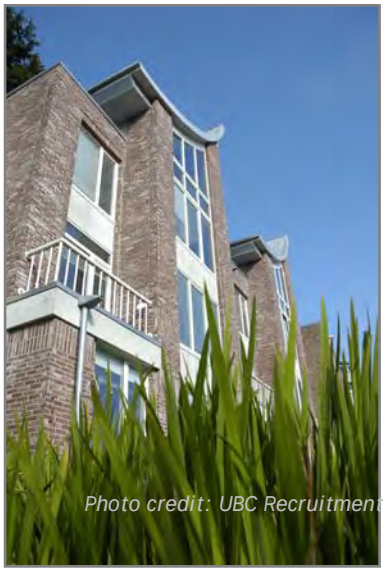
[15] As optional reporting categories, the Scope 3 emissions dealt with in the CAP (other than paper) are more problematic to accurately quantify. Where possible, targets have been set for these emissions areas. As data tracking and reporting systems evolve, reduction targets may be developed in the future.

[16] 100% assumes that UBC will export energy to the surrounding community and offset the emissions that would otherwise be produced.

KEY ACTION AREAS

The following emissions source areas or **key action areas** were established for the Climate Action Plan:

- Campus Development and Infrastructure
- Energy Supply and Management
- Fleets and Fuel Use
- Travel and Procurement
- Food
- Transportation



Working Groups made up of staff, faculty and student representatives were formed in these areas to provide input on objectives, actions and implementation requirements.

Key strategies have been identified to assist UBC in achieving its GHG emissions reduction targets. These include:

- Programs and activities to foster energy conservation behaviours amongst the campus community
- A continuous commissioning program for core academic buildings
- Converting the existing district energy system from steam to hot water
- Implementing a biomass gasification cogeneration system (UBC Bioenergy Research and Demonstration Project)
- Fleet management activities, including transitioning to a low emission fleet
- Fuel switching from natural gas to renewable sources
- Exporting energy to the UBC community

The sections that follow provide context on each of the key action areas and discuss specific actions for UBC to advance over the short to medium term. Together, the strategies and actions will assist UBC in achieving its GHG emissions reduction targets and in demonstrating leadership on climate action.

Further detail on the actions discussed in this section, including estimated implementation requirements is provided in CAP Technical Report #5.

Campus Development and Infrastructure

A summary of the major components of this key action area is provided in Table 6. This describes what is included in each component, the responsible portfolio (or department) and the campus activities / programs that impact each component.

Table 6: Development Overview

Component	Description	Responsible Portfolio	Activities / Programs
Buildings	New/Existing; Institutional/Residential; Privately owned / University owned	UBC Properties Trust; Campus & Community Planning; Infrastructure Development; Building Operations; Student Housing and Hospitality; Athletics and Recreation	See break out box at right
Land Use	Institutional areas; Residential Areas	Campus & Community Planning; UBC Properties Trust	Official Community Plan; Design Guidelines; TREK program
Infrastructure	Streetlights; Water/Wastewater (Central Plant excluded); Roads, Electrical/Space Heat, Solid waste	Campus & Community Planning; Utilities (Building Operations); UBC Properties Trust	Design Guidelines; Technical Guidelines

Buildings Categories

CORE – Administration and Academic buildings
Activities: Technical Guidelines, UBC ReNew

ANCILLARY – Student Housing and Athletics
Activities: Technical Guidelines

TENANT – Commercial rental Units, non-UBC owned buildings
Activities: Technical Guidelines,

FAMILY HOUSING NEIGHBOURHOODS – Residential
Activities: REAP

Land use and infrastructure development at UBC Vancouver are governed by several documents including:

- Vancouver Campus Plan
- Comprehensive Community Plan, and;
- Design Guidelines and Technical Guidelines

The Technical Guidelines serve as the code of quality and performance for the design, construction and renovation of all academic buildings built at UBC. They are updated annually, providing a chance to increase energy performance criteria.

Facilities on the Vancouver Campus currently account for 1,550,142m^2 of floor space (see Table 7).[17] An additional 450,000m^2 of floor space is anticipated by 2020.[18]

Table 7: Campus Buildings Overview (2008)

Component	Area (m^2)
Core Academic Buildings	734,072
Ancillary Facilities	497,665
Tenants	147,243
Family Housing Neighbourhoods	171,163
TOTAL	**1,550,142**

In spite of these plans for future development, 70% of the floor space existing in 2020 has already been built. This highlights the need for an action plan to address energy consumption and emissions from existing buildings. The UBC ReNew program (see text box below) has been successful in avoiding GHG emissions associated with construction; though due to challenges in securing funding, the program has been limited to select buildings.

UBC ReNew
A program designed to mitigate deferred maintenance, increase the capabilities of existing space, and preserve campus culture by retaining heritage buildings. Phase 1 of the program:

- Renovated almost 40,000 gross square metres;
- Eliminated deferred maintenance issues for 10 key academic buildings on campus, mitigating $77 million of the deferred maintenance debt;
- Diverted over 1000 metric tonnes of waste;
- Prevented over 6000 metric tonnes of CO_2 emissions;
- Conserved 95 million MJ of primary energy;
- Avoided 27 million litres of water use;
- Saved 3 million kWh of electricity, and;
- Saved $88 million dollars in capital replacement costs.

Phase 2 of UBC ReNew is currently in the planning stage.

http://www.sustain.ubc.ca/renew.html

[17] Note that tenant and family housing neighbourhoods are not part of the CAP.

[18] 350,000m^2 of this increase is attributed to student residential housing as a result of the Vancouver Campus Plan target to house 50% of students on campus. The remaining 100,000m^2 will be in academic floor space.

Campus Development and Infrastructure Summary	
Emissions	Operating Emissions: 60,390 t CO_2e/year Embodied Emissions of Buildings: 10,200 t CO_2e/year (50 year life cycle).
Scope	1 and 2
Target	10% below 2007 levels by 2015 (campus-wide target for scope 1 and 2 emissions)
Influence	 (High) (Med) (Low)

Legend to Key Action Area Summary (above):

Emissions: The amount and magnitude of emissions associated with the key action area. It should be noted that certain key action areas lend themselves more easily to quantification, while others, such as Food are not quantifiable at present.

Scope: Whether the key action area falls into Scope 1, 2 or 3 emissions. Scope 1 and 2 emissions and certain Scope 3 emissions (i.e., paper) are mandated under Bill 44, which means that UBC must track and report them.

Target: Energy and GHG reduction targets and other quantitative commitments in each key action area.

Influence: The degree of influence that UBC has to affect change in the key action area.

Actions for Campus Development and Infrastructure are compiled into five key activity areas: [19]

DV-01 Increase the energy efficiency of development on campus

a) Adopt the 2011 Model National Energy Code for Buildings (MNECB)

b) Commit all UBC ReNew buildings to achieve energy performance targets.

c) Adopt higher energy efficiency standards for the Residential Environmental Assessment Program (REAP).

d) Develop a LEED® Guide to identify optional LEED® points that are a priority for UBC

e) Develop design guidelines around site orientation to include passive solar heating and light access, tree shading, and co-locating buildings to support shared infrastructure.

f) Ensure that UBC's Technical Guidelines explicitly require the highest standards of energy efficiency

g) Develop "Energy Density Targets" for new student housing and core academic development.

h) Increase infill development on the North Campus

[19] See CAP Technical Report #5 for detailed descriptions of each action.

DV-02 Establish long term funding for energy efficiency for both new construction and existing buildings.

a) Evaluate the legal and financial opportunities to create new financing mechanisms for retrofits.

b) Incorporate energy efficiency awareness into communications with financial donors and granting agencies to ensure that the green and energy efficient features of buildings are properly funded.

c) Develop funding mechanisms for addressing energy efficiency in existing and new ancillary buildings

d) Include the lifecycle costs when developing business cases for capital projects.

e) Develop UBC specific financial business case criteria to guide the evaluation of facility upgrades.

DV-03 Implement comprehensive renovation projects for existing buildings.

a) Support the proposed UBC ReNew Phases 2 through 5 in order to continue retrofits of existing core buildings, and ensure that high performance building envelopes and systems are included in ReNew projects.

b) Develop a ReNew equivalent program for Ancillary Buildings

DV-04 Work with our neighbours and partners to understand and reduce the complete UBC carbon footprint.

a) Support the University Neighbourhood Association (UNA) in developing an emissions inventory and strategies for reducing emissions from campus neighborhoods.

DV-05 Leverage our experiences in development and emissions reduction for academic and research purposes.

a) Support the inclusion of climate change and energy efficiency in the Social, Ecological, Economic Development Studies (SEEDS) program on campus to build a campus scale learning network and support the incubation of demonstration projects related to net positive energy and water.

Energy Supply and Management

Energy supply to campus facilities is primarily natural gas (the majority of which is used to make steam), and electricity. Small amounts of heating oil are used as a backup fuel source as required. The generated steam is distributed throughout campus for space and water heating.

Core academic building consumption is not historically measured for individual buildings. An outcome of the ECOTrek initiative (see text box below) has been to develop a metering program for over 80 individual core academic buildings to aid energy management activities.

The cost of not taking action will result in required capital expenses estimated at $18 million and annual operating expenses for carbon taxes and carbon offsets of approximately $25 million each (see Table 2).

ECOTrek – Recently completed, the ECOTrek program was successful in reducing:

- Electricity consumption by 20 GWh per year;
- Steam production by 1.5 million lbs per year;
- Water consumption by 1.3 million m^3 per year,
- GHG emissions by 11,000 tonnes CO_2e per year.

With the completion of the ECOTrek program, UBC will be saving at least $2.6 million annually in electricity, steam, and water costs.

The requirement for a major capital investment to the steam plant presents an opportunity to review the entire steam supply system. It is apparent that if UBC is going to achieve "net zero" emissions or become a "net positive campus" then a transition from a fossil fuel energy system to renewable energy sources is required. The long term provision of energy from a fossil fuel source contradicts the vision and targets of the CAP.

Feasibility research (known as the Alternative Energy Study Project or AESP) was undertaken to define key options for renewable energy supply on campus. Preliminary results indicate that a transition from a medium-pressure steam heating distribution system to a heating water distribution system will be required to reduce peak heating load and energy consumption. Additionally, UBC is proceeding with implementation of the UBC Bioenergy Research and Demonstration Project, a biomass gasification cogeneration system that converts wood biomass into heat and power for use on campus. The AESP has short-listed three heating plant options, including an expanded biomass heating plant (based on the Bioenergy Research and Demonstration Project).

Energy Supply and Management is intimately linked with the activities and decisions of the Campus Development and Infrastructure action area. The former focuses on the source of energy, as well as the operational energy management opportunities, whereas the latter looks at major capital projects and the policies guiding development on campus.

Energy Supply and Management Summary	
Emissions	61,870 tonnes CO_2e/year (See Table 4 for breakdown by fuel source)
Scope	1
Target	See campus-wide targets
Influence	(High) (Med) (Low)

Identified actions include:

EN-01 Expand energy management activities on campus.

a) Develop an energy management program for all ancillary facilities.

b) Implement full campus-wide energy monitoring, reporting and benchmarking.

c) Participate in the Canada Green Building Council's (CaGBC) Green Building Performance Initiative to benchmark with peers.

EN-02 Maintain optimal performance of existing systems

a) Implement a continuous commissioning program for core academic buildings.

b) Expand condition assessment activities and preventative maintenance

c) Ensure O&M staff receives adequate training to allow them to operationalize the CAP

d) Invest in the Sustainability Coordinators program to increase participation in energy management efforts.

e) Optimize steam plant efficiency through setting annual plant commissioning and optimization targets.

EN-03 Develop incentive systems for building operators and users to reduce energy and water consumption

a) Review utility rates, rate structure and departmental budgeting strategy to provide correct market signals to encourage conservation.

b) Create building-by-building user groups to link Plant Ops with faculty, staff and students (building users).

c) Review space planning requirements and develop financial incentives to encourage departments to operate within the BC University Space Standards.

d) Expand the pilot test of a real time energy management dashboard to visualize and track building energy use.

EN-04 Control peak demand

a) Develop and implement a peak demand management strategy

b) Support a UBC Green IT strategy for consolidation of IT Data Centres (server rooms, etc.) to achieve economies of scale in terms of resource efficiency

EN-05 Prepare for the transition to a renewable energy system on campus

a) Develop an energy supply transition strategy, based primarily on implementing the recommendations of the Alternative Energy Study Project (i.e. to prepare for the transition from a steam heating to a heating water distribution system).

b) Conduct thermal enclosure upgrades during all envelope remediations.

c) Conduct reliability risk assessments for new energy technology proposals.

EN-06 Support the campus community in energy management activities

a) Promote an Energy Management Office (within the Sustainability Office) that all departments (including Ancillaries) can access for energy-related questions and advice.

b) Develop a campus community engagement strategy to build awareness and encourage energy conserving behaviours.

c) Strengthen the relationship between the academy and operations by establishing joint research / operational projects aimed at providing tangible examples of climate action.

EN-07 Reduce energy consumption from laboratory and research activities

a) Develop a “Green” or “Low Carbon” Laboratories initiative.

Fleets and Fuel Use

Vehicles fleets on campus include fleets owned or operated by UBC operational departments, academic departments, and research groups. Two major groups of vehicles are: (1) operational vehicles that support the functioning of UBC facilities (2/3 of vehicles), and; (2) a dispersed fleet of vehicles owned by individual departments and used for research and departmental needs.

UBC Plant Operations is the largest single vehicle user (140 vehicles) and has instigated a number of sustainable fleet management initiatives (see text box at right). These initiatives may have significant non-GHG benefits such as reducing air pollutants, or improving maintenance schedules and utilization.

Many operational vehicles leave campus only rarely, operate over relatively short distances, serve regularly scheduled shifts, and may be parked at worksites for a significant portion of their working time. Research and academic vehicles have been the responsibility of individual departments that secure their own funding and operating budgets for these vehicles. Departments with field study components have larger fleets, but over half the departments operate only one vehicle.

UBC Building Operations has developed a Fleet Management Business Plan to articulate how UBC intends to achieve a 40% reduction in fleet-related GHG emissions by 2015. The business plan estimates incremental costs of $1.5 to $1.8 million to replace the current fleet with low emissions vehicles. Additional costs for telematics equipment and infrastructure to support electric and natural gas vehicles are estimated at $300,000 and $500,000, respectively. These costs are expected to be offset by an overall reduction in fleet vehicles, which will be achieved through utilization management and centralized fleet administration. To achieve the 40% target the new fleet is expected to include 60 fewer vehicles than the current fleet and be composed of 115 electric vehicles, 45 natural gas powered vehicles, 5 propane powered forklifts, and 195 gas or diesel powered vehicles.

Plant Operations Sustainability Initiatives:

- Bio-diesel in all diesel-run vehicle
- Seven new electric vehicles to replace gas-powered vehicles
- A telemetric vehicle usage monitoring program, with the aim of reducing the vehicle fleet size
- Retrofitting older diesel-powered equipment with the latest exhaust filtration systems to reduce particulates, carbon monoxide and hydrocarbons
- Shuttling staff around campus in the Jack Bell ride share vehicles
- Planning to replace larger gas-powered service vans with smaller four-cylinder models, where applicable.
- Replacing larger diesel-powered vehicles with hybrid-diesel units ideally suited for on-campus use

Fleets and Fuel Use Summary	
Emissions	1,500 tonnes CO_2e annually
Scope	1
Target	40% below 2007 levels by 2015 (included in campus-wide targets)
Influence	(High) (Med) (Low)

Actions identified for **campus operational vehicles** are:

FF-01 Complete E3 Silver certification of the operational fleet

An initiative of the Fraser Basin Council, the **E3 Fleet Rating System** is designed to recognize fleets that improve fuel efficiency, reduce emissions, implement best management practices, incorporate new technologies and use alternative fuels. The E3 Fleet Rating uses a point-based system to evaluate performance at a Bronze, Silver, Gold or Platinum level. Points are obtained by implementing actions in the following areas: Green Fleet Action Plan; Training and Awareness; Idling Reduction; Vehicle Purchasing; Fuel Data Management; Operations and Maintenance; Trip and Route Planning; Utilization Management; Fuel Efficiency, and; GHG Reductions.

FF-02 Continue to integrate electric or ultra low consumption vehicles into the 'on campus' fleet and increase the profile of these vehicles through signage and display

FF-03 Review legal requirements and explore opportunities for allowing low speed electric vehicles to be registered for use on campus

FF-04 Provide right sizing advisory service and enact policy which requires departments to evaluate the size and efficiency of their vehicle prior to purchase.

The following actions were identified for **academic and research vehicles:**

FF-05 Implement a tracking system for campus vehicles not currently serviced at the Land and Building Services facility.

FF-06 Establish a departmental monitoring system to ensure cost recovery on department vehicles used by projects and researchers (e.g., require odometer readings, fuel meter readings, etc).

FF-07 Promote the costs and benefits of centralized vehicle services (established in the UBC Building Operations Fleet Management Business Plan) to UBC departments.

Travel and Procurement

This action area includes business travel (flights) and purchasing of goods and services for the Vancouver Campus. Emissions associated with these areas fall under scope 3. Scope 3 emissions (except paper consumption) are not currently mandated under the GHGRTA (Bill 44 - 2007). In 2007, paper use accounted for 850 tonnes CO_2e[20] on the Vancouver Campus.

For business travel (both staff travel for operational reasons and faculty travel for research and academic reasons) UBC is not currently required to report. Reducing emissions associated with business travel is seen as an area where many organizations are trying to make reductions.

At present there is not a suitable system in place for accurately tracking travel-related emissions. At present it is estimated that about 60% of business travel is booked through UBC Travel Management. A portion of business travel may also be tracked through Finance, but at this point in time that information is only tracked by expenditures, and not distances or modes of travel.

While reporting emissions associated with paper use is mandatory for UBC, reducing business travel flights presents a popular area for organizations to reduce emissions. A hierarchical strategy that (1) avoids, and (2) offsets emissions from business flights is a logical approach for UBC to take. Potentially the offset expenditures could be used to feed an on-campus offset program.

UBC Supply Management is responsible for most of the purchasing done on the UBC Vancouver Campus, though other buyers do exist in departments and faculties throughout the University. Supply management has implemented a number of sustainability initiatives (see text box below) and will continue to build on these efforts through CAP activities.

Supply Management Sustainability Initiatives:

- Adopting **sustainability principles** to guide supply management activities
- Developing a Supplier Code of Conduct that sets performance expectations for UBC suppliers
- Working with specific suppliers to augment sustainable procurement practices
- Developing the UBC Sustainable Purchasing Guide that can be used by all buyers at UBC to make smart, sustainable purchases.

[20] Figures for paper assume 41% recycled paper with 30% post consumer recycled content.

Travel and Procurement Summary	
Emissions	Paper: 850 tonnes CO_2e year (2008) Flights: to be determined
Scope	3
Target	80% of all paper purchases to contain at least 30% post-consumer recycled content by 2012.
Influence	 (High) (Med) (Low)

Actions to reduce emissions associated with **moving people**:

BTP-01 Update UBC Policy 83 (Travel and Related Expenses) to articulate UBC's commitment to reducing emissions associated with operational business travel.

BTP-02 Convene a Task Team to refine and implement a measurement and reporting system to support flight reduction by all UBC departments.

BTP-03 Anticipating a future need to offset emissions associated with research travel, begin a dialogue between the Office of the Vice President of Research and the research granting agencies on the capacity to absorb the costs of carbon offsets for travel into research grants.

BTP-04 Fund and promote use of video conferencing facilities.

Actions to reduce emissions associated with **moving materials**:

BTP-05 Study the potential to create an off campus central depot for shipments in order to reduce the number of shipments coming to campus on a daily basis.

