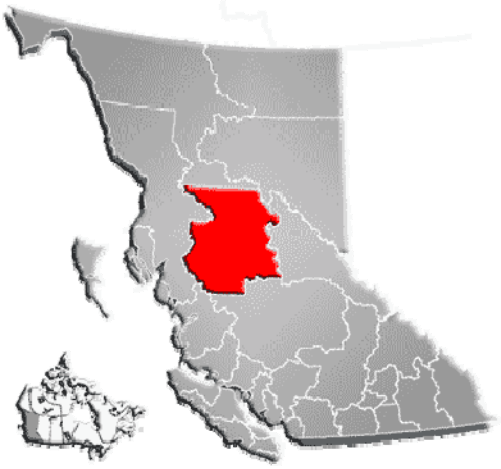
Regional District of Bulkley Nechako



Corporate Energy and Emissions Plan

Final Draft
10 August 2011

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1 Introduction

1.1 Methodology

The RDBN, as a signatory to BC's Climate Action Charter, has agreed to be "carbon neutral," i.e., zero net Greenhouse Gas (GHG) emissions, in its corporate operations by 2012 and, as a result, is entitled to a rebate of carbon tax payments for their direct fuel purchases, in a program known as the Climate Action Revenue Incentive Program (CARIP). In 2010, the CARIP payment to RDBN was $4,592, which will rise by 2012 to approximately $7000, assuming current energy consumption, fuel sources, and purchasing patterns. The Regional District completed a detailed 2009 corporate energy and emissions inventory, by department, in 2010. The inventory looked at a range of "traditional" services defined by the province:

- Administration and Governance;
- Drinking, Storm and Waste Water;
- Solid Waste Collection, Transportation, and Diversion;
- Roads and Traffic Operations;
- Arts, Recreation, and Cultural Services; and
- Fire Protection.

A number of other local government activities that have associated GHG emissions, such as employee commuting and business travel, where personal vehicles or aircraft are used for Regional District business, are not in the inventory. These activities could be considered and incorporated into future energy and emissions inventory updates, but are not currently reportable for the purposes of the Climate Action Revenue Incentive Program (CARIP) carbon tax rebate. Energy usage data from the Regional District's contractors providing traditional services does, however, need to be incorporated into the GHG inventory.

To move forward, the Regional District initiated the development of this Corporate Energy and Emissions Plan (CEEP) to outline a cost-effective strategy to demonstrate regional leadership by reducing energy use and becoming carbon neutral in its operations, including the identification of a range of actions for achieving these outcomes.

In local government, the key sources of energy and emissions are:

1. Facilities, including the heating and powering of buildings;

2. Infrastructure, by natural gas, electricity, and other sources;

3. Fleet (driving staff vehicles using gasoline and diesel); and

4. Solid Waste, where these are local government responsibilities. It should be noted that while the energy and emissions for the collection, transfer, and handling solid waste is considered "reportable" for corporate purposes, the methane and other greenhouse gases that may be emitted from landfills is not. Landfills are, however, major sources of GHG emissions, particularly methane, and these should be minimized. Landfill emissions could be considered as a source of energy or of carbon offsets, through initiatives such as methane capture and conversion to energy and less potent Greenhouse Gases.

For the RDBN to become carbon neutral in its operations, the Regional District must focus on emission reduction actions, particularly in the years leading up to 2012 and beyond, and offset those emissions that cannot be reduced.

The CEEP considers opportunities for the RDBN to reduce corporate GHG emissions in the following broad areas:

1. Improving energy efficiency;

2. Developing low-impact and renewable energy sources; and

3. Finding cleaner fuel alternatives that support flexibility and future energy resilience.

The following chapters are organized according to the steps for accomplishing the goal of becoming carbon neutral:

1. **Measure.** An initial inventory has been completed. Analysis was undertaken of this data, and discussions held with Regional District staff, to identify opportunities and timeframes for implementing change.