BTP-06 Use the Acklands-Grainger arrangement as a model to consolidate deliveries from suppliers.[21]

Actions to **reduce the use of paper**:

BTP-07 Study workflow to identify opportunities to eliminate paper from operations and to assess the feasibility of various electronic/paperless systems

BTP-08 Implement the Document Management Strategy and set target to achieve paperless operations.

BTP-09 Eliminate the use of virgin paper immediately. Communicate and encourage uptake of the current 30% post-consumer recycled content standard.

Actions to **reduce or eliminate wastes**:

BTP-10 Replace packaged/carded stock with bulk items in bookstore

21 The Acklands Grainger arrangement focuses on reducing packaging. For more information, visit UBC Supply Management at http://www.supplymanagement.ubc.ca/Sustainability/acklands-grainger_env_sustainability.htm.

BTP-11 Require all suppliers to use reusable or recyclable packaging or to uncrate and take back packaging.

BTP-12 Conduct a campus-wide waste audit and use the results to set waste reduction targets.

Actions to **encourage sustainable procurement:**

BTP-13 Work with UBC researchers to conduct lifecycle analyses on common purchases in an effort to define the embodied energy within the supply chain and show buyers at UBC the life cycle costs of their choices.

BTP-14 Conduct outreach to ensure that all people making purchasing decisions on campus are aware of Supply Management resources to encourage sustainable purchasing.

BTP-15 Create a policy for 3-way sharing of savings (between the buying department, Finance and the Sustainability Office) from smart purchasing decisions. Give a portion of the savings to a UBC 'sustainability fund' to support ongoing initiatives.

BTP-16 Create a policy for cost sharing across campus that allows researchers and departments to share the cost and resources (e.g., furniture, lab equipment, etc.)

BTP-17 Evaluate opportunities for centralizing purchasing decisions in order to achieve multiple benefits.

BTP-18 Expand list of preferred vendors to include green hotels, car rental agencies that provide low emissions vehicles, etc.

BTP-19 Continue the commitment to promote/advertise sustainable or low emissions product options at retail outlets on campus

BTP-20 Investigate options for asset disposal. Consider online equipment inventory system and SERF (Surplus Equipment Recycling Facility) in this investigation.

BTP-21 Mandate industry standards for energy efficient products (i.e., EPEAT for electronics, Energy Star, etc)

Photo credit: UBC Supply Management

Food

Nationally, GHG emissions from the agricultural sector grew by 23 % between 1990 and 2007. Overall, the agricultural sector is responsible for 8 % of Canada's total GHG emissions;[22] a figure that includes only the production of food - while transportation, waste disposal and land use changes are accounted for elsewhere in the national inventory. Understanding the total burden of our food system is inherently complex.

Major contributors to energy and GHG emissions in our food system are meat and dairy production and transportation (i.e., land and air freight). According to the United Nations Food and Agricultural Organization (FAO), the livestock sector is responsible for more GHG emissions (18%) than the transport sector[23]. Note that a quarter of all the goods transported on our roads and the majority of all airfreight is food[24], contributing significantly to the GHG emissions associated with food consumption.

The challenge in compiling accurate inventories of our food supply chain has not impeded progress towards a more sustainable, low carbon food system on the Vancouver Campus. The **UBC Food Systems Project** has focused on research and collaboration around sustainable food systems for the last eight years and its partners have implemented several measures to reduce emissions.

UBC Food Services (UBCFS) and Alma Mater Society Food Services (AMSFS) are increasing their efforts to source local food. Together – with the teaching, research and land resources of the UBC Farm, and the Faculty of Land and Food Systems – there are opportunities to further reduce GHG emissions through practical, applied research on the cradle-to-grave impacts of food consumption.

The UBC Food System Project (FSP)

An initiative of the Faculty of Land and Food Systems, the UBC Sustainability Office, UBC Food Services and eight other partner organizations to conduct collaborative, community-based action research projects aimed at increasing the sustainability of the UBC food system.

[22] Canada's 2007 Greenhouse Gas Inventory
http://www.ec.gc.ca/pdb/ghg/inventory_e.cfm

[23] FAO website: http://www.fao.org/newsroom/en/news/2006/1000448/index.html

[24] Information obtained at Getlocalbc.org

Food Summary	
Emissions	Unknown
Scope	3
Target	Establish a baseline inventory for the UBC Food System by 2012
Influence	 (High) (Med) (Low)

The Food Working Group discussed the reduction of GHG emissions ***throughout the entire food supply chain***. Actions put forward included those that increase knowledge and awareness and provide incentives in order to shift demand towards more sustainable, low carbon foods. In the short term, priorities for this key action area include:

(1) Establishing a GHG baseline for the UBC food system, along with targets and indicators for measuring progress;

(2) Defining, and then increasing supply of and markets for sustainable food on campus;

(3) Gradually decreasing demand for "high input" (or energy and GHG intensive) foods – including eating "lower on the food chain" and;

(4) Reducing wastes from the food system (working towards eliminating the concept of 'waste' in our food system entirely, so that it is viewed as a resource or input)

Identified actions include:[25]

FO-01 Integrate the UBC Food Systems Project (FSP) with the CAP. Use the CAP as a vehicle to advance FSP recommendations.

FO-02 Using a Life Cycle Analysis (LCA) approach, establish a baseline inventory for the UBC food system.

FO-03 Engage UBC food providers in building a network with local producers to increase sourcing of local food.

FO-04* Develop a sustainable food purchasing policy to articulate *"when price and quality are comparable, UBC will purchase from the most sustainable, local source."*

FO-05* Increase food production at the UBC Farm. Use the farm to represent the types of food that can be grown, seasonally, in our climate.

FO-06 Advocate for more edible landscapes on campus through participation in the development of the Public Realm Plan, Technical Guidelines and Design Guidelines

FO-07* Provide incentives for consumers to purchase healthy, low carbon food.

[25] Actions marked with an asterisk build on recommendations from the UBC Food System Project.

FO-08* Develop a campus-wide social marketing program to promote sustainable, low carbon food choices, as well as recycling and composting at UBC.

FO-09* Building on existing models, develop curriculum for an interactive 100-level sustainability course to engage students in learning about sustainable food systems.

FO-10* Reduce packaging waste from the UBC food system:

FO-11 Work collaboratively with Waste Free UBC to conduct a composting audit. Use the results to set goals for food waste reduction on campus

FO-12* Conduct research on food waste recovery and nutrient reintroduction into the production system.

FO-13 Undertake a feasibility assessment for an on-campus food processing facility.

FO-14* Conduct plant-based research to identify climate mitigation and adaptation opportunities for the food system.

FO-15 Conduct research on carbon cycling and sequestration associated with food production.

Photo credit: UBC Recruitment

Photo credit: UBC Recruitment

Transportation

The transportation component of the CAP include the movement of people both to-and-from campus (e.g., commuter travel) and around campus. The movement of goods and transportation for purposes other than commuting (e.g., business travel, UBC fleet vehicles, etc.) are addressed in other theme areas.

Emissions associated with transportation are indirect and fall under scope 3 in the emissions inventory. UBC is not required to report these emissions under the GHGRTA (Bill 44-2007), however, commuter travel data is tracked through UBC's Transportation Management Office and the availability of this data presents UBC with an opportunity to demonstrate leadership in its GHG reporting. In 2008, emissions from commuter travel accounted for 29,000 tonnes CO_2e.[26]

The Transportation Management Office runs the well-established TREK Program, which is committed to improving transportation choices by promoting sustainable transportation. These efforts are guided by UBC's Strategic Transportation Plan, which sets targets, goals, objectives and policies related to commuter and truck traffic.

Between 1997 and 2008, UBC achieved great results with its transportation demand management programs, including:

- a 168% increase in transit ridership
- an 18% reduction in automobile trips, despite a 36% growth in the daytime campus population
- a 33% reduction in commuter parking supply
- a 31% reduction in single occupancy vehicle (SOV) trips per person[27]

The U-Pass Program

This program is an integrated, comprehensive transportation package that provides students with universal, accessible, and affordable access to public transit.

[26] 2008 figures developed using data gathered for an evaluation of the U-Pass program. Includes passenger vehicles, though UBC fleet vehicles may be double counted in these figures.

[27] Figures obtained through annual screenline data (Fall 2008 Status Report)

Transportation Summary	
Emissions	29,100 tonnes CO_2e / year
Scope	3
Target	10% below 2008 levels by 2015 (~ 3,000 tonnes CO_2e)[28]
Influence	 (High) (Med) (Low)

The Transportation Working Group focused their efforts to define actions that were within UBC's control or influence to implement. While actions focused on improving regional transit options would certainly help to reduce emissions associated with travel to-and-from the Point Grey Campus, the CAP focuses on actions where UBC can have a more direct impact, acknowledging that continued partnerships (with TransLink and Metro Vancouver) and advocacy (for a sustainable regional transit system) are essential to realizing deep emission reductions over the long term.

[28] This target is based on the target in the 2005 Strategic Transportation Plan, which calls for a 30% reduction SOV trips per person over 1997 levels. The total number of trips is assumed to stay the same, with the difference redistributed equally among increases in transit, pedestrian and bicycle trips. This is explained in greater detail in Technical Report #5.

Actions identified for **commuter travel to-and-from campus** are:

TR-01 Explore the feasibility of implementing a combined discounted transit-parking pass program for staff and faculty.

TR-02 Evaluate opportunities to grant employee benefits or create incentives for dedicated non-GHG commuters.

TR-03 Improve 'end of trip' biking facilities in Technical Guidelines.

TR-04 Develop preferential parking strategy targeting faculty and staff.

TR-05 Study the feasibility of implementing a U-Pass 'tax' for UBC residents (charge new market residential development for 1 U-Pass per household, at the point of purchase)

TR-06 Partner with the Vancouver Area Cycling Coalition (VACC) to improve cycling skills and awareness

TR-07 Per the current study being conducted by Parking Services, build way-finding/ congestion reporting system to mitigate traffic congestion (and emissions) on campus and enhance accessibility to pedestrians, cyclists, transit users, etc

TR-08 Building on the 'telecommuting guideline,' consider developing an employee transit policy to assist staff in reducing GHG emissions associated with commuting.

TR-09 Evaluate the feasibility of implementing a cap on vehicle parking on campus.

TR-10 Explore opportunities to expand U-Pass to staff and faculty members

TR-11 Provide plug-in for electric-assist vehicles

TR-12 Review the policy around student resident parking permits and assess the feasibility of: A) eliminating parking passes for 1st year students living on campus; B) raising rates significantly to discourage the purchase of parking permits by students living on campus.

TR-13 Explore the feasibility of providing a U-Pass opt-in for students who are currently not eligible.

TR-14 Evaluate opportunities to revise UBC's Faculty Housing Program to include incentives for faculty to find housing closer to campus, thereby encouraging shorter commutes (e.g., financial assistance weighted to give more to faculty members that choose to live closer to campus)

TR-15 Improve communications to promote various commuting options for staff, faculty and students (i.e., EPP, Flex, ICBC, etc)

TR-16 Develop Bike Buddy program to encourage bike pooling (advertise on carpool notice board)

Actions identified for **travel on campus** are:

TR-17 Consider setting limits on the transferability of parking passes to discourage driving on campus (phase this in the next time parking fees get restructured).

TR-18 Improve on-campus bike sharing program (make available to conference guests)

TR-19 Evaluate opportunities to promote a culture of cycling with guided on-campus bike tours

TR-20 Ensure that the Campus Plan aligns with the CAP in terms of land use and the need for infrastructure that encourages alternative transportation (e.g., compact, **mixed**-use, walkable communities with more retail and grocery stores on campus)

Photo credit: UBC Recruitment

IMPACT AND IMPLEMENTATION

Resource Requirements

Resources required to implement the majority of the actions outlined in the CAP will be prioritized through existing budgets and staff. There are a few key strategies – those that will greatly assist UBC in meeting its targets – that will require substantial capital resources for implementation. These strategies and their estimated total costs for implementation are shown below in Table 8.

Table 8: Estimated Total Costs for Key Emissions Reduction Strategies

GHG Target	Key Strategies	Estimated Total Costs ($)*
33% below 2007 by 2015	Continuous commissioning program for core academic buildings	$ 3.25 million
	Behaviour change initiatives	n/a
	Convert existing district energy system from steam to hot water	$ 40 million
	Implement biomass gasification cogeneration system (UBC Bioenergy Research and Demonstration Project)	$ 26 million
	Fleet management activities, including:	
	• Incremental costs of transitioning to a low emission fleet	$1.5 - $1.8 million
	• Equipment to track vehicle usage (telematics)	$300,000
	• Infrastructure for electric and natural gas powered vehicles	$500,000
	Reduce GHG intensity of electricity generation (provincial action)	n/a
66% below 2007 by 2020	Fuel switching from natural gas to renewable sources	$ 30 million
100% below 2007 by 2050	Further fuel switching from natural gas to renewable sources	
	Export of energy to the UBC community creates offsets and results in UBC becoming a "net exporter" of energy	$30 million
		~ $ 130 million

* UBC's investment share of the estimated total costs of key strategies varies by strategy. Estimated total costs are in thought to be in the order of magnitude of $130 million; however, further work will need to be done to refine these costs estimates.

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The net present value (NPV) of energy purchases over the next 25 years is in the range of $100 to $110 million dollars for each of natural gas and electricity. Transitioning to a renewable energy system may be able to save substantial expenditures for future natural gas or electricity purchases. The magnitude of this opportunity is established in more detail in the Alternative Energy Study Project (AESP).[29]

In addition to the fuel costs, there are carbon costs that provide further incentive to act. The business-as-usual (BAU) scenario values the carbon liability of the carbon tax and the cost of offsets at about $25 million for a total carbon cost of $50 million (net present value over 25 years). As shown in Figure 4, achieving the defined GHG emissions reduction targets reduces the carbon liability to $23 million (net present value over 25 years).

In other words, there is a $27 million dollar savings to be had by achieving the GHG emissions reduction targets in this plan. Combined with the $18 million in capital spending that a BAU will require, there is essentially $ 45 million "on the table" that can be used to achieve the reductions defined in the CAP.

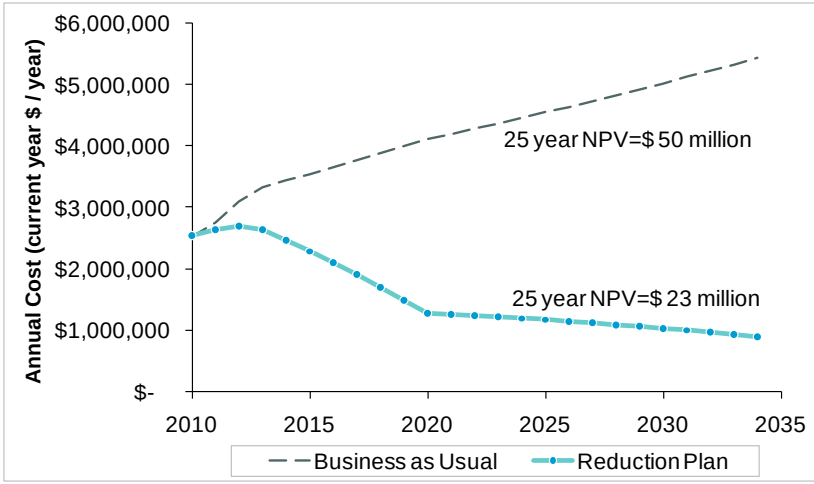

Figure 4: Forecasted Expenditures for the Carbon Tax and Offset Liabilities

A final note about the NPV of the carbon tax and offset costs: As a result of discounting future expenses (a 6% discount rate was applied), the near term expenditures weigh most heavily on the NPV. The economic argument is that earlier action will reduce the carbon liability (in today's dollars) more effectively than deferred action.

[29] The cost of fuel could be quite variable. For example, a solar panel receives free heat energy, a heat pump system might use 1/3 of the energy of a natural gas boiler, but switches from a cheaper fuel to a more expensive fuel, and a biomass system would require the purchase of fuel - the cost of which is currently unknown.

Cost of GHG Reduction

A cost curve provides an illustrative example of the types of reductions possible. Figure 5 shows the cost effectiveness of various activities to reduce scope 1 and 2 emissions. While the figures are approximate, they do provide an indication of how UBC might approach CAP implementation. Cost curve assumptions are presented in CAP Technical Report #6.

Key observations from the cost curve are:

- **The inclusion of the carbon tax and requirement to purchase offsets effectively changes the "breakpoint" for activities to be considered profitable.** That is, a reduction is no longer profitable when it can be achieved for less than zero dollars per tonne. Rather it is profitable when it can be achieved for less than the cost of the carbon tax +offsets - estimated to total $50 to $70 per tonne by 2012 (the blue shaded region on the curve).
- **Several activities have attractive cost effectiveness, but have a limited amount of tonnes that can be reduced.** For example, fleet management results in an estimated reduction of 300 tonnes of CO_2e annually. These actions may, however have co-benefits, such as contributing to a culture of climate action at UBC.
- **Activities are not mutually exclusive and may be more cost effective if implemented simultaneously.** The plot shows the reductions from replacing the district energy system OR conducting extensive retrofits. These have been analyzed separately here, but are not mutually exclusive. If conducted in conjunction with a district energy system renewal project, building envelope upgrades could be cost effective (e.g., by reducing the load and therefore reducing the size of a district energy heating plant).
- **Activities may have co-benefits, beyond just GHG reductions.** Many activities save energy and money, but may not have attractive cost effectiveness when viewed solely from a GHG perspective. GHG reduction AND energy reduction goals need to be advanced simultaneously. The GHG cost curve highlights only the GHG benefits. Further, the cost curve does not include activities to reduce scope 3 emissions, which also tend to have numerous co-benefits. Activities in these areas will not register on UBC's carbon "ledger" and may be more difficult to quantify. However, these actions should be pursued as part of a longer term initiative on climate change.

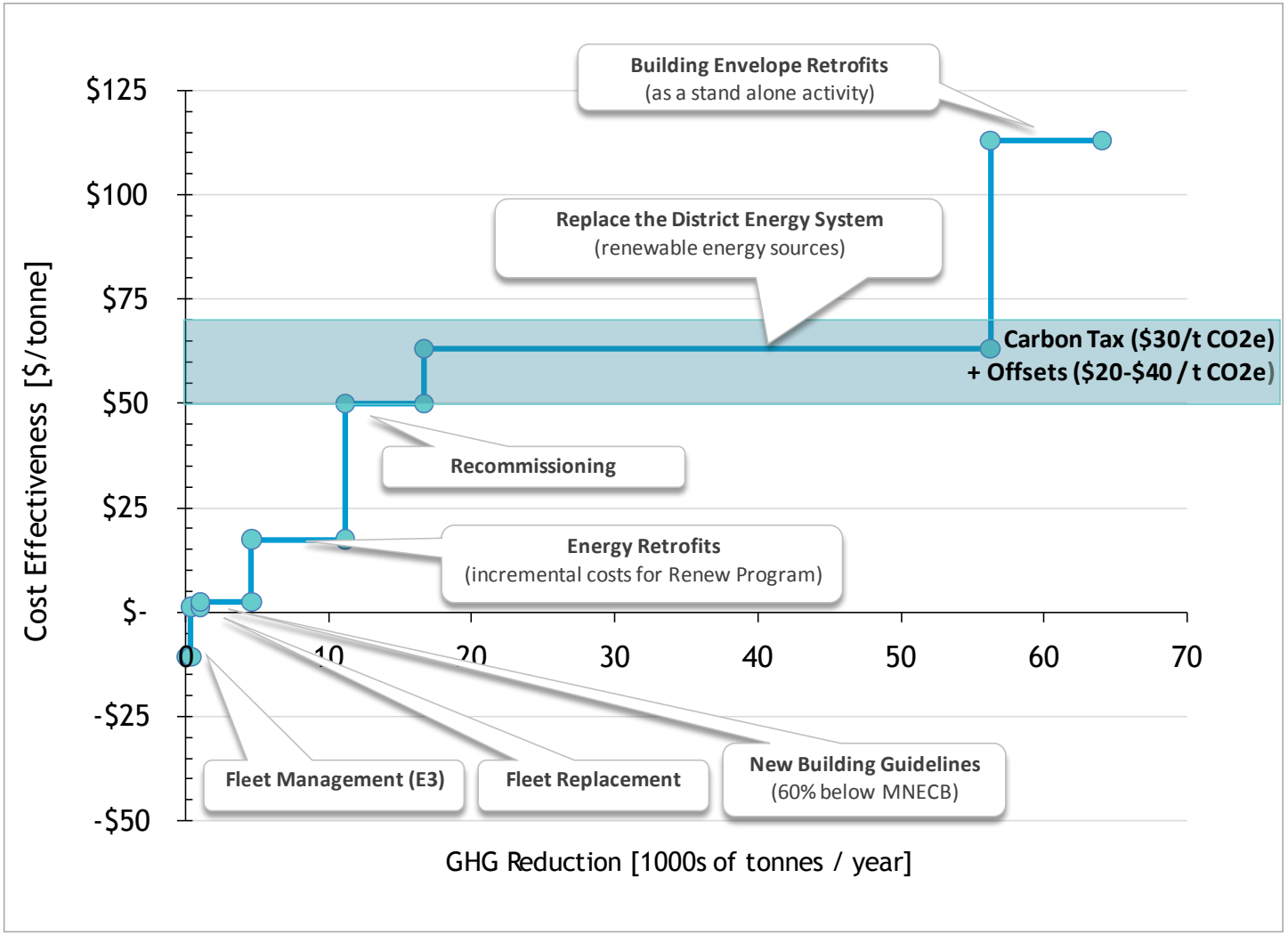

Figure 5: GHG Abatement Cost Curve

Management System

This section provides general guidance on CAP implementation using a management system framework. The management system is discussed in further detail in CAP Technical Report #7.

The Climate Action Plan (CAP) sets out a vision, a baseline emissions inventory, GHG reduction targets, key action areas and specific climate change mitigation actions for UBC to undertake on the Vancouver Campus.

A **management system** is a tool to facilitate the continuous improvement of a plan. For the CAP, it ensures that there will be ongoing monitoring, management and refinement over time. This will keep the plan current and ensure it is a living document.

Management systems in general range from simple documents to elaborate IT systems. In this context a management system is simply a documented delineation of the processes, roles and responsibilities to ensure the plan is implemented.

The key focus of a management system is its commitment to continuous improvement. Moving forward, the actions and monitoring requirements developed for the CAP will be regularly reassessed and refined.

Process: Plan, Do, Check, Act

An ongoing feedback loop, known as the Deming Cycle facilitates continuous improvement. The four components of the Deming Cycle, shown below in Figure 6, are "plan, do, check and act."

A run through the plan-do-check-act cycle must occur on an annual basis and should coincide with the annual budget cycle for planning each year's capital and operating budgets.

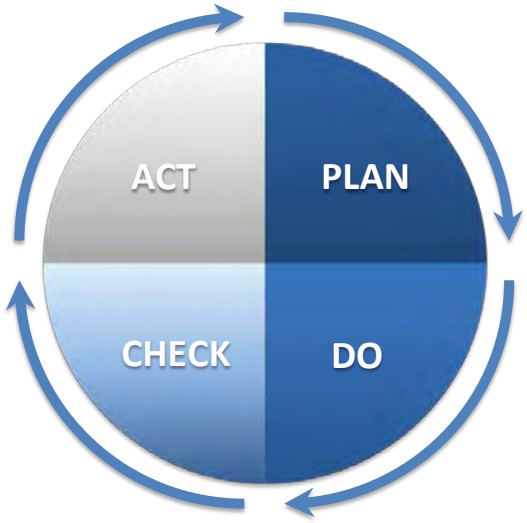

Figure 6: The Deming Cycle (Plan-Do-Check-Act)

Plan

UBC's approach to climate action planning has been to:

- Gain broad support for the high-level vision and targets;
- Engage stakeholders in developing actions that make progress towards achieving the targets;
- Estimate resource requirements to implement the actions, and;
- Assign responsibility for overseeing the implementation of actions.

Do

Plan implementation will require the formulation of a work plan to define CAP activities to be implemented on an annual basis. The work plan will tie into departmental business plans and budgets to ensure responsibilities and resources are allocated for CAP activities. Annual planning activities will be focused around the budget preparation cycle. Capital and operating budgets are defined annually in December.

Check

Monitoring includes two components. The first is the monitoring of plan activities – what is being done, who is doing it, is the activity funded, etc. The second component is the compilation of the energy and emissions inventory to monitor the success of GHG emissions reduction measures. At present there are a few data compilation gaps that must be resolved, including:

- The energy consumption of off campus buildings;
- The mileage/fuel consumption of all fleet vehicles, and;
- Energy monitoring systems to track the impact of demand-side management activities.

Finally, UBC will need to put systems in place in order to track and report on certain Scope 3 emissions (as desired) in the future.

Act

Key reporting requirements for UBC are:

To the **Province of BC:**

- A progress report on emissions reduction due in June of each year. This quantitative report is compiled using the *SMARTTool*, a web-based application developed by the Province that converts activity data to GHG emissions.
- A *Carbon Neutral Action Report* provides a qualitative account of progress made on climate action (e.g., outreach and engagement activities, programs, policies, research, training, etc.).

To the **UBC Executive** and **Board of Governors**:

- This reporting will be broader in nature than the provincial requirements and will be UBC's report to its stakeholders and campus community. This could be a standalone report, or part of the annual reporting compiled by UBC for *Inspirations and Aspirations: The Sustainability Strategy*.
- A five-year review and report for the Climate Action Plan. This would be a comprehensive review to determine the success of activities implemented in achieving GHG emission reductions. As a result of this review, UBC will essentially produce an updated CAP, including a summary of progress made in the period from 2010 to 2015 and where necessary, revised goals, targets and actions for the period from 2015 to 2020. A Climate Action Plan report would be produced and disseminated broadly every five years.

Next Steps and Implementing Actions

An environmental management system, such as ISO 14001:2004, or the emerging ISO 50001Energy Management System standard, would assist UBC in formalizing many of the processes required for CAP implementation. UBC may wish to explore linkages with existing management systems handled by the Health, Safety and Environment (HSE) Department. Efforts are ongoing within HSE to establish a comprehensive approach to environmental management at UBC. Aligning with these efforts may create efficiencies with regards to monitoring and reporting of CAP activities.

This chapter identified a number of actions to assist UBC in further refining a management system to manage CAP implementation and other climate-related plans and activities.

Specific actions include:

IMP-01 Clearly define and communicate accountabilities and responsibilities for the CAP to all stakeholders involved in ongoing implementation.

IMP-02 Invest in the enhancement of information systems in order to ensure consistent and accurate data management. Explore whether PeopleSoft has a module that UBC could buy off the shelf to assist in tracking and monitoring performance.

IMP-03 Establish key performance indicators, related to achieving climate action goals and targets and other sustainability targets (e.g. from Inspirations and Aspirations), for Managing Directors and Directors.

IMP-04 Identify where activities may be running counter to CAP goals and work to create alignment so that UBC is not just engaging in activities that reduce emissions, but also refraining from activities that increase emissions.

IMP-05 Explore opportunities to formalize the management system outlined in this chapter to ensure successful implementation of the CAP and of other climate-related plans at UBC.

IMP-06 Improve monitoring systems as per the requirements defined in CAP Technical Report #3.

CLIMATE ACTION PLAN
UBC Vancouver Campus

Technical Report #1

Climate Action Plan Process

February 2010

Figure 1: Climate Action Plan Process

Vision Statement

In March of 2009, two Visioning Workshops took place on UBC's Vancouver Campus. Students, staff, faculty and residents were invited to share their vision for climate action at UBC. Workshops began with an exercise which asked participants to develop a climate-related headline from the year 2050. Headlines generated were both negative (e.g., Gulf Islands totally submerged!) and positive (UBC: World's First Energy Self Sufficient University), yet all were creative and served to get participants into a future-thinking mindset. Working as individuals, participants were given props and asked to articulate or illustrate their vision for climate action at UBC. Following this individual exercise, participants worked in small groups to share their visions and draw out common or recurring elements found in the visions. These elements were then written down on individual pieces of paper and stuck on the wall for all participants to see. A silent exercise had participants grouping similar elements and ideas together on the wall. In silence, participants were better able to read the elements brought forward by others and had to work harder to group them into like areas. Once all elements were grouped to the satisfaction of participants, the facilitator asked the participants (as a whole group) to assign names to each element area – using one to three words to describe the key elements in the grouping as accurately as possible. From this exercise, the key elements of a vision were generated. Figure 2 shows the vision elements generated through both workshops. The larger the word, the more times it was used during the key elements exercise.

Figure 2: Word cloud of vision elements

Participants were asked to brainstorm possible actions for the Plan and post them on an "Ideas Wall." From these workshops, a draft vision was created and tested on a focus group of UBC community members before being presented at a Town Hall meeting in late March. Input received at the Town Hall meeting helped to refine UBC's Vision for Climate Action.

Create Plan

UBC identified seven key emissions source areas and created a working group to address each one. The working groups – made up of staff, faculty and students – encouraged the cross-pollination of ideas between operational practice, research and teaching at UBC. Each working group met three times between March and June 2009 in order to develop strategies for each emissions source area.

Draft Plan

The draft emissions source strategies were then rolled up to create the draft Climate Action Plan.

Following endorsement by the Working Groups, the draft plan was presented for review by the Technical Advisory Committee (TAC), a multi-stakeholder committee that also produced UBC's first GHG emissions inventory.

After the TAC review, an implementation workshop was held with key implementation stakeholders and the Operations Working Group- a working group of the President's Advisory Council on Sustainability, mandated with oversight of the Climate Action Plan. The purpose of this workshop was to gain endorsement from implementers on strategies housed within the plan. The draft plan was then presented to both the President's Advisory Council on Sustainability and the UBC Executive Board. Following this process, the draft plan was made available to the UBC community via the climate action website throughout the summer of 2009.

Final Plan

The Climate Action Plan was reviewed and approved by the UBC Board of Governors on April 8, 2010.

Implement Plan

The CAP benefits from a strategy that outlines resources and responsibilities to guide CAP implementation. The management system underscores UBC's commitment to continually improving climate action efforts.

climateaction.ubc.ca – Throughout the CAP process, the website provided a vehicle for gathering and sharing information. Moving forward, the website will continue to be a space for sharing progress on implementation and ideas for climate action.

CLIMATE ACTION PLAN

UBC Vancouver Campus

Technical Report #2

Emissions Inventory Detail

February 2010

This inventory update accounts for energy consumption and greenhouse gas emissions from UBC's Point Grey campus for 2008. The inventory documents energy consumptions and GHG emissions associated with the following items related to the operation of UBC:

Component	Bill 44 Requirement	Scope
Core Buildings	Yes	1 & 2
Ancillary Buildings		1 & 2
TRIUMF (1/6 share)		1 & 2
Fleet		1
Paper		3
Solid Waste	No	3
Commuting		3
International Student Travel		3
Building Lifecycle		3

Components from previous inventories that were omitted from this update due to data unavailability include emissions related to business travel, fertilizers and animals. Recommendations have been made in this plan to facilitate the collection of the data required for future inclusion of business travel. Details for the collection of data regarding animals and fertilizer are in Technical Report #3.

The methodologies used are compatible with standard GHG reporting protocols where possible, or are consistent with previous versions of UBC's energy and GHG inventory where standard methods were not available. This inventory documents energy consumption and GHG emissions where data was available, though it is noted that UBC's share of emissions from TRIUMF corresponds to its ownership share of 16.7%. Emissions from Tenant facilities are not reported in this inventory. The emissions factors used in this inventory are summarized below and are consistent with those used in the Province of British Columbia at the time the inventory was completed.

Energy Source	GHG Emission Factor	Units	Source
Electricity (average)	22	tonnes CO_2e / GWh	BC Hydro intensity of BC produced electricity for 2007. Does not include any evaluation of electricity imports or exports.
	0.0061	tonnes CO_2e / GJ	
Natural Gas	0.050	tonnes CO_2e / GJ	Terasen Gas
Propane	0.061	tonne CO_2e / GJ	Jaques, A. (1992). Canada's Greenhouse Gas Emissions: Estimates for 1990. Environmental Protection, Conservation and Protection, Environment Canada. EPS 5/AP/4, December.
	0.025	GJ / L	
Heating Oil	0.073	tonnes CO_2e / GJ	
	0.040	GJ / L	
Gasoline	0.00238	tonne CO_2e / L	
	0.036	GJ / L	
Diesel	0.00279	tonne CO_2e / L	
	0.038	GJ / L	
B20 Biodiesel	0.00223	tonne CO_2e / L	US Department of Energy - National Renewable Energy Laboratory (NREL)
	0.037	GJ / L	
B5 Biodiesel	0.00265	tonne CO_2e / L	
	0.038	GJ / L	
Solid Waste (SW)	0.484	tonne CO_2e / tonne SW	Metro Vancouver
Paper (100% virgin fibre)	2.87	tonne CO_2e / tonne paper	Environmental Defense Fund Paper Calculator - www.papercalculator.org
Paper (10% recycled)	2.77	tonne CO_2e / tonne paper	
Paper (20% recycled)	2.66	tonne CO_2e / tonne paper	
Paper (30% recycled)	2.56	tonne CO_2e / tonne paper	
Paper (50% recycled)	2.35	tonne CO_2e / tonne paper	
Paper (100% recycled)	1.83	tonne CO_2e / tonne paper	
Building Lifecycle	0.00825	tonnes CO_2e/m^2/year	Norman, Maclean, ASCE, & Kennedy (2006)

In 2008, UBC operations that would be subject to Provincial carbon neutrality requirements include a total:

- Energy consumption of 2.24 million GJ
- GHG emissions of 62,700 tonnes CO_2e

Additional reported components not subject to UBC's carbon neutrality requirements total an estimated 50,300 tonnes CO_2e for 2008. Forecasts of energy and emissions for the year 2020 are based on a business-as-usual scenario from projected growth in building floor space or student populations. The total GHG emissions from UBC Point Grey Campus are summarized below.

GHG by inventory category								
Item	Units	1990	1994	2000	2006	2007	2008	2020
Total	tonnes CO2e / yr	67,560	64,780	76,850	111,185	110,888	113,056	133,657
Buildings	tonnes CO2e / yr	9,260	9,490	10,620	10,230	10,680	11,870	17,360
Buildings via Steam Plant	tonnes CO2e / yr	49,430	45,420	51,660	50,070	47,420	48,510	58,030
Fleet	tonnes CO2e / yr	1,970	1,970	1,970	1,970	1,970	1,490	1,490
Solid Waste	tonnes CO2e / yr	N.A.	N.A.	N.A.	1,430	1,930	1,800	2,440
Paper	tonnes CO2e / yr	N.A.	N.A.	N.A.	1,215	1,003	852	1,153
Commuting	tonnes CO2e / yr	N.A.	N.A.	N.A.	27,670	28,885	29,134	29,985
International Student Travel	tonnes CO2e / yr	N.A.	N.A.	3,700	8,400	8,800	9,200	9,400
Building Lifecycle	tonnes CO2e / yr	6,900	7,900	8,900	10,200	10,200	10,200	13,800

Utilities

Data for electricity consumption at UBC's Vancouver campus is generated by UBC Utilities and made available through the UBC Campus Sustainability Office. The data is compiled based on a fiscal year of April 1st to March 31st, but monthly data can be used to determine usage for a calendar year. In studying data for a number of years, instances of missing values were discovered where estimates had been made in their places. While annual consumption totals for the entire campus are known for electricity, natural gas and steam production, only the consumptions of ancillary and tenant facilities have been metered since 1993. The consumption for core facilities is estimated as the difference between total and metered consumptions, but does not account for any losses or transmission efficiencies. Prior to 1993, the distribution of utilities to facilities was unmetered and estimated using regression analysis.

The energy consumptions and GHG emissions related to utilities for UBC buildings are summarized below.

GHG by consumer								
Item	Units	1990	1994	2000	2006	2007	2008	2020
Total	tonnes CO2e / yr	58,690	54,910	62,280	60,300	58,100	60,380	75,390
Core Buildings	tonnes CO2e / yr	47,370	46,360	50,150	48,680	46,480	46,390	52,910
Ancillary Buildings	tonnes CO2e / yr	11,280	8,330	11,930	11,400	11,410	13,460	22,480
TRIUMF (UBC share)	tonnes CO2e / yr	40	220	200	220	210	530	N.A.

Energy by consumer								
Item	Units	1990	1994	2000	2006	2007	2008	2020
Total	GJ	1,499,000	1,501,800	1,556,300	1,736,400	1,711,100	1,808,400	2,220,500
Core Buildings	GJ	1,199,600	1,245,000	1,197,600	1,366,700	1,341,100	1,332,700	1,492,400
Ancillary Buildings	GJ	293,200	256,800	358,700	369,700	370,000	432,900	728,100
TRIUMF (UBC share)	GJ	6,200	N.A.	N.A.	N.A.	N.A.	42,800	N.A.

Energy by utility energy source								
Item	Units	1990	1994	2000	2006	2007	2008	2020
Total	GJ	1,584,400	1,581,000	1,725,600	1,809,000	1,776,700	1,838,300	2,243,400
Electricity	kWh	127,986,500	144,788,600	157,990,900	181,531,500	184,360,200	193,018,000	224,853,500
Natural Gas	GJ	129,300	126,100	142,900	124,900	132,700	152,400	248,700
Natural Gas (for Steam)	GJ	906,600	889,100	872,100	994,000	949,700	960,800	1,162,300
Heating Oil	GJ	57,100	13,900	111,200	6,000	0	7,300	0

GHG by utility energy source								
Item	Units	1990	1994	2000	2006	2007	2008	2020
Total	tonnes CO2e / yr	60,680	56,870	64,250	62,260	60,070	61,850	76,890
Electricity	tonnes CO2e / yr	2,820	3,190	3,480	3,990	4,060	4,250	4,950
Natural Gas	tonnes CO2e / yr	6,460	6,300	7,140	6,230	6,620	7,610	12,420
Natural Gas (for Steam)	tonnes CO2e / yr	45,260	44,390	43,540	49,630	47,420	47,970	58,030
Heating Oil	tonnes CO2e / yr	4,170	1,020	8,120	440	0	530	0

Electricity

Electricity consumption at UBC is associated with the operation and activities in campus buildings, primarily lighting, air handling and conditioning, and plug loads. Electricity is distributed throughout UBC from a bulk purchase and while the delivery to Ancillary and Tenant facilities is metered, the consumption by Core Buildings is calculated as the difference remaining after the other two building sectors.

Total electricity use at UBC's Point Grey campus for Core, Ancillary and TRIUMF facilities reached approximately 193 million kWh in 2008, with Core Buildings as the largest consumer using nearly 131 million kWh. The associated GHG emissions for electricity consumption at all UBC facilities were approximately 4,250 tonnes CO_2e.

Natural Gas

While much of campus is heated by steam, there is some direct natural gas consumption for heating and process usages in UBC facilities. Natural gas is distributed throughout UBC from a bulk purchase, and while the delivery to Ancillary and Tenant facilities is metered, the consumption by Core Buildings is calculated as the difference remaining after the other two building sectors.

The UBC Point Grey campus used a total of approximately 152,400 GJ. The resulting GHG emission from direct natural gas usage was 7,610 tonnes CO_2e.

Steam

Steam is generated at a central plant and then distributed throughout campus for heating and process loads in UBC facilities. Natural gas is the primary fuel for steam generation, although oil is burned on occasion when needed. The produced steam is measured at the boilers, as is the delivery to Ancillary and Tenant facilities. The remainder is taken as the usage by Core Buildings, although all distribution system losses are included in this value as well. Data for steam production and usage is generated by UBC Utilities and made available through the UBC Campus Sustainability Office.

For the 2008 inventory, the original steam data was adjusted to redistribute the distribution losses accordingly to the respective building sectors. The metered steam consumptions for Ancillary and Tenant building sectors were adjusted to account for an

estimated 25% energy loss through the steam distribution system. The subtraction of these adjusted values from the total metered production was then assumed to be a more accurate estimate of core building steam consumption and losses associated with distribution to core buildings only. This methodology was used to adjust all historical data presented in this inventory so that consistent comparisons can be made.

Total steam production for Core, Ancillary and Tenant building consumptions in 2008 was 765,439,000 lbs of steam from the burning of 1,028,000 GJ of natural gas and 196,100 L of heating oil. The respective GHG emissions that UBC is responsible for (Core and Ancillary consumption only) were approximately 48,970 tonnes CO_2e from natural gas and 530 tonnes CO_2e from oil.

Fleet

The management of UBC's vehicle fleet is distributed across departments. The fleet comprises approximately 430 ICBC registered vehicles at the Point Grey campus. Nearly two-thirds of the fleet is used for campus operations activities, with the remaining third related to departments and research. There is a fueling station at the Plant Operations facility which services the majority of campus operations related vehicles and some department vehicles. All fuel dispensed at the station is tracked by department. A new purchasing system is being implemented that will track the fuel dispensed to individual vehicles registered on the system, allowing for more detailed and accurate fuel consumption data. All other fuel purchases made off-campus were estimated based on the proportion of the fleet that does not fill at the LBS station, assuming that variations in consumption patterns would average out across the two sets.

Energy by fuel source								
Item	Units	1990	1994	2000	2006	2007	2008	2020
Total	GJ	30,600	30,600	30,600	30,600	30,600	23,000	23,000
Gasoline	L	601,100	601,100	601,100	601,100	601,100	530,500	530,500
Biodiesel	L	243,100	243,100	243,100	243,100	243,100	104,400	104,400

GHG by fuel source								
Item	Units	1990	1994	2000	2006	2007	2008	2020
Total	tonnes CO2e / yr	1,970	1,970	1,970	1,970	1,970	1,490	1,490
Gasoline	tonnes CO2e / yr	1,430	1,430	1,430	1,430	1,430	1,260	1,260
Biodiesel	tonnes CO2e / yr	540	540	540	540	540	230	230

An estimated 530,000 L of gasoline and 104,000 L of biodiesel were used by UBC vehicles in 2008. Emissions from biodiesel were based on the use of B20 biodiesel blend (20% biodiesel with 80% petroleum diesel). The resulting GHG emissions were estimated to be 1,300 tonnes CO_2e from gasoline and 233 tonnes CO_2e from B20 biodiesel blend.

Solid Waste

Solid waste generated on campus is tracked and managed by UBC Waste Management. There are significant diversion programs in place, including the separation of organics which are composted and used for gardening on campus. The GHG emissions related to the remainder of solid waste disposed, represents the off-gas that results from decomposition in landfills.

Data for solid waste was provided by UBC Waste Management, although the compilation of data for 2008 was not yet fully complete and some of the values for diverted materials were estimated. UBC diverts 44% of the 6,400 tonnes of solid waste generated on campus, leaving 3,700 tonnes to be incinerated or landfilled. The resulting GHG emissions were estimated to be 1,800 tonnes CO_2e.

Paper

UBC has a contract with Unisource for the provision of all paper on campus, and reports of all paper purchases can be provided by the Unisource IT department. The GHG emissions from paper are associated with the energy and materials involved in the production of paper, and can be estimated based on the recycled content and mass of paper used.

A total of 318 tonnes of paper were purchased by UBC in 2008 with various recycled material contents. The total GHG emissions related to UBC's paper consumption were estimated to be 850 tonnes CO_2e.

Commuting

Emissions related to commuting were estimated using the methodologies by Frantz (2003) from the previous versions of UBC's inventory. UBC population data from UBC Planning And Institutional Research (PAIR) and travel patterns outlined in the UBC TREK Fall 2008 Transportation Status Report were used to estimate the GHG emissions associated with the different modes of transportation used to travel to-and-from campus. Commuting related emissions for 2008 were approximately 29,100 tonnes CO_2e.

International Student Travel

Assuming that international students make one return trip to their home country each year, GHG emissions from international student travel were estimated using PAIR data on international student countries of origin and a carbon calculator produced by the International Civil Aviation Organization (ICAO) that can determine the emissions from flights modeled on routing through the hub system that modern air travel is based on.

A number of representative routes to destinations covering the different regions of origin for UBC's international students were modeled using the ICAO tool, and the GHG emissions were estimated based on the number of students from each region. In 2008, the total emissions resulting from international students travelling home once a year was estimated to be 9,200 tonnes CO_2e.

Building Lifecycle

The embodied impacts of UBC's buildings and infrastructure were determined using the methodology of Norman et al. (Norman, MacLean, ASCE & Kennedy, 2006) from UBC's previous inventory. Emissions for 2008 were estimated by updating the floor areas of

campus buildings, and are subject to the same constraints as previous inventories. The embodied energy of UBC buildings represents approximately 10,200 tonnes CO_2e.

Other Components

Data for 2008 was unavailable for fertilizer, animals and business travel. As a result, values shown are from the latest available information included in the 2006 and 2007 UBC GHG Inventory Reports.

Component	Tonnes of CO_2e / year	Reporting Year
Fertilizer	150	2007
Animals	1,500	2007
Business Travel	13,600	2006

The UBC Gardener did not have data available regarding the amount of synthetic fertilizers applied on UBC grounds in 2008. The information may be tracked, but could not be compiled for this inventory update. Similarly, information for UBC livestock is tracked, but could not be compiled for the 2008 inventory. Developing standardized reporting systems and structures may facilitate more consistent collection of accurate data needed for future inventories.

There is currently no system in place to track and compile the needed information to accurately determine emissions from business (staff and faculty) travel. Opportunities to facilitate the inclusion of this information in future inventories have been discussed in the Business Travel and Procurement section of the Climate Action Plan. Similarly, there are currently no methods with which to track emissions associated with the UBC food system or with UBC's procurement practices; however, these may be developed in the future.

Detailed Summaries

The following tables summarize the complete findings of the 2008 GHG inventory for UBC's Point Grey campus. (Note: Grey shaded areas indicate estimates based on the last year that real data was available.)

Inventory Detail										
Use		**Item**	**Units**	**1990**	**1994**	**2000**	**2006**	**2007**	**2008**	**2020**
Buildings										
Use		Item	Units	1990	1994	2000	2006	2007	2008	2020
Core Buildings	Floor Area	Total Floor Area	square feet	5,862,900	6,224,200	6,814,700	8,010,400	7,953,200	7,901,500	8,933,500
		Total Floor Area	square meters	544,700	578,200	633,100	744,200	738,900	734,100	829,900
		Floor Area (steam)	square feet	5,297,800	5,658,500	6,249,500	7,468,600	7,468,600	7,468,600	8,444,100
		Floor Area (steam)	square meters	492,200	525,700	580,600	693,900	693,900	693,900	784,500
		Floor Area (natural gas)	square feet	396,500	407,900	407,900	395,200	378,100	354,300	400,600
		Floor Area (natural gas)	square meters	36,800	37,900	37,900	36,700	35,100	32,900	37,200
	Energy Consumption	Electricity	kWh	100,211,900	105,715,100	103,323,500	126,348,800	129,835,300	130,502,400	136,911,100
		Natural Gas (direct use)	GJ	99,800	86,500	87,100	63,300	70,400	57,300	98,600
		Natural Gas (for steam)	GJ	737,100	777,400	734,800	848,400	803,300	805,400	900,900
		Heating Oil (for steam)	GJ	46,400	12,200	93,700	5,100	0	6,100	0
		Total Energy Consumption (kWh)	kWh	333,215,000	345,823,700	332,665,500	379,647,000	372,526,100	370,198,400	414,543,600
		Total Energy Consumption (GJ)	GJ	1,199,600	1,245,000	1,197,600	1,366,700	1,341,100	1,332,700	1,492,400
	Building Performance	Overall BEPI (in kWh)	kWh/m^2/yr	612	598	525	510	504	504	499
		Overall BEPI (in GJ)	GJ/m^2/yr	2.2	2.2	1.9	1.8	1.8	1.8	1.8
	Greenhouse Gas Emissions	Electricity	tonnes CO2e / yr	2,200	2,330	2,270	2,780	2,860	2,870	3,010
		Natural Gas (direct use)	tonnes CO2e / yr	4,980	4,320	4,350	3,160	3,510	2,860	4,920
		Natural Gas (for steam)	tonnes CO2e / yr	36,800	38,820	36,690	42,360	40,110	40,210	44,980
		Heating Oil (for steam)	tonnes CO2e / yr	3,390	890	6,840	380	0	450	0
		Total GHG Emissions	tonnes CO2e / yr	47,380	46,350	50,150	48,670	46,480	46,390	52,910
Ancillary Operations	Floor Area	Total Floor Area	square feet	3,175,300	4,028,800	4,860,100	5,278,300	5,336,200	5,356,800	9,011,900
		Total Floor Area	square meters	295,000	374,300	451,500	490,400	495,700	497,700	837,200
		Floor Area (steam)	square feet	1,344,800	1,449,900	1,559,400	1,847,900	1,847,900	1,847,900	3,108,800
		Floor Area (steam)	square meters	124,900	134,700	144,900	171,700	171,700	171,700	288,800
		Floor Area (natural gas)	square feet	914,000	1,180,100	1,774,400	1,774,400	1,774,400	1,737,200	2,922,500
		Floor Area (natural gas)	square meters	84,900	109,600	164,800	164,800	164,800	161,400	271,500
	Energy Consumption	Electricity	kWh	26,060,200	29,269,300	45,799,800	45,144,100	44,822,100	52,274,500	87,942,400
		Natural Gas (direct use)	GJ	29,500	39,700	55,800	61,600	62,300	89,200	150,100
		Natural Gas (for steam)	GJ	169,500	111,700	137,300	145,500	146,400	155,400	261,400
		Heating Oil (for steam)	GJ	10,700	1,800	17,500	900	0	1,200	0
		Total Energy Consumption (kWh)	kWh	81,433,600	71,331,900	99,631,000	102,691,900	102,790,400	120,237,700	202,256,100
		Total Energy Consumption (GJ)	GJ	293,200	256,800	358,700	369,700	370,000	432,900	728,100
	Building Performance	Overall BEPI (in kWh)	kWh/m^2/yr	276	191	221	209	207	242	242
		Overall BEPI (in GJ)	GJ/m^2/yr	1.0	0.7	0.8	0.8	0.7	0.9	0.9
	Greenhouse Gas Emissions	Electricity	tonnes CO2e / yr	570	640	1,010	990	990	1,150	1,930
		Natural Gas (direct use)	tonnes CO2e / yr	1,470	1,980	2,790	3,080	3,110	4,460	7,500
		Natural Gas (for steam)	tonnes CO2e / yr	8,460	5,580	6,850	7,270	7,310	7,760	13,050
		Heating Oil (for steam)	tonnes CO2e / yr	780	130	1,280	60	0	90	0
		Total GHG Emissions	tonnes CO2e / yr	11,280	8,330	11,930	11,400	11,410	13,450	22,480

Use		Item	Units	1990	1994	2000	2006	2007	2008	2020
Buildings										
Use		Item	Units	1990	1994	2000	2006	2007	2008	2020
Tenants	Floor Area	Total Floor Area	square feet	1,428,400	1,483,900	1,620,300	1,622,800	1,584,900	1,584,900	-
		Total Floor Area	square meters	132,700	137,900	150,500	150,800	147,200	147,200	-
		Floor Area (steam)	square feet	1,028,200	1,012,000	1,083,900	1,022,400	1,022,400	1,022,400	-
		Floor Area (steam)	square meters	95,500	94,000	100,700	95,000	95,000	95,000	-
		Floor Area (natural gas)	square feet	386,300	457,900	522,500	604,900	604,900	604,900	-
		Floor Area (natural gas)	square meters	35,900	42,500	48,500	56,200	56,200	56,200	-
	Energy Consumption	Electricity	kWh	22,852,200	21,557,900	24,363,400	34,101,600	32,920,900	32,179,700	-
		Natural Gas (direct use)	GJ	23,900	25,000	55,300	97,900	99,300	107,500	-
		Natural Gas (for steam)	GJ	89,300	69,500	80,200	65,700	61,900	67,000	-
		Heating Oil (for steam)	GJ	5,600	1,100	10,200	400	0	500	-
		Total Energy Consumption (kWh)	kWh	54,365,500	47,811,500	62,129,900	79,539,000	77,691,300	80,653,600	-
		Total Energy Consumption (GJ)	GJ	195,700	172,100	223,700	286,300	279,700	290,400	-
	Building Performance	Overall BEPI (in kWh)	kWh/m^2/yr	410	347	413	528	528	548	-
		Overall BEPI (in GJ)	GJ/m^2/yr	1.5	1.2	1.5	1.9	1.9	2.0	-
	Greenhouse Gas Emissions	Electricity	tonnes CO2e / yr	500	470	540	750	720	710	-
		Natural Gas (direct use)	tonnes CO2e / yr	1,190	1,250	2,760	4,890	4,960	5,370	-
		Natural Gas (for steam)	tonnes CO2e / yr	4,460	3,470	4,000	3,280	3,090	3,350	-
		Heating Oil (for steam)	tonnes CO2e / yr	410	80	750	30	0	40	-
		Total GHG Emissions	tonnes CO2e / yr	6,570	5,270	8,050	8,950	8,770	9,460	-
TRIUMF	Floor Area	Total Floor Area	square feet	-	-	-	-	-	-	-
(UBC - 1/6 share)		Total Floor Area	square meters	-	-	-	-	-	-	-
		Floor Area (steam)	square feet	-	-	-	-	-	-	-
		Floor Area (steam)	square meters	-	-	-	-	-	-	-
		Floor Area (natural gas)	square feet	-	-	-	-	-	-	-
		Floor Area (natural gas)	square meters	-	-	-	-	-	-	-
	Energy Consumption	Electricity	kWh	1,714,400	9,804,100	8,867,600	10,038,600	9,702,700	10,241,100	-
		Natural Gas (direct use)	GJ	-	-	-	-	-	5,900	-
		Natural Gas (for steam)	GJ	0	0	0	0	0	0	-
		Heating Oil (for steam)	GJ	0	0	0	0	0	0	-
		Total Energy Consumption (kWh)	kWh	1,714,400	-	-	-	-	11,883,800	-
		Total Energy Consumption (GJ)	GJ	6,200	-	-	-	-	42,800	-
	Building Performance	Overall BEPI (in kWh)	kWh/m^2/yr	-	-	-	-	-	-	-
		Overall BEPI (in GJ)	GJ/m^2/yr	-	-	-	-	-	-	-
	Greenhouse Gas Emissions	Electricity	tonnes CO2e / yr	40	220	200	220	210	230	-
		Natural Gas (direct use)	tonnes CO2e / yr	-	-	-	-	-	300	-
		Natural Gas (for steam)	tonnes CO2e / yr	0	0	0	0	0	0	-
		Heating Oil (for steam)	tonnes CO2e / yr	0	0	0	0	0	0	-
		Total GHG Emissions	tonnes CO2e / yr	40	220	200	220	210	520	-

Vehicles and Equipment										
Use		Item	Units	1990	1994	2000	2006	2007	2008	2020
UBC Fleet	Vehicles	UBC Operations	number	-	-	-	-	-	300	-
		Departments & Research	number	-	-	-	-	-	100	-
	Fuel Consumption	Gasoline	L	601,100	601,100	601,100	601,100	601,100	530,500	530,500
		B20 biodiesel	L	243,100	243,100	243,100	243,100	243,100	104,400	104,400
	Greenhouse Gas Emissions	Gasoline	tonnes CO2e / yr	1,430	1,430	1,430	1,430	1,430	1,260	1,260
		B20 biodiesel	tonnes CO2e / yr	540	540	540	540	540	230	230
		Total	tonnes CO2e / yr	1,970	1,970	1,970	1,970	1,970	1,500	1,500

Solid Waste										
Use		Item	Units	1990	1994	2000	2006	2007	2008	2020
Solid Waste		Quantity	tonnes	-	-	-	2,960	3,990	3,730	5,050
Disposed		Greenhouse Gas Emissions	tonnes CO2e / yr	-	-	-	1,430	1,930	1,800	2,440

Paper										
Use		Item	Units	1990	1994	2000	2006	2007	2008	2020
Paper Purchases	Quantity	100% Virgin Fibre	tonnes	-	-	-	259	194	134	181
		10% Recycled Content	tonnes	-	-	-	0	0	1	1
		20% Recycled Content	tonnes	-	-	-	0	0	1	2
		30% Recycled Content	tonnes	-	-	-	184	174	176	239
		100% Recycled Content	tonnes	-	-	-	0	0	5	7
	Greenhouse Gas Emissions	100% Virgin Fibre	tonnes CO2e / yr	-	-	-	744	557	384	520
		10% Recycled Content	tonnes CO2e / yr	-	-	-	0	0	3	4
		20% Recycled Content	tonnes CO2e / yr	-	-	-	0	0	4	5
		30% Recycled Content	tonnes CO2e / yr	-	-	-	471	446	451	610
		100% Recycled Content	tonnes CO2e / yr	-	-	-	0	0	10	14

Commuting										
Use		Item	Units	1990	1994	2000	2006	2007	2008	2020
Commuting	Fuel Consumption	Light Duty Gas Vehicle	L	-	-	-	6,984,200	7,061,000	7,207,100	7,416,200
		Light Duty Gas Trucks	L	-	-	-	2,962,400	2,995,000	3,056,900	3,145,600
		Heavy Duty Diesel Vehicles	L	-	-	-	0	0	0	0
		Trolley Bus	L	-	-	-	-	N/A	N/A	-
		Diesel Bus	L	-	-	-	1,205,700	1,542,000	1,450,400	1,492,500
	Greenhouse Gas Emissions	Light Duty Gas Vehicle	tonnes CO2e / yr	-	-	-	17,060	17,250	17,610	18,120
		Light Duty Gas Trucks	tonnes CO2e / yr	-	-	-	7,240	7,320	7,470	7,690
		Heavy Duty Diesel Vehicles	tonnes CO2e / yr	-	-	-	0	0	0	0
		Trolley Bus	tonnes CO2e / yr	-	-	-	-	5	4	5
		Diesel Bus	tonnes CO2e / yr	-	-	-	3,370	4,310	4,050	4,170

International Student Travel										
Use		Item	Units	1990	1994	2000	2006	2007	2008	2020
Student Travel		Greenhouse Gas Emissions	tonnes CO2e / yr	-	-	3,700	8,400	8,800	9,200	9,400

Buildings Lifecycle										
Use		Item	Units	1990	1994	2000	2006	2007	2008	2020
Buildings		Activity (Core & Ancillary)	square metres	839,700	952,500	1,084,600	1,234,600	1,234,600	1,231,700	1,667,200
		Greenhouse Gas Emissions	tonnes CO2e / yr	6,900	7,900	8,900	10,200	10,200	10,200	13,800

CLIMATE ACTION PLAN
UBC Vancouver Campus

Technical Report #3

Emissions Monitoring Requirements

February 2010

As a requirement under Bill 44 (the Greenhouse Gas Reductions Target Act, GHGRTA), the University of British Columbia must report its total GHG emissions. While UBC has shown leadership in reporting its emissions from a number of Scope 3 sources, there remain some emissions for which the University does not yet have the systems in place to track and monitor.

Given the decentralized nature of UBC's administration and operations, the development of tracking systems may require significant resources initially, but the effort needed on a continuous basis once the systems are implemented may be reduced if the monitoring framework is well designed. Much of the data may need to be collected by individual departments and faculties or facilities, and efficient reporting mechanisms need to be developed to facilitate regular compilation and analysis of that information.

Item	Data Requirement	Data Source	Source Department	Source Contact	Source Contact Information
Scope 1					
Natural Gas (Direct Use)	Gigajoule (GJ) consumption by building type	Utility data file Utility bills for all off-campus facilities Energy consumption questionnaire to departments & faculties (to be developed)	Utilities Campus Sustainability Office Individual departments & faculties Facilities Managers	Lillian Zaremba Individual contacts in different departments & faculties (to be determined)	604 827-3441 lillian.zaremba@ubc.ca To be determined
Natural Gas (Steam)	Gigajoule (GJ) consumption Steam production (000 lbs) Steam usage (000 lbs) by building type	Utility data file	Utilities Campus Sustainability Office	Lillian Zaremba	604 827-3441 lillian.zaremba@ubc.ca

Item	Data Requirement	Data Source	Source Department	Source Contact	Source Contact Information
Oil (Steam)	Litre (L) consumption Steam production (000 lbs) Steam usage (000 lbs) by building type	Utility data file	Utilities Campus Sustainability Office	Lillian Zaremba	604 827-3441 lillian.zaremba@ubc.ca
Fleet Fuels	Litre (L) consumption by fuel type (gasoline / diesel / biodiesel / propane) Vehicles manifest from ICBC registrations (make / model / year / department) Odometer readings (preferably taken quarterly) for all vehicles identified in vehicles manifest	Fuel purchase report Vehicle fleet report Energy consumption questionnaire to departments & faculties (to be developed)	Plant Operations Campus Sustainability Office Individual departments & faculties	Lee Ferrari Individual contacts in different departments & faculties (to be determined)	604 822-0992 lee.ferrari@ubc.ca To be determined
Animals	Number of heads of livestock by species	Personal requests for data	Agassiz Farm Animal Care Centre	Nelson Dinn - Agassiz Farm Gordon Gray - Animal Care Centre	Nelson Dinn - 604 796-8410 / dinn@shawbiz.ca Gordon Gray - 604 822-6818 / gray@interchange.ubc.ca
Fugitive Emissions	Number and volume of refrigerant and gas storage containers and equipment with storage containers Volume of refrigerant or gas acquisitions & disbursements	To be determined	To be determined	To be determined	To be determined

Item	Data Requirement	Data Source	Source Department	Source Contact	Source Contact Information
Scope 2					
Electricity	Kilowatt-hour (kWh) consumption by building type	Utility data file Utility bills for all off-campus facilities Energy consumption questionnaire to departments & faculties (to be developed)	Utilities Campus Sustainability Office Individual departments & faculties Facilities Managers	Lillian Zaremba Individual contacts in different departments & faculties (to be determined)	604 827-3441 lillian.zaremba@ubc.ca To be determined
Scope 3					
Paper	Number of packages (500 sheets) by paper type (% recycled content)	Unisource report	Supply Management	Vicki Wakefield	604 827-4530 victoria.wakefield@ubc.ca
Solid Waste	Mass (tonnes) by waste type	Personal requests for data	Waste Management - Building Operations	Pat Fitzgerald	604 822-9456 pat.fitzgerald@ubc.ca
Commuting	Mode share Trip frequency Average trip distances by mode Campus population	UBC Transportation Status Report UBC Transportation Survey	TREK	Carole Jolly, TREK Director	604 822-6674 carole.jolly@ubc.ca http://www.trek.ubc.ca/research/index.html
Int'l Student Travel	Campus population by country of origin Flight emissions	UBC International Student Headcount	PAIR	PAIR website	http://www.pair.ubc.ca/statistics/students/visaubcv.xls

Item	Data Requirement	Data Source	Source Department	Source Contact	Source Contact Information
Building Lifecycle	Gross building floor area (square metre or square foot) by space category	UBC Buildings Inventory	Facilities & Capital Planning	Peter Jia	604 822-0475 peter.jia@ubc.ca
Fertilizer	Mass of fertilizer (kg) Composition of fertilizer	Personal requests for data	Soft Landscape - Building Operations	Grazyna Rougeau	604 822-9483 gardener@ exchange.ubc.ca
Other Reporting Requirements					
Complete Buildings & Facilities List	Comprehensive list of buildings and facilities, including off-campus, leased or equity share holdings.	UBC Buildings Inventory (Point Grey campus) To be determined (off-campus, leased or equity-share holdings)	Facilities & Capital Planning Individual departments & faculties Facilities Managers	Peter Jia Individual contacts in different departments & faculties (to be determined)	604 822-0475 peter.jia@ubc.ca To be determined

CLIMATE ACTION PLAN
UBC Vancouver Campus

Technical Report #4

Derivation of Targets

February 2010

This report provides rationale for how the GHG reduction targets were defined. Specifically, it provides some background information on the GHG reduction targets for the campus as a whole, as well as for Fleets and Fuel Use and Transportation. The rest of the targets in the CAP do not necessarily address GHG emissions reductions and some of them relate to specific actions. These targets do not require detailed explanation and are outlined in Appendix B.

Campus Reduction Targets

The proposed GHG emissions reduction targets for the Vancouver Campus are:

33% below 2007 levels by 2015

The transition has begun towards a campus where the growing energy needs are met, but emissions are reduced. This target will be achieved through aggressive conservation and demand-side management activities (i.e. continuous commissioning program); conversion from a steam-based to a hot water heating system, and; implementation of a biomass gasification cogeneration system (i.e. UBC Bioenergy Research and Demonstration Project). These activities will be complemented by programs and initiatives aimed at encouraging energy conservation behaviours amongst the campus community.

67% below 2007 levels by 2020

The conversion to a sustainable energy system on campus is well underway and energy use is becoming 'decoupled' from GHG emissions through the deployment of renewable technologies. This target will be met through fuel switching from natural gas to renewable sources.

100% below 2007 levels by 2050, "Net Positive Campus"

Scope 1 and Scope 2 GHG emissions from campus activities have been eliminated through the implementation of an ultra low carbon energy supply system. Residual emissions have been negated through the export of energy to a portion of the UBC community (i.e. commercial and residential tenants). Efforts to reduce campus-wide emissions and contribute to energy and emissions reductions elsewhere in our community have resulted in a net positive campus. This target goes beyond the science and is driven by UBC's Vision for Climate Action. The "net positive" target assumes that residual emissions have been negated through the supply of energy to the surrounding community.

Fleets and Fuel Use Targets

The proposed GHG reduction target for Fleets is **40% below 2007 levels by 2015**.

This target assumes that by 2015, fuel consumption will be[1]:

- Approximately 50% - 60% of the gas consumed in 2008, since over 90% of vehicles are scheduled to be replaced by battery or natural gas powered vehicles;
- Approximately 90% of the B10 biodiesel consumed in 2008;
- Approximately 10,000 kg of natural gas;
- Approximately 2000 L of propane.

These assumptions of fuel consumption result in an emissions reduction of approximately 33% below 2007 levels by 2015. The additional reductions are expected to come from further downsizing the fleet by approximately 30 vehicles.

The new fleet would be composed of 115 electric vehicles, 45 natural gas powered vehicles, 5 propane powered forklifts, and 195 gas or diesel powered vehicles.

Transportation Targets

The proposed reduction target for Transportation is **10% below 2007 levels by 2015**.

This target was derived by translating the single occupancy vehicle (SOV) trips target in UBC's Strategic Transportation Plan (2005) – *reduce daily SOV trips per person by 30% from 1997 levels* – into a GHG reduction target. A 30% reduction from the 1997 figure (46,000 daily SOV trips per person) was used as an input for SOV trips/person, with the remaining daily person trips assumed to be equally split between transit, bicycles and pedestrians. Further, it was assumed that total daily person trips and the campus population remained constant. Using the same methodology employed in the GHG inventory, this figure translated into a GHG reduction of 3,000 tonnes or 10% below 2007 levels.

[1] These estimates were provided by a member of the Fleets and Fuel Use Working Group and are outlined further in the Fleet Management Business Plan.

CLIMATE ACTION PLAN

UBC Vancouver Campus

Technical Report #5

Action Implementation Matrix

February 2010

Table 1: Actions for Campus Development and Infrastructure, and Energy Supply and Management

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working group(s)	(If applicable)	Department(s)	Internal & external	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific general stage of the plan (<3 yrs, 3-5 yrs, >5yrs)
Campus Development and Infrastructure									
DV-01	Increase the energy efficiency of development on campus	Campus development is guided by a number of existing and evolving policies including the REAP standards for market residential, the Technical Guidelines, and the BC Building code. The Province of BC, through the BC Energy Plan, has stated its intention to mandate the LEED® Gold standard for all public sector buildings. Currently, UBC ReNew projects renovate existing buildings according to LEED standards, and moving forward, all new buildings will be developed to meet the LEED® Gold standard; however, UBC does not currently prescribe a specific number of LEED points for energy, which it may need to do in the future to ensure buildings achieve higher standards of energy efficiency. The pace at which the updated standards are incorporated into the Provincial Building Code (or the Vancouver energy code) cannot be predicted. This action commits UBC to embrace the most current energy codes as they are released. In addition to standards improvement, development activities can be focused to densify key areas (e.g., North Campus) to encourage the most energy efficient activities on campus. Specific elements of this action are listed below.								
a)	Adopt the MNECB 2011 when available for all new construction including core, ancillary, and market residential development. This standard will result in energy consumption approximately equivalent to the expected ASHRAE 90.1 (2010) which is targeting energy performance30% below ASHRAE 90.1(2004) - the current BC Building code requirement - or about 25% below ASHRAE 90.1(2007) - the current Vancouver energy code requirement. While the MNECB 2011 and ASHRAE 90.1 (2010) are expected to result in similar performance of buildings, the MNECB 2011 is expected to include features more relevant to the Canadian context, as well as be harmonized with the National Building Code. (In the event that the MNECB 2011 is delayed, then UBC can choose to adopt the ASHRAE 90.1 (2010) standard).	Governance	Bldgs, LU & Infra	30% below current BC building code (about 45% below MNECB 1997) for all new buildings. This target would be similar to achieving 5 LEED points in energy and atmosphere. Adopt MNECB (2011) when available.	Infrastructure Development	Housing, Building Ops, Sustainability Office	20K for advisory services	0.2 PY	Commencing 2010. Adopt when available (expected in 2011).

ID	ACTIONS	Type of Action	Identified by…	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working group(s)	(If applicable)	Department(s)	Internal & external	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific general stage of the plan (<3 yrs, 3-5 yrs, >5yrs)
b)	Commit all UBC ReNew buildings to achieve energy performance targets. ReNew projects are targeted to LEED standards, but are not specifically required to achieve energy performance targets. This action commits UBC to explicit energy targets for ReNew projects.	Governance	Bldgs, LU & Infra	20% below current BC building code (about 35% below MNECB 1997) for all ReNew buildings. This target would be similar to achieving 5 LEED points in energy and atmosphere.	Infrastructure Development	Housing, Building Ops, Sustainability Office		0.2 PY	Commencing 2010.
c)	Adopt higher energy efficiency standards for the Residential Environmental Assessment Program (REAP). While market residential buildings on campus are not formally part of the UBC inventory, or within the scope of this action plan, pragmatically, it must be recognized that many in the UBC community regard these residences as part of UBC. As other actions encourage core and ancillary buildings to develop more energy efficient construction standards, the Residential Environmental Assessment Program (REAP) standard should also evolve to adopt similar levels of energy efficiency.	Governance	Sustainability Office		Campus and Community Planning	Infrastructure Development, UBC Properties Trust		0.20 PY	< 3 yrs
d)	Develop a LEED® Guide to identify optional LEED® points that are a priority for UBC (e.g. energy and atmosphere) and to share lessons learned to date to guide consultants through LEED® certification at UBC.	Operations	Sustainability Office		Sustainability Office	Building Ops, Infrastructure Development, Housing, C&CP	20K for advisory services	0.20 PY	< 3 yrs
e)	Develop design guidelines around site orientation to include passive solar heating and light access, tree shading, and co-locating buildings to support shared infrastructure.	Governance	Bldgs, LU & Infra		C&CP	Infrastructure Development, Building Ops, Housing, Properties Trust	Operating	0.1 PY	< 3 yrs

ID	ACTIONS	Type of Action	Identified by…	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working group(s)	(If applicable)	Department(s)	Internal & external	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific general stage of the plan (<3 yrs, 3-5 yrs, >5yrs)
f)	Ensure that UBC's Technical Guidelines explicitly require highest standards of energy efficiency. The Technical Guidelines define design and construction requirements for UBC buildings. Though not compulsory, they are considered in the engineering of UBC infrastructure and buildings. An annual update to these guidelines is performed. Energy specific considerations in the guidelines will ensure that energy efficiency is considered in equipment purchase, construction and infrastructure development. As well, these updates should include recommendations from the Alternative Energy Study Project to start preparing UBC facilities and buildings for a transition to a renewable energy system.	Governance	Bldgs, LU & Infra		Infrastructure Development, Building Operations Steering Committee	Building Ops, Housing, Properties Trust	Operating	0.1 PY	Complete by end of fiscal year 2009-10.
g)	Develop "Energy Density Targets" for new student housing and core academic development. The BC Government through its Energy Efficient Buildings Strategy (www.enerplan.bc.ca/efficiency/) has committed to developing energy intensity targets (e.g. how much energy is used annually per square foot). These measures are often used to evaluate and benchmark the performance of existing buildings. Energy intensity targets can serve a number of purposes – to inform the design of new buildings, to become a tool for building operators, and to provide feedback to the occupants of constructed buildings. For this action, UBC will evaluate UBC specific intensity targets – informed by the work of the Province – incorporating unique features of student housing developments on campus.	Governance	Bldgs, LU & Infra		Infrastructure development	C&CP, Building Ops, Housing, Properties Trust	Operating	0.1 PY	Establish Targets by 2012, to be included in development by 2013

ID	ACTIONS	Type of Action	Identified by…	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working group(s)	(If applicable)	Department(s)	Internal & external	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific general stage of the plan (<3 yrs, 3-5 yrs, >5yrs)
h)	Increase infill development on the North Campus as a means of increasing density and reducing emissions associated with achieving UBC's growth targets as outlined in the Vancouver Campus Plan (e.g., 50% of students housed on campus by 2030).	Governance	Sustainability Office		C&CP	Sustainability Office	Operating	Existing staff	ongoing
DV-02	**Establish long term funding to support energy efficiency for both new construction and existing buildings.**	A key limitation to reducing energy consumption is to find the resources to improve the **existing building stock** and the commitment to contribute potential **incremental funding for energy efficiency in new building** construction budgets in order to achieve the highest energy efficiency possible. Specific elements of this action include:							
a)	Evaluate the legal and financial opportunities to create new financing mechanisms for retrofits .These could include the UBC endowment, working capital, GPO, etc. Potentially, a portion of the endowment could be 'loaned' to projects to fund retrofits of existing buildings and / or the incremental cost of achieving the highest standard of energy efficiency. The payback to the endowment would be based on recovered energy savings. This would require a number measures, including proper costing of energy services to building users.	Funding	Bldgs, LU & Infra		Treasury		40 K for business case development and legal review	0.1 PY	End of fiscal year 2009 - 2010
b)	Incorporate energy efficiency awareness into communications with financial donors and granting agencies to ensure that the green and energy efficient features of buildings are properly funded. This would occur when seeking sponsorship of UBC ReNew projects, and extend to conversations with the Province to review funding for new buildings and major renovations. Currently, provincial funding is designed to maximize space for teaching, learning and research. If the Province wants UBC to target improved energy performance, a different model or additional ear marked funds will be required	Funding	Bldgs, LU & Infra		Development Office	Infrastructure Development, Building Ops, Housing	Operating	0.1 PY	Ongoing
c)	Develop funding mechanisms for addressing energy efficiency in existing and new ancillary buildings (e.g. housing and athletics facilities). Ancillary buildings typically do not attract/receive funding in the same way that core buildings do (which often are supported by donors or government grants). Rather, ancillary buildings have traditionally been financed through operating revenues (serviced debt or reserves from operating surpluses). Developing an incremental revenue stream for these facilities, particularly in light of proposed new on campus housing goals, could be challenging. Incremental capital costs may not be recoverable through rents and user fees.	Funding	HCAR		C&CP	Housing and Athletics, Infrastructure Development	Operating	Existing staff	< 3 yrs

ID	ACTIONS	Type of Action	Identified by…	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working group(s)	(If applicable)	Department(s)	Internal & external	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific general stage of the plan (<3 yrs, 3-5 yrs, >5yrs)
d)	Include the lifecycle costs (e.g., operations and maintenance, energy costs, carbon tax, offset costs) when developing business cases for capital projects. Highlighting the long term operational savings of energy efficiency can often make a compelling case for dedicating higher up front capital costs to a project. Challenges lie within the way that different activities (capital spending and operations) are funded. Activities might include researching case studies to demonstrate the value of full life cycle costing, developing business case templates, or providing additional training to staff.	Funding	Bldgs, LU & Infra		Infrastructure Development	Building Operations, Housing, Properties Trust	Operating	Existing Staff	Ongoing
e)	Develop UBC specific financial business case criteria (e.g. payback thresholds, etc.) to guide the evaluation of facility upgrades. As a property owner, and long term (perpetual) occupant to the location on Point Grey, UBC can tolerate different criteria for building business cases. Typically these could include longer paybacks periods, since there is security that UBC will still be present to recover the benefits of the investments.	Funding	Bldgs, LU & Infra, HCAR		Infrastructure Development, Treasury	Building Operations, Housing and Athletics, Properties Trust	20K for advisory services	0.1PY	End of fiscal year 2009-10
DV-03	Implement comprehensive renovation projects for existing buildings.	Currently core buildings are retrofitted through the UBC ReNew Program. Phase 1 has been completed and Phases 2-5 are seeking approval and funding. Ancillary buildings are maintained through regular maintenance activities and major refurbishments are executed by their respective departments. This action commits UBC to a long term building renewal program for the existing building stock.							
a)	Support the proposed UBC ReNew Phases 2 through 5 in order to continue retrofits of existing core buildings and ensure that high performance building envelopes and systems are included in ReNew projects. To support this initiative, project budgets should be allocated in such a way that 5% of the overall budget is put towards energy performance upgrades.	Operations	Bldgs, LU & Infra		Infrastructure Development	Building Operations, Sustainability Office	Incremental costs of high performance building envelope upgrades as part of ReNew Phase 2 (approx 5% of $242M = $12 million)	Existing staff	3 - 5 yrs

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			Working group(s)	(If applicable)	Department(s)	Internal & external	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific general stage of the plan (<3 yrs, 3-5 yrs, >5yrs)
b)	Develop a ReNew equivalent program for Ancillary Buildings (Housing and Athletics). Ancillary services have traditionally self funded their activities through debt serviced by income or using reserves accumulated from operating surpluses. These resources may vary year to year and may also be consumed by new construction activities etc. This action commits the University to develop a renovation and retrofit program for Ancillary services (analogous to the current UBC ReNew program for core buildings). Note that housing activities include student housing as well as conferences and events.	Operations	Bldgs, LU & Infra		Infrastructure Development	Building Operations, C&CP	Operating	0.1 PY	Program development and approval by 2012.
DV-04	Work with our neighbors and partners to understand and reduce the complete UBC carbon footprint.	UBC can leverage its campus opportunities to leverage other members of the campus community to take action and reduce emissions - moving beyond what is on UBC's ledger or Bill 44 requirement. Specific actions include:							
a)	Support the University Neighbourhood Association (UNA) in developing an emissions inventory and strategies for reducing emissions from campus neighborhoods.	Engagement	Bldgs, LU & Infra		Sustainability Office	UNA, C&CP, Housing, Properties Trust	20K for advisory services	0.1 PY	Commence in 2010.
DV-05	Leverage our experiences in development and emission reduction for academic and research purposes.	UBC's unique position allows the lessons learned to be incorporated into a variety of research and academic areas - urban planning, social sciences, technology evaluation and so on.							
a)	Support the inclusion of climate change and energy efficiency in the Social, Ecological, Economic Development Studies (SEEDS) program on campus to build a campus scale learning network and support the incubation of demonstration projects related to net positive energy and water.	Research	Bldgs, LU & Infra		Sustainability Office	All departments	Operating	Existing staff	continuous

ID	ACTIONS	Type of Action	Identified by…	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working group(s)	(If applicable)	Department(s)	Internal & external	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific general stage of the plan (<3 yrs, 3-5 yrs, >5yrs)
Energy									
EN-01	Expand energy management activities on campus.	The EcoTrek project initiated the activities of energy management and tracking on campus. Outcomes of this project have included sub-metering of core buildings and pilot testing of energy management software. These activities can be expanded to more of the campus.							
a)	Develop an energy management program for all ancillary facilities. As part of this program, hire a full-time energy manager, develop an energy management plan with a periodic cycle for building consumption review and reporting, convert existing revenue meters to electronic metering, and conduct audits on all buildings by 2012.	Operations	HCAR	Save 15% of housing and athletics energy consumption by 2020	Sustainability Office	Housing and Athletics	20K for advisory services to guide plan/program development	Existing staff	Start in year 2 (2011)
b)	Implement full campus-wide energy monitoring, reporting and benchmarking. From the results of the action EN-01 (a) and (b) and EN-02 (a), UBC will be able to report on energy consumption by sector or group or department as appropriate. This information will highlight to the community the activities of the office and help users become aware of their consumption.	Operations	Bldgs, LU & Infra		Sustainability Office (Energy Manager)	Building Operations	~ 500K Capital (for energy mgmt software for each building)	Existing staff	Start in year 1 (ongoing)
c)	Participate in the Canada Green Building Council's (CaGBC) Green Building Performance Initiative to benchmark with peers	Operations	Bldgs, LU & Infra; Energy		Building Ops/Sustainability Office		Operating		< 3 yrs
EN-02	Maintain optimal performance of existing systems.	Building performance is often a neglected area of activity following the successful design and commissioning of a new building. As well, many old buildings are not revisited to evaluate the potential for optimization. Recent studies have indicated that optimization of buildings can reduce energy costs substantially – with median savings of 15% indicated with common paybacks of 1-4 years. For the entire campus – this would equate to several million dollars a year in operating savings.							

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			Working group(s)	(If applicable)	Department(s)	Internal & external	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific general stage of the plan (<3 yrs, 3-5 yrs, >5yrs)
a)	Implement a continuous commissioning program for core academic buildings Implement a program to continuously optimize core academic building performance, to achieve an estimated 10% reduction in energy and water consumption within five years. This program would take advantage of BC Hydro's Continuous Optimization Program to implement a 3 year, 3 phase program to: analyze building performance using energy management software; audit buildings; implement conservation measures, and; train Operations Centre staff to monitor performance and respond to reports of over consumption.	Operations	Sustainability Office.	10% reduction in energy use in existing core buildings by 2015.	Building Operations	Access BC Hydro funding to perform energy studies to direct re-commissioning exercise.	$ 2.1 million over 3 years (with a payback of less than 2 years)		Program development to begin in 2010
b)	Expand condition assessment activities and preventative maintenance to support energy efficiency in existing buildings.	Operations	Bldgs, LU & Infra		Building Operations		Operating and Capital		< 3 yrs
c)	Ensure O&M staff receive adequate training (and certification) to allow them to operationalize the CAP and fulfill their mandates	Engagement	Bldgs, LU & Infra; HCAR		Building Ops		10K/year		Start in year 1
d)	Invest in the Sustainability Coordinators program (currently includes 140 volunteers) to increase participation in energy and GHG management efforts. These coordinators can assist to deliver the awareness-raising information and activities in the campus community engagement strategy (Action EN-06, b)	Engagement	Energy		Sustainability Office		30K Operating; 10K Capital (for program materials)		Start in year 1
e)	Optimize steam plant efficiency through setting annual plant commissioning and optimization targets.	Operations	Energy	1% annual saving in natural gas consumption	Building Ops (Utilities)		Unknown		
EN-03	Develop incentive systems for building operators and users to reduce energy and water consumption.	Building occupants have little incentive to reduce energy and water consumption as they are not directly liable for the costs. Create an incentive system to reward/penalize occupants based on building performance. Building user groups could provide the direct link between Building Operations and staff, faculty and students. Adjustable building performance baseline ranges would be created to judge annual performance. Financial or celebratory incentives would be created.							

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			Working group(s)	(If applicable)	Department(s)	Internal & external	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific general stage of the plan (<3 yrs, 3-5 yrs, >5yrs)
a)	Review utility rates, rate structure and departmental budgeting strategy to provide correct market signal to encourage conservation. This would include core, ancillary, and tenant buildings.	Operations / Research	Bldgs, LU & Infra		Building Operations / Sustainability Office treasury	Budget Office	Operating	0.25 PY	Start in year 1
b)	Create building-by-building user groups to link Plant Ops with faculty, staff and students (building users).	Operations	Bldgs, LU & Infra		Building Ops		Operating		Start in year 1
c)	Review space planning requirements and develop financial incentives to encourage departments to operate within the BC University Space Standards.	Operations	Bldgs, LU & Infra		Infrastructure Development	Building Operations	Operating	0.1PY	< 3 yrs
d)	Expand the pilot test of a real time energy management dashboard to visualize and track building energy use. Include a broader range of user groups.	Operations / Research	Bldgs, LU & Infra		Building Operations / Sustainability Office		Unknown		Ongoing
EN-04	Control peak demand	Peak demand spikes require that infrastructure be sized larger than is required for most of the system operations. Controlling peak demand reduces the excess capacity (and capital cost) for infrastructure. As well it may allow for more synergistic implementation of the alternative energy study recommendations.							
a)	Develop and implement a peak demand management strategy	Operations / Research	Sustainability Office	10% reduction in Peak Demand	Building Operations / Sustainability Office		Unknown	Existing staff	2011 (once monitoring systems are more reliable)
b)	Support a UBC Green IT strategy for consolidation of IT Data Centres (server rooms, etc.) to achieve economies of scale in terms of resource efficiency	Operations	Sustainability Office		IT (Finance) / Sustainability Office		Unknown	0.25 PY	< 2 yrs

ID	ACTIONS	Type of Action	Identified by…	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working group(s)	(If applicable)	Department(s)	Internal & external	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific general stage of the plan (<3 yrs, 3-5 yrs, >5yrs)
EN-05	Prepare for the transition to a renewable energy system on campus.	The Alternative Energy Study Project (AESP) – an ongoing study to define the most suitable alternative energy systems for the UBC-Vancouver campus – has identified the opportunity to convert the existing medium-pressure steam heating distribution system to a heating water distribution system to reduce peak heating load and energy consumption. Additionally, UBC is proceeding with implementation of the UBC Bioenergy Research and Demonstration Project, a biomass gasification cogeneration system that converts wood biomass into heat and power for use on campus. This project is estimated to reduce GHG emissions from UBC-controlled sources (i.e. Scope 1 emissions) by 4,500 metric tonnes annually. The AESP has short-listed three heating plant options, including an expanded biomass heating plant (based on the Bioenergy Research and Demonstration Project), and recommended further detailed exploration (including technical, financial, environmental and regulatory assessments) of these options.								
a)	Develop an energy supply transition strategy based primarily on implementing the recommendations of the Alternative Energy Study Project (i.e. to prepare for the transition from a steam heating to a heating water distribution system).	Governance	Bldgs, LU & Infra		Building Operations, C&CP	Infrastructure Development, Housing and Athletics, Properties Trust	Operating	Role described in EN-01b	< 3yrs
b)	Conduct thermal enclosure upgrades during all envelope remediations. Building envelope upgrades are often considered too expensive to conduct as a retrofit - typically because the payback periods can be very long. However, the Alternative Energy Study Project identified that there may be synergistic benefits to these actions. For example, upgrading windows may have a payback period of decades if evaluated solely from the perspective of the energy conserved. However, these upgrades might allow for a medium temperature water system to operate within the buildings (rather than the current high temperature system) which then opens opportunities for more energy sources, and possibly for reduced capital costs in a new energy system.	Operations	Bldgs, LU & Infra		Building Ops		Capital (unknown)		Start in year 1
c)	Conduct reliability risk assessments for new energy technology proposals. These assessments would identify requirements for baseline firm, interruptible and peaking energy in an effort to support the demonstration of non-commercial research-oriented technologies and practices. The objective is to allow new technologies to be tested, without risking the performance of the energy systems as a whole. (For example, a new heat system could be implemented, but a back-up boiler might be required until the system has demonstrated consistent performance.)	Operations	Energy		Building Ops (Utilities)		20K for advisory services		< 3 yrs
EN-06	Support the campus community in energy management activities.	Beyond the operations of UBC facilities there are a number of measures that can be used to engage the various members of the UBC community in energy efficiency. Specific elements of this action include:							

ID	ACTIONS	Type of Action	Identified by…	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working group(s)	(If applicable)	Department(s)	Internal & external	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific general stage of the plan (<3 yrs, 3-5 yrs, >5yrs)
a)	Promote an Energy Management Office (within the Sustainability Office) that all departments (including Ancillaries) can access for energy-related questions and advice. This office would be the "go to" place for: building energy management, knowledge of procurement options, funding opportunities, other relevant information or services (i.e., research, consultants), and campus resources (e.g., projects done on campus that can serve as models), etc	Engagement	HCAR		Sustainability Office	Building Operations, Housing and Athletics	100K - Operating	Role described in EN-01 (b) + existing Energy Manager	< 3 yrs
b)	Develop a campus community engagement strategy to build awareness and encourage energy conserving behaviours. This strategy will have targeted information and activities at the individual level (staff, students, faculty, and residents), department level and building level and would include: (1) awareness and knowledge raising activities, (2) promotions/contests and incentives/disincentives, and (3) the use of technology (e.g., workstation control, dashboards to track building energy consumption, etc).	Engagement	Bldgs, LU & Infra		Sustainability Office		30K for advisory services; 20K for materials		Start in year 1
c)	Strengthen the relationship between the academy (teaching, research, and learning) and operations by establishing joint research / operational programs and projects aimed at providing tangible examples of energy efficiency/conservation, GHG emissions reduction and climate action.	Engagement	Energy		SAS		Operating	Existing staff and faculty	< 3 yrs
EN-07	Reduce energy consumption from laboratory and research activities.	Energy and Climate action plans are often focused on the heating and hot water supply of buildings. Research facilities – due to the process equipment within them – have unique energy and performance requirements. These actions focus on the activities within the facilities.							
a)	Develop a “Green” or “Low Carbon” Laboratories initiative. Research intensive buildings consume significantly more energy than other campus buildings. A large portion of the energy consumed is due to high conditioned air flow rates required by laboratories. Activities such as fume hood verification of flow rates could be made to define the optimal conditions for operations. Determine if a sensory system can be installed to detect spillage such that standard air flow rates can be used unless an emergency situation occurs. Determine the energy savings and retrofit costs.	Engagement and Operations	Sustainability Office		Sustainability Office	Building Operations and HS&E.	Operating	Role described in EN-01b	< 3 yrs

Table 2: Actions for Fleets and Fuel Use, Business Travel and Procurement, Food, and Transportation

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working Group(s)	(If applicable)	Department(s)	Internal and External	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific stage of the plan (>3yrs, 3-5yrs, >5yrs)
Fleets and Fuel Use									
FF-01	Complete E3 Silver Certification of the operational fleet. An initiative of the Fraser Basin Council, the E3 Fleet Rating System is designed to recognize fleets that improve fuel efficiency, reduce emissions, implement best management practices, incorporate new technologies and use alternative fuels. The E3 Fleet Rating uses a point-based system to evaluate performance at a Bronze, Silver, Gold or Platinum level. UBC has recently begun the E3 certification process for its operational fleet and is aiming to achieve a silver level of certification by the fall of 2010. In order to do this, UBC will need to obtain between 67 and 78 points in the E3 system. These points are obtained by implementing various actions in the following areas: • Green Fleet Action Plan • Training and Awareness • Idling Reduction • Vehicle Purchasing • Fuel Data Management • Operations and Maintenance • Trip and Route Planning • Utilization Management • Fuel Efficiency • GHG Reductions	Operations	Fleets & Fuel Use	Achieve Silver certification by the Fall of 2010	Building Ops (Plant Ops)	None	Program fee + (optional) summer student salary, 10K)	(or 0.25PY)	Fall 2010
FF-02	Continue to integrate electric or ultra low consumption vehicles into the 'on campus' fleet and increase the profile of these vehicles through signage and display to create awareness of UBC activities.	Operations	Fleets & Fuel Use	20% of on campus fleet to be electric or ultra low consumption by 2015	Building Ops (Plant Ops)	None	200K in capital funding over next five years	0.1 PY	Within 5 years
FF-03	Review legal requirements and explore opportunities for allowing low speed electric vehicles to be registered for use on campus (e.g., "ZENN" cars and others). This may require a bylaw in concert with the City of Vancouver.	Operations	Fleets & Fuel Use	N/A	Building Ops (Plant Ops)	Metro Vancouver	15K for legal review	0.1 PY	Start in year 1

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working Group(s)	(If applicable)	Department(s)	Internal and External	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific stage of the plan (>3yrs, 3-5yrs, >5yrs)
FF-04	Provide right sizing advisory service and enact policy which requires departments to evaluate the size and efficiency of their vehicle prior to purchase.	Operations	Fleets & Fuel Use		Building Ops (Plant Ops)	All depts	N/A	0.1 PY	
FF-05	Implement a tracking system for campus vehicles not currently serviced at the Land and Building Services facility.	Operations	Fleets & Fuel Use	Implement by Dec 2009	Sustainability Office	All Depts	Unknown		Implement by December 2009 (data required under Bill 44)
FF-06	Establish a departmental monitoring system to ensure cost recovery on department vehicles used by projects and researchers (e.g., require odometer readings, fuel meter readings, etc).	Operations	Fleets & Fuel Use	N/A	Building Ops (Plant Ops)	All Depts	Unknown	0.1 PY	Start in year 1
FF-07	Promote the costs and benefits of centralized vehicle services (established in the UBC Building Operations Fleet Management Business Plan) to UBC departments.	Operations	Fleets & Fuel Use	N/A	Building Ops (Plant Ops)	All Depts	Operating		Start in year 1

Business Travel and Procurement

BTP-01	Update UBC Policy 83 (Travel and Related Expenses) to articulate UBC's commitment to reducing emissions associated with operational business travel.	Governance	Business Travel & Procurement		Supply Mgmt (Travel Mgmt),	All Depts	Operating	0.2 PY	Start in year 1
BTP-02	Convene a Task Team to refine and implement a user-friendly measurement and reporting system to support flight reduction by all UBC departments.	Operations	Business Travel & Procurement	Target 2012 for system roll out	IT	Supply Management (Travel Management), Finance, Sustainability Office, Department representatives	Operating	0.1 PY	Start in year 1

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working Group(s)	(If applicable)	Department(s)	Internal and External	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific stage of the plan (>3yrs, 3-5yrs, >5yrs)
BTP-03	Anticipating a future need to offset emissions associated with research travel, begin a dialogue between the Office of the VP of Research and the research granting agencies on the capacity to absorb the costs of carbon offsets for travel into research grants and use the offset fees to contribute to a reduction fund on campus.	Operations	Business Travel & Procurement		Office of the VP of Research	Research Granting Agencies (NSERC, etc)	Operating	0.1 PY	< 3 yrs
BTP-04	Fund and promote use of video conferencing facilities. Using Classroom Services as a model, investigate the potential of having a centralized booking system for video-conferencing facilities.	Operations	Business Travel & Procurement; Transportation		IT		Equipment costs unknown; communication/ training ~ 5K (Capital and Operating)	0.1 PY	Start in year 1
BTP-05	Study the potential to create an off campus central depot for shipments in order to reduce the number of shipments coming to campus on a daily basis.	Operations	Business Travel & Procurement		UBC-O AVP Admin and Finance (Supply Management)	All Depts, vendors	Operating	0.2 PY	Start in year 1
BTP-06	Use the Acklands-Grainger arrangement as a model to consolidate deliveries for suppliers, shippers and couriers in an effort to reduce the number of trips to-from and around campus.	Operations	Business Travel & Procurement; Food	Make arrangements with a minimum of 10 suppliers by 2012	UBC-O AVP Admin and Finance (Supply Management)		Operating	0.2 PY	Start in year 1
BTP-07	Study workflow to identify opportunities to eliminate paper from operations and to assess the feasibility of various electronic / paperless systems and integration of digital technology and print management (e.g., handheld scanners, laser fiche, online viewers, electronic ordering, electronic submission of proposals, alternative practice to original signatures on approvals, etc)	Operations	Business Travel & Procurement		UBC-O AVP Admin and Finance (Supply Management)	All Depts	Operating 20K	Contract	< 3 yrs
BTP-08	Implement the Document Management Strategy and set target to achieve paperless operations to support UBC in a transition from a paper based to digital model	Governance	Business Travel & Procurement		UBC-O AVP Admin and Finance (Supply Management)	All Depts	Operating and Capital	0.2 PY	Already underway (set target once strategy is complete)

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working Group(s)	(If applicable)	Department(s)	Internal and External	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific stage of the plan (>3yrs, 3-5yrs, >5yrs)
BTP-09	Eliminate the use of virgin paper immediately. Communicate and encourage uptake of the current 30% post-consumer recycled content standard for paper purchasing on campus.	Operations	Business Travel & Procurement	80% of all paper purchases to contain recycled content by 2012	UBC-O AVP Admin and Finance (Supply Management)	All Depts	Operating		< 3 yrs
BTP-10	Replace packaged/carded stock with bulk items (e.g. pens) in bookstore	Operations	Business Travel & Procurement		Community Services (Bookstore)		Capital cost unknown	0.1 PY	< 3 yrs
BTP-11	Require all suppliers to use reusable or recyclable packaging or to uncrate and take back packaging that is non-reusable or recyclable.	Operations	Business Travel & Procurement	Target arrangements with 50% of suppliers by 2015	UBC-O AVP Admin and Finance (Supply Management)	Suppliers and all Depts	Operating		3-5 yrs
BTP-12	Conduct a campus-wide waste audit and use the results to set waste reduction targets.	Operations	Sustainability Office		Sustainability Office		Unknown		< 1 yr
BTP-13	Work with UBC researchers to conduct lifecycle analyses on common purchases in an effort to define the embodied energy within the supply chain and show buyers at UBC the life cycle costs of their choices (e.g., LCA of laser vs. inkjet printers). Communicate these findings to the UBC Community.	Research	Business Travel & Procurement	Complete LCA studies for 5 common purchases by the Fall of 2010.	UBC-O AVP Admin and Finance (Supply Management)	Faculty/students	20K for study	Contract	< 1 yr
BTP-14	Conduct outreach to ensure that all people making purchasing decisions on campus are aware of Supply Management resources to encourage sustainable purchasing (e.g., list of preferred vendors, Supplier Code of Conduct, Sustainable Purchasing Guide, template RFPs, etc.)	Engagement	Business Travel & Procurement		UBC-O AVP Admin and Finance (Supply Management)	Working Group members + SO (assist with outreach)	~5K (outreach materials) - Capital and Operating	0.1 PY	Start in year 1

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working Group(s)	(If applicable)	Department(s)	Internal and External	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific stage of the plan (>3yrs, 3-5yrs, >5yrs)
BTP-15	Create a policy for 3-way sharing of savings (between the buying department, Finance and the Sustainability Office) from smart purchasing decisions. Give a portion of the savings to a UBC 'sustainability fund' to support ongoing initiatives.	Funding	Business Travel & Procurement		UBC-O AVP Admin and Finance (Supply Management), Finance, Sustainability Office	All Depts	Operating	0.2 PY	< 3 yrs
BTP-16	Explore opportunities for cost-sharing across campus that allows researchers and departments to share the cost and resources (e.g., furniture, lab equipment, etc)	Funding	Business Travel & Procurement		Provost	All Depts, SO, Supply Management, Budget Office	Operating	0.2 PY	< 3 yrs
BTP-17	Evaluate opportunities for centralizing purchasing decisions in order to achieve multiple benefits (i.e., sustainability leverage, efficiency, meeting user needs)	Operations	Business Travel & Procurement		UBC-O AVP Admin and Finance (Supply Management)	All Depts, SO	Operating	0.2 PY	Start in year 1
BTP-18	Expand list of preferred vendors to include green hotels, car rental agencies that provide low emissions vehicles, etc. Add current green suppliers to preferred vendor list by fall 2009.	Operations	Business Travel & Procurement		UBC-O AVP Admin and Finance (Supply Management)	Suppliers + supply mgmt.	Operating	0.1 PY	Start immediately
BTP-19	Continue the commitment to promote/ advertise sustainable or low emissions product options at retail outlets on campus	Engagement	Business Travel & Procurement		UBC-O AVP Admin and Finance (Supply Management)	Retail outlets on campus (see similar action in Food list)	~5K capital costs (marketing, advertising materials); Operating	Existing staff	Start in year 1
BTP-20	Investigate options for asset disposal. Consider online equipment inventory system and SERF (Surplus Equipment Recycling Facility) in this investigation	Operations	Business Travel & Procurement		Sustainability Office	Finance, Supply Management	Capital costs for promotion ~ 5K; Operating	0.2 PY	Start in year 1 (January 2010)

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working Group(s)	(If applicable)	Department(s)	Internal and External	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific stage of the plan (>3yrs, 3-5yrs, >5yrs)
BTP-21	Implement industry standards for energy efficient products (i.e., EPEAT for electronics, Energy Star, etc). This would include energy efficient research equipment where applicable. Include annual reporting on this through inspirations and aspirations.	Operations	Business Travel & Procurement	50% of all equipment purchases to meet this requirement by 2010; 100% by 2015.	UBC-O AVP Admin and Finance (Supply Management)	All depts.	Operating	0.1 PY	Start in year 1
Food Note: An asterisk (*) next to an action denotes actions that derive from recommendations made by the UBCFSP									
FO-01	Integrate the UBC Food Systems Project with the Climate Action Plan. Use the CAP as a vehicle for advancing FSP recommendations, some of which are highlighted in this plan.	Governance	Food		Food System Project (FSP) stakeholders and Sustainability Office		Operating	Existing staff, faculty, students (CAP Food WG)	Start in year 1
FO-02	Using a Lifecycle Analysis (LCA) approach, establish a baseline inventory for the UBC food system. Use the inventory results to set targets and develop actions to reduce emissions, eliminate waste, and increase the sustainability of the food system.	Research	Food	Establish baseline inventory by the Fall of 2010.	FSP stakeholders and SO		Operating	0.25 PY	< 1 year
FO-03	Engage UBC food providers (i.e., Food Services, AMS, UBC Farm, food retail outlets, etc) in building a network with local producers to increase sourcing of local food.	Engagement	Food		Housing, Conferences and Food Operations, AMSFBD UBC Farm, food retail outlets	Get Local BC or other established network	Operating	0.1 PY	< 3 yrs

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working Group(s)	(If applicable)	Department(s)	Internal and External	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific stage of the plan (>3yrs, 3-5yrs, >5yrs)
FO-04*	Develop a sustainable food purchasing policy to articulate "when price and quality are comparable, UBC will purchase from the most local source." Reinforce this policy through the bid process by weighting evaluation criteria to favour suppliers that support sustainable, low carbon agricultural practices. Finally, promote the policy and evaluation criteria amongst all UBC Food Services outlets and to contracted vendors.	Governance	Food		Housing, Conferences and Food Operations, AMSFBD	Supply Management	Operating	0.1 PY	< 3 yrs
FO-05*	Increase food production at the UBC Farm. Use the farm to represent the types of food that can be grown, seasonally, in our climate.	Operations	Food		UBC Farm	LFS, SO, UBCFS, AMSFS	Unknown	Existing staff, faculty and students	3-5 years
FO-06	Advocate for more edible landscapes (i.e., gardens, rooftop gardens, etc) on campus through participation in the development of the Public Realm Plan, Technical Guidelines for new buildings and the new Design Guidelines.	Governance	Food		Housing, Conferences and Food Operations	C&CP, SALA, LFS, SO	Operating	0.1 PY	< 3 yrs
FO-07*	Provide incentives for consumers to purchase healthy, low carbon food: • Gradually shift menus towards healthy, low carbon food options (e.g., offer "meat free" specials or "meat free" days on campus) • Evaluate opportunities to subsidize healthy food on campus with junk food (e.g., increase prices at vending machines and decrease costs of healthy food) • Offer targeted promotions through the UBC meal card • Promote ethical choices with the AMS “lov” card – local, organic or vegan • Build a meal card program to promote sustainable, low carbon food options.	Engagement	Food		Housing, Conferences and Food Operations, AMSFBD	FSP/Working Group members, Food retail outlets on campus, SO	Revenue neutral program, costs to get programs up and running is unknown	0.1 PY	< 3 yrs (ongoing)
FO-08*	Develop a campus-wide social marketing program to promote sustainable, low carbon food choices, as well as recycling and composting at UBC. As part of this, evaluate the potential for a food labeling system on campus.	Engagement	Food		Housing, Conferences and Food Operations, AMSFBD	FRE, FNH (LFS), Waste Free UBC	25K for advisory services to develop program; capital cost to develop program materials (10K)	0.1 PY	<3 yrs
FO-09*	Building on existing models, develop curriculum for an interactive 100-level sustainability course to engage students in learning about sustainable food systems. Through this course, provide opportunities for students to make the links between a healthy diet and a healthy planet through: • practical studies on the UBC Farm • lectures from sustainable food champions	Research	Food		Land and Foods Systems (build on efforts by existing grad students, Will and Yona)	UBC Farm, outside experts/lecturers	Costs for course materials unknown	Existing faculty in LFS	Start in year 1

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working Group(s)	(If applicable)	Department(s)	Internal and External	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific stage of the plan (>3yrs, 3-5yrs, >5yrs)
FO-10*	Reduce packaging waste from the UBC food system: • Develop a case study with an external supplier to demonstrate packaging waste reduction - and build from there. • Provide incentives for customers to supply their own containers at UBC and AMS Food Services outlets and encourage contracted vendors to do the same.	Operations	Food		Housing, Conferences and Food Operations, AMSFBD	Supply Management	Operating	0.1 PY	Start in year 1
FO-11	Work collaboratively with Waste Free UBC to conduct a composting audit. Use the results to set goals for food waste reduction on campus.	Operations	Food		Housing, Conferences and Food Operations, AMSFBD	Waste Free UBC	Operating	0.1 PY to coordinate audit (student volunteers to conduct audit)	< 3 yrs
FO-12*	Conduct research on food waste recovery and nutrient reintroduction into the production system.	Research	Food		LFS, FSP	UBC Farm	Unknown	Existing faculty and staff	3 - 5 years
FO-13	Undertake a Feasibility Assessment for an on-campus food processing facility	Operations	Food		Housing, Conferences and Food Operations, AMSFBD, LFS	FSP (potential for students to contribute to this feasibility assessment through project work)	25K for study	0.1 PY	< 3 yrs
FO-14*	Conduct plant-based research to identify climate mitigation and adaptation opportunities for the food system	Research	Food		LFS (FNH and Wine Research Centre), Botany, Forestry		Unknown	Existing faculty, students	3-5 years (and then ongoing)
FO-15	Conduct research on carbon cycling and sequestration associated with food production	Research	Food		Ag Eng, LFS, Botany, Forestry	UBC Farm (directed studies)	Unknown	Existing faculty, students	3-5 years (and then ongoing)

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working Group(s)	(If applicable)	Department(s)	Internal and External	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific stage of the plan (>3yrs, 3-5yrs, >5yrs)
Transportation									
TR-01	Explore the feasibility of implementing a combined discounted transit-parking pass program for staff and faculty (make bus pass a priority component of salary/compensation increase)	Operations	Transportation		TREK, Parking	TransLink	20K for marketing; revenue neutral program	0.5 PY	> 5 years
TR-02	Evaluate opportunities to grant employee benefits or create incentives for dedicated non-GHG commuters (as part of Healthy Workplace Plan)	Funding	Transportation		Central HR		Operating		3-5 years
TR-03	Improve 'end of trip' biking facilities in technical standards (tie level of facility to occupancy, provide safe and secure bike parking, showers, etc)	Governance	Transportation		TREK		(To be determined as part of existing consultant study)		< 3 years
TR-04	Develop preferential parking strategy targeted at faculty and staff (ideally revenue neutral, focused on preferred location rather than lower rates/fees, target carpoolers, low emissions vehicles, low SOV users, scooters, small cars, etc)	Operations	Transportation		Parking, TREK to x-promote		10K for marketing (producing decals for vehicles); Revenue Neutral program		< 3 years
TR-05	Study the feasibility of implementing a U-Pass "tax" for UBC Residents (i.e. charge new market residential development for 1 U-Pass per household, at the point of purchase)	Funding	Transportation		TREK, UNA, Budget Office Planning	TransLink, UNA	Revenue neutral - Operating	1 PY (UNA)	> 5 years *(may not be suitable for the current CAP)*
TR-06	Partner with the Vancouver Area Cycling Coalition (VACC) to improve cycling skills and awareness	Engagement	Transportation		TREK	VACC	$5000/year - Operating	Contract	< 3 years

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working Group(s)	(If applicable)	Department(s)	Internal and External	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific stage of the plan (>3yrs, 3-5yrs, >5yrs)
TR-07	Per Pictoform study being conducted by Parking Services , build way-finding/ congestion reporting system to mitigate traffic congestion (and emissions) on campus and enhance accessibility to pedestrians, cyclists, transit users, etc	Operations	Transportation		Parking, Campus and Community Planning, Trek, Pictoform (consultant)	City of Vancouver (try to harmonize with regional way finding system)	Unknown (to be determined as part of consultant study)		3 - 5 years
TR-08	Building on the 'telecommuting guideline', consider developing an employee transit policy to assist staff in reducing GHG emissions associated with commuting (e.g., encourage flexible work hours for staff through staggered start times, compressed work weeks, telecommuting, etc)	Governance	Transportation		HR		Revenue Neutral -Operating	0.1 PY	< 3 years
TR-09	Evaluate the feasibility of implementing a cap on vehicle parking on campus	Governance	Transportation		Parking, TREK to x-promote		Operating		< 3 years
TR-10	Explore opportunities to expand U-Pass to staff and faculty members	Operations	Transportation		TREK, HR, Faculty Assn	TransLink	Revenue neutral - Operating	0.5 PY	> 5 years
TR-11	Provide plug-in for electric assist vehicles	Operations	Transportation		Parking, Utilities, Plant Ops, TREK Infra Dev'mt		Unknown		< 3 years
TR-12	Review policy around student resident parking permits and assess the feasibility of: A) eliminating parking passes for 1st year students living on campus; B) raising rates significantly to discourage the purchase of parking permits by students living on campus.	Governance	Transportation		Parking, Housing, Trek		Operating		< 3 years
TR-13	Explore the feasibility of providing a U-Pass opt-in for students who are currently not eligible.	Operations	Transportation		TREK, AMS, Enrollment Services	TransLink	$3/additional student/month		TBD based on Translink negotiations

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Estimated Staff Resources	Timeline
			Working Group(s)	(If applicable)	Department(s)	Internal and External	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific stage of the plan (>3yrs, 3-5yrs, >5yrs)
TR-14	Evaluate opportunities to revise UBC's Employee Housing Program to include incentives for staff and faculty to find housing closer to campus, thereby encouraging shorter commutes (e.g., financial assistance weighted to give more to employees that choose to live closer to campus)	Governance	Transportation		Treasury, Housing, UBC, HR, UNA		Operating		< 5 years
TR-15	Promote various commuting options for staff, faculty and students (i.e., EPP, Flex, ICBC, etc)	Engagement	Transportation		TREK, HR		40K - strategy; 10K materials	Contract	3 - 5 years
TR-16	Develop Bike Buddy program to encourage bike pooling (advertise on carpool notice board)	Engagement	Transportation		TREK	VACC	10K for contract; 5K capital (advertising)	Contract	< 3 years
TR-17	Consider setting limits on the transferability of parking passes to discourage driving on campus (phase this in the next time parking fees get restructured)	Operations	Transportation		Parking	No	TBD		> 5 years
TR-18	Improve on-campus bike sharing program (make available to conference guests)	Operations	Transportation		TREK, AMS	No	5K for contract	Contract	TBD
TR-19	Evaluate opportunities to promote a culture of cycling with guided on-campus bike tours	Engagement	Transportation		Sustainability Office		Operating	0.1 PY	< 3 years
TR-20	Ensure the Campus Plan aligns with the CAP in terms of land use and the need for infrastructure that encourages alternative transportation (e.g., compact, mixed-use, walkable communities with more amenities on campus).	Engagement	Transportation		Sustainability Office		Operating		Start in year 1

Table 3: Implementing Actions

ID	ACTIONS	Type of Action	Identified by...	Target	Responsible Portfolio(s)	Partnerships Required	Budget Estimates	Staff Resources	Timeline
			Working Group(s)	(If applicable)	Department(s)	Internal and External	Disbursements ($)	Staff Effort in Person Years (PY)	Milestones or specific stage of the plan (>3yrs, 3-5yrs, >5yrs)
Implementation									
IMP-01	Clearly define and communicate accountabilities and responsibilities for the CAP to all stakeholders involved in ongoing implementation.	Governance	N/A	N/A	VP FRO	Sustainability Office	All Depts		Start immediately
IMP-02	Invest in the enhancement of information systems in order to ensure consistent and accurate data management. Explore whether PeopleSoft has a module that UBC could buy off the shelf to assist in tracking and monitoring performance.	Funding	N/A	N/A	Finance	All Depts	Unknown		< 3years
IMP-03	Establish key performance indicators, related to achieving climate action goals and targets and other sustainability targets (e.g. from Inspirations and Aspirations), for Managing Directors and Directors (where applicable).	Governance	N/A	N/A	VP FRO	Sustainability Office	N/A		Start in year 1
IMP-04	Identify where activities may be running counter to CAP goals and work to create alignment so that UBC is not just engaging in activities that reduce emissions, but also refraining from activities that increase emissions.	Governance	N/A	N/A	Sustainability Office	All Depts	N/A		Ongoing
IMP-05	Explore opportunities to formalize the management system outlined in this plan to ensure successful implementation of the CAP and of other climate-related plans at UBC.	Governance	N/A	N/A	Sustainability Office	All Depts	50K (to create ISO certified management system); ~ 15K (to add energy and GHG management program on to existing system)	Existing staff + contract	Start in year 1
IMP-06	Improve monitoring systems as per the requirements defined in CAP Technical Report #3	Operations	N/A	N/A	Sustainability Office	All Depts	Unknown		Start immediately

CLIMATE ACTION PLAN

UBC Vancouver Campus

Technical Report #6

Cost Curve Assumptions

February 2010

The actual costs of many activities cannot be predicted. However, some scoping level costs can be estimated and then the resulting cost curves compared to define the activities that might be best pursued. Complete business cases cannot be made without further analysis of the capital costs, as well as the future energy costs (biomass, solar, etc.). However, two "costs" which are known are the costs of the carbon tax, and the costs of purchasing offsets.

It is important to note that the building envelope upgrades are not meant to be implemented as a stand-alone option, hence the relatively high cost shown by the curve. Instead, building envelope upgrades are meant to be implemented opportunistically with consideration of potential synergistic benefits with alternative energy systems. Realistically, certain building retrofits are to be considered in packages with alternative energy systems upgrades in order to maximize the benefit and cost efficiency of the initiatives.

Note that while some actions may have low implementation costs, they also tend to be limited in potential impact with regards to GHG reductions. Options such as district energy system upgrades and building retrofits will have higher implementation costs, but are also associated with the highest potential emissions reductions.

The cost estimates provided in the table below are scoping level only and are intended to be indicative of the possibilities.

Table 1: Cost Curve Assumptions and Comments

Action	Capital Cost [$ million]	Operating savings [$ million/yr]	GHG Savings [T/yr]	Life [Years]	NPV [$ million]	Cost/tonne
E3 Fleet Program	Fleet activities can be zero or low cost. Have assumed promotions, training, and extra staffing over three years of $350 k.	Estimated 15% reduction in fuel usage. Within range of other communities' activities.	GHG reduction same as fuel reduction (15%).	3 years	Slightly positive NPV indicates that savings pay for capital investment.	Negative cost per tonne indicate that the activity saves money.
Fleet upgrade	Assumes that 1/3 of the fleet is converted to electric vehicles, incremental cost of $15k per vehicle.	Electrification of 1/3 of fleet saves 15% of operating costs (fuel savings offset by electrical costs).	Electrification of 1/3 of fleet saves 30% of fleet GHGs.	10 years	Slightly negative NPV indicates that there is a small cost to this action.	Positive cost per tonne indicate that the activity costs money.

Action	Capital Cost [$ million]	Operating savings [$ million/yr]	GHG Savings [T/yr]	Life [Years]	NPV [$ million]	Cost/tonne
New construction guidelines	Assumed that 300,000 m^2 built annually, at extra cost of \$50/m^2.	Assumes thermal energy is 0.6 GJ/m^2; 40% reduction; Energy cost is \$12/GJ.	40% reduction. Emission factor is 50 kg/GJ.	Long life of building - means that savings continue.		
Replace the district heating system (as a standalone activity - i.e. without energy efficiency upgrades to buildings)	Assumed \$100 million required for plant, piping and building retrofits - with lots of contingency. Very approximate estimate.	Assumed none, but would anticipate some cost savings.	Alternative energy is installed and designed to meet 30% of peak demand which corresponds to 70% of annual energy. Therefore the GHG reduction is 70% of the existing 66,000 tonnes/yr	40 years	Negative NPV equal to capital cost of \$100 million. (NB this does not include the capital – about \$18 million - that would be required to retain the current system.)	At full cost for a system, this is in the range of the carbon tax and offset costs. Using incremental costs, this project would be revenue positive.

Action	Capital Cost [$ million]	Operating savings [$ million/yr]	GHG Savings [T/yr]	Life [Years]	NPV [$ million]	Cost/tonne
Large program of building envelope upgrades	Example: Standalone envelope retrofits to 80 buildings at $4 million each.	Savings of 0.6 GJ/m^2 at $12/GJ.	Achieves a 60% reduction in space heating.	40 years	Negative NPV indicates that this activity costs over the life of the upgrade.	Cost is above the expected range of carbon taxes and offsets (this does not include possible fuel cost savings.
Re-commissioning	$6.0 million over 5 years (includes capital and operating costs)	Savings of 2% increase annually to 10% in year 5; Five-year average is 5%.	5470 tonnes/year – about 10% of building GHG emissions (NB: approximate estimate, assumes that efforts reduce heat loads. Re-commissioning activities focus on cost and energy savings, not all actions will reduce GHG emissions.	5 years	Slightly negative based on energy savings alone (does not include carbon taxes and offsets)	Cost per GHG reduction estimated near $50 per tonne.

CLIMATE ACTION PLAN
UBC Vancouver Campus

Technical Report #7

Management System

February 2010

Management System

This report provides overall guidance on how to manage implementation of the Climate Action Plan, and defines the implementation requirements for a Climate Management System at UBC.

The Climate Action Plan (CAP) sets out a vision, a baseline emissions inventory, GHG reduction targets, key action areas and specific climate change mitigation actions for UBC to undertake on the Point Grey Campus in the period from 2010 to 2015.

A **management system** is a tool to facilitate the continuous improvement of a plan. For the CAP, it ensures that there will be ongoing monitoring, management and refinement over time. This will keep the plan current and ensure it is a living document.

Management systems in general range from simple documents to elaborate IT systems. In this context a management system is simply a documented delineation of the processes, roles and responsibilities to ensure the plan is implemented.

The key focus of a management system is its commitment to continuous improvement. Moving forward, the actions and monitoring requirements developed for the CAP will be regularly reassessed and refined.

Process: Plan, Do, Check, Act

An ongoing feedback loop, known as the Deming Cycle facilitates continuous improvement. The four components of the Deming Cycle, shown below in Figure 1, are "plan, do, check and act."

A run through the plan-do-check-act cycle must occur on an annual basis and should coincide with the annual budget cycle for planning each year's capital and operating budgets.

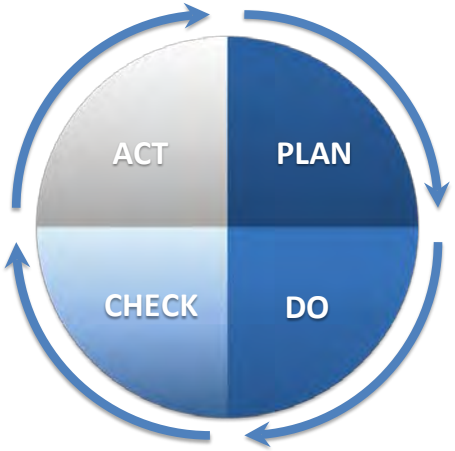

Figure 1: The Deming Cycle (Plan-Do-Check-Act)

PLAN

Plan Design and Approach

UBC's approach to climate action planning has been to:

- Gain broad support for the high-level vision and targets;
- Engage stakeholders in developing actions that make progress towards achieving the targets;
- Estimate resource requirements to implement the actions, and;
- Assign responsibility for overseeing the implementation of actions.

This approach cascades responsibility to the department, the unit and in some instances, the individual level. As such, it requires alignment within the organizational structure to ensure that:

A. Departmental mandates reinforce the goals of the CAP;

B. Expectations are clearly communicated to staff with resources allocated accordingly, and;

C. Performance is measured and reported in order to allow for timely adjustments to be made to the CAP.

DO

Plan Implementation

Plan implementation will require the formulation of an annual work plan that defines CAP activities to be implemented on an annual basis. The work plan should tie into departmental business plans and budgets to ensure responsibilities and resources are allocated for CAP activities. Annual planning activities are focused around the budget preparation cycle. Capital and operating budgets are defined annually in December.

Each responsible department will budget for and implement the activities defined for its components of the CAP on an annual basis. These activities will be rolled up (by the Campus Sustainability Office) into an annual work plan for the CAP, which will be reviewed with the VP Finance, Resources and Operations (VP FRO) and the Operations Working Group of the President's Advisory Council on Sustainability.

Figure 2, on the following page, shows the organizational structure of the Finance, Resources and Operations Organization at UBC. Within this structure, there are a few specific departments that have responsibility for managing the majority of Scope 1 and 2 emissions. Responsibility for Scope 3 emissions lies with various units both internal and external to the Finance, Resources and Operations Organization.

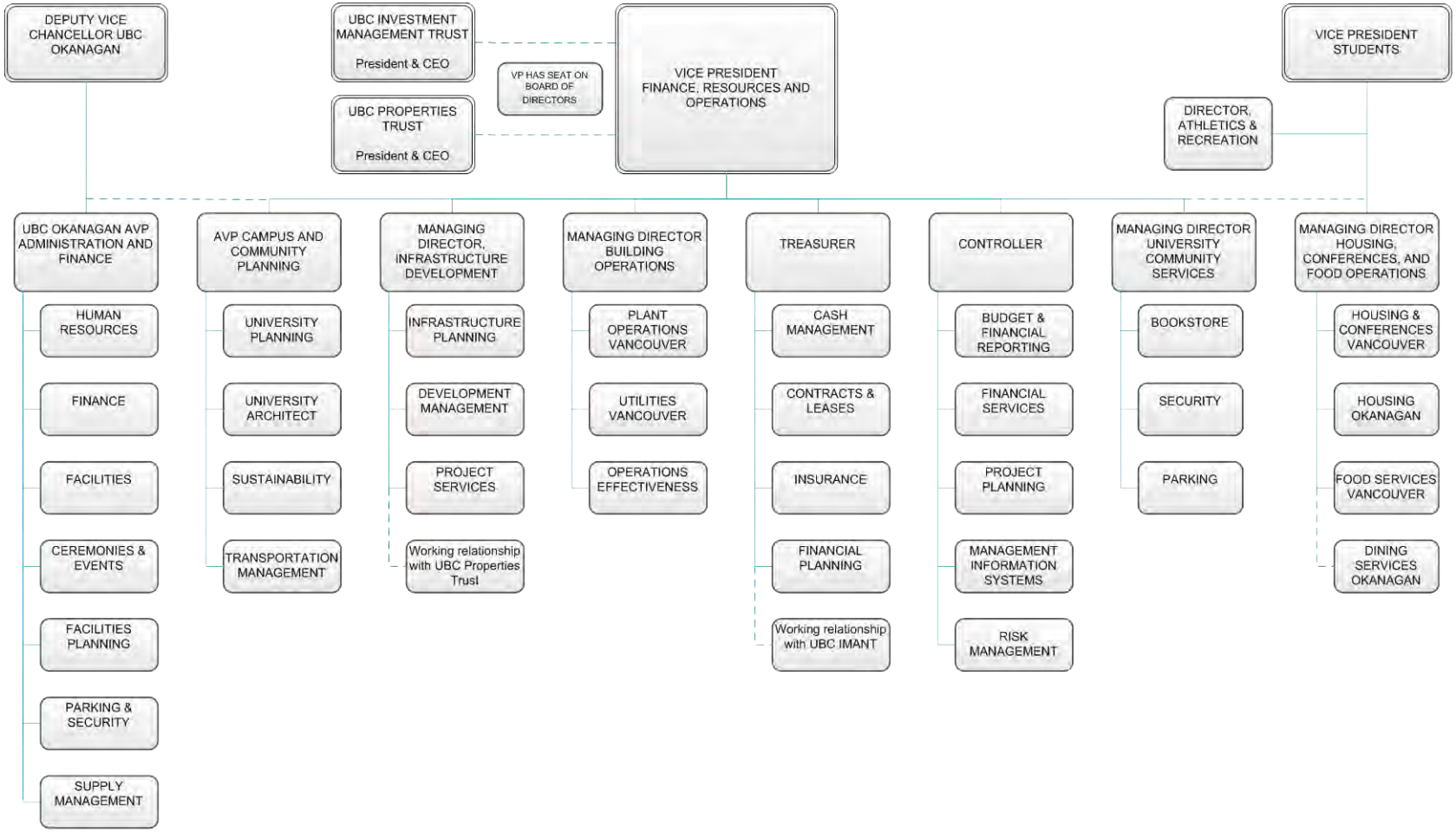

Figure 2: UBC Finance, Resources and Operations Organizational Structure

Key responsibilities for the plan are:

- **Strategic Oversight** is provided by the Operations Working Group (OWG) of the President's Advisory Council on Sustainability (PAC-S)
- **Accountability / Ownership** of the plan rests with the Vice President, Finance, Resources and Operations (VP FRO).
- **Coordination** falls to the Campus Sustainability Office, a unit within Campus and Community Planning, which reports to the VP FRO through the Associate Vice President (AVP), Campus and Community Planning. The coordination role includes the provision of technical guidance, policy and planning support, monitoring, reporting, communications and outreach.
- **Implementation and Monitoring** will be led by Departments and Units, with guidance from the CAP Working Groups to assist in defining measures, targets and indicators for monitoring progress.
- **Technical Guidance** will be provided by the CAP Working Groups. Currently, the Working Groups are comprised of staff, faculty and student representatives. As the CAP evolves, Working Group membership may change in order to provide the most relevant technical expertise to CAP activities.

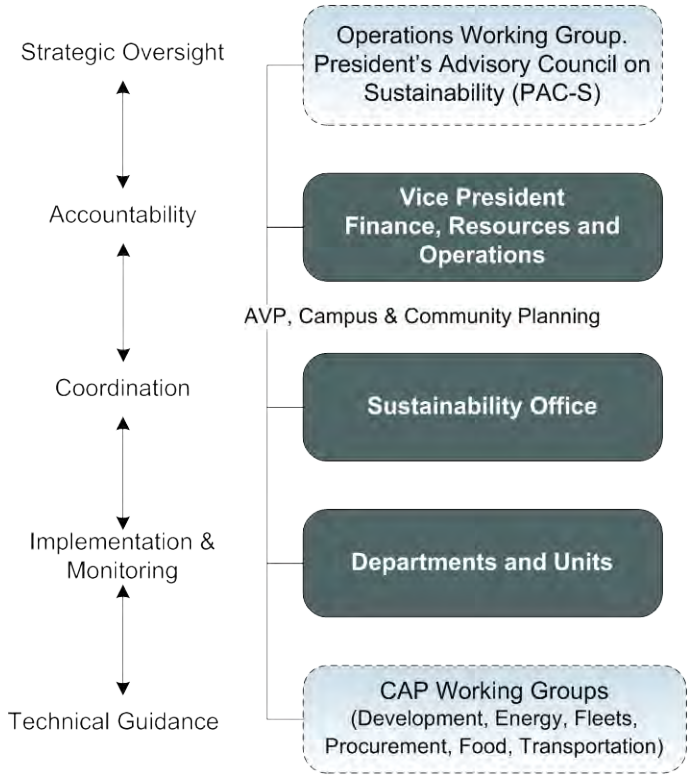

Figure 3: Proposed CAP Reporting Structure

CHECK

Monitoring and Measurement

Monitoring includes two components. The first is the monitoring of the plan activities - what is being done, who is doing it, is the activity funded, etc. The second component is the compilation of the emissions inventory to monitor the success of GHG emissions reduction measures.

Coordination of monitoring activities, including compilation of the emissions inventory, falls to the Campus Sustainability Office. This will need to be done in close coordination with the departments responsible for plan implementation.

Responsibility for the management of Scope 1 and 2 emissions falls mainly to a few departments, including Building Operations and Infrastructure Development. These are the departments responsible for the steam plant, the development and operation of core buildings, and the management of the majority of fleet vehicles on campus. Other departments with some responsibility for Scope 1 and 2 emissions include Housing (Conferences and Food Operations), Athletics and Recreation and various other departments that operate fleet vehicles. Campus and Community Planning, while not directly responsible for Scope 1 and 2 emissions, can have a significant impact on energy and GHG emissions through land use planning and design.

CAP Technical Report 3 provides details for monitoring energy and GHG emissions, including guidance on how to collect and report data.

At present there are data compilation gaps that must be resolved. These include:

- the energy consumption of off campus buildings;
- developing a vehicle survey cycle for tracking odometer readings for vehicles, and;
- using the energy monitoring systems being deployed to gauge the impact of re-commissioning and maintenance activities, etc.

In the long term, UBC aspires to report on a suite of Scope 3 emissions including the food system, procurement activities beyond paper consumption, business travel (staff and academic), and refined commuter travel emissions data. Performance monitoring frameworks will need to be developed to ensure that these Scope 3 emissions can be accurately tracked and quantified.

ACT

Reporting and Improving

Key reporting requirements are:

- A **progress report** on emissions reduction (i.e. an annual inventory) for the Province of BC for each calendar year. Monitoring begins at the Unit Level and gets rolled up by the Campus Sustainability Office into an inventory report. This inventory report is a quantitative measure of the progress that UBC is making on the CAP and is facilitated by the **SMARTTool,** a web-based tool developed by the Province that converts activity data to GHG emissions.

- A **Carbon Neutral Action Report**, which is a qualitative account of progress made on climate action (e.g., outreach and engagement activities, programs, policies, research, training, etc.). The Carbon Neutral Action Report is an opportunity to compliment quantitative measurements with stories to provide a more complete picture of progress.

- **Reporting to the Executive and to the Board of Governors**. This reporting will be broader in nature than the GHGRTA (Bill 44) requirements and will be UBC's report to its stakeholders and campus community. This could be a standalone report, or part of the annual reporting compiled by the Campus Sustainability Office for "Inspirations and Aspirations: The Sustainability Strategy" (see next bullet).

- Reporting on energy and GHG emissions indicators as part of the annual reporting requirements for **Inspirations and Aspirations: The Sustainability Strategy.**

- A **five-year review and report** for the Climate Action Plan. This would be a comprehensive review to determine the success of activities implemented in achieving GHG emission reductions. As a result of this review, UBC will essentially produce an updated CAP, including a summary of progress made in the period from 2010 to 2015 and where necessary, revised goals, targets and actions for the period from 2015 to 2020. A Climate Action Plan report would be produced and disseminated broadly every five years.

Table 1, on the following page, provides a summary of the key milestones in the annual cycle for the CAP.

Table 1: CAP Annual Implementation Cycle

Quarter	Activity	Deliverable	UBC Milestones
4	**January:** Units/Departments provide monitoring data (from previous year) to the Campus Sustainability Office (Climate Action Coordinator) **January:** Working Groups meet to report out on progress (from previous year) and discuss implementation plans for the coming year. **January – March:** Campus Sustainability Office (Climate Action Coordinator) develops draft inventory and status report (Carbon Neutral Action Report) for activities from previous year. Drafts circulated to Working Groups and relevant Managing Directors.	Draft inventory & Carbon Neutral Action Report	Fiscal year end March 31
1	**April:** Working Groups meet to review draft inventory and status report. Working Group Chairs submit feedback (from Working Groups and Managing Directors) to Campus Sustainability Office. **April – May:** Campus Sustainability Office finalizes inventory and Carbon Neutral Action Report for the previous year and reports to AVP Campus and Community Planning. AVP provides progress update to VP FRO. **June:** Carbon Neutral Action Report submitted to the Province and presented to the Board of Governors.	Final inventory and Carbon Neutral Action Report; Presentation to Board of Governors	Board of Governors meets in June
2	**July-August:** Management Review – VP FRO and Managing Directors meet to discuss feedback/direction given by the Board. Managing Directors to share feedback with Working Group Chairs and Campus Sustainability Office. **September:** Working Groups meet to discuss feedback from the Management Review and to develop implementation plans for the following year.	Draft CAP Implementation Plans (by Working Groups)	Fall term begins
3	**October-November:** Implementation plans finalized and ready for incorporation into departmental budgets and business plans.	Final CAP Implementation Plans	Department budget submissions due (end of December)

Alignment and Integration into UBC Activities

A key indicator of sustainability integration is clear assignment of accountabilities and responsibilities for sustainability performance from the Board level to the Executive level and through to the Operational Management of each business unit within an organization[1]. Considerations for UBC include:

- Defining climate action responsibilities and where relevant, including key performance indicators in management staff and employee job descriptions.
- Providing outreach and training to all staff affected by the action plan so that they are equipped for implementation.
- Clear communication from the Board level through to Unit staff that the implementation of the CAP is an important part of UBC activities - a must have, not a "nice to have."
- Support for staff to experiment and learn. CAP implementation must be supportive and not punitive.
- A forum for exchange between staff to ensure that all activities are aligned towards the same goals. This could include workshops, or in-house conferences, lunch 'n' learns, etc.
- Aligning departmental and project budgets such that UBC's sustainability and climate action objectives are considered from the outset of any activities or projects. For example, ensuring that 5% of the UBC ReNew budget is allocated to high performance envelope upgrades.

An environmental management system, such as ISO 14001:2004, or the emerging ISO 50001 Energy Management System standard, would assist UBC in formalizing many of the processes required for CAP implementation. The Campus Sustainability Office may wish to explore linkages with existing management systems handled by the Health, Safety and Environment (HSE) Department at UBC. Efforts are ongoing within HSE to establish a more comprehensive approach to environmental management at UBC and management system certification is being considered for the future. Aligning with these efforts may create efficiencies with regards to monitoring and reporting of CAP activities.

Beyond establishing a management system to guide CAP implementation, UBC may wish to consider using auditable standards for GHG accounting and verification, such as the ISO 14064 suite of standards, which provide specifications and guidance for GHG accounting, validation and verification,. This may serve to better prepare UBC to manage GHG-related liabilities, assets and risks; participate in the trade of carbon offset credits, and; prepare for the possibility of more stringent regulation around GHG emissions.

[1] Integrating Sustainability into Business Processes: Case Studies of Leading Companies. http://www.stratos-sts.com/publications/Sustainability_Integration_Study_Brochure_EN_.pdf

The CAP as a Tool for Decision Making

This plan identifies a number of actions for implementation for the period 2010 – 2015. Going forward, there will always be new opportunities that come to light.

What guides the Plan over the long-term is the *Vision for Climate Action*, which can be used, at a very practical level, to provide guidance for evaluating future decisions at UBC. These decisions considerations are outlined in Table 2.

Table 2: Decision Considerations from the CAP Vision

Key Themes	Considerations: Does this decision…?
Become a net positive energy producer.	… reduce overall energy use on campus? … specifically reduce fossil fuel use on campus? … allow us to share energy with our community – reducing their emissions?
Act as an agent for change.	… show leadership to our stakeholders and communities? … accelerate change, rather than simply 'join the bandwagon'? … challenge and inspire ourselves to achieve more? … leverage our unique features to do more than other institutions and communities are able to do?
Use campus as a living laboratory	… provide us with flexibility for future knowledge and technologies, or does it "lock us in" to a specific path? … allow us to manage risks and at the same time be cutting edge innovators? … deliver our energy services reliably, economically, and efficiently? … provide unique research and teaching opportunities? … provide visible demonstrations of what can be achieved? … allow us to learn and share our experiences?
Account for the full costs of our decisions.	… truly reduce our global burden and not simply shift it elsewhere? … be equitable to all affected parties? … deliver the most attractive life cycle cost? … account for the co-benefits? … account for the trade-offs (i.e. are we making sacrifices elsewhere to achieve these emissions reduction?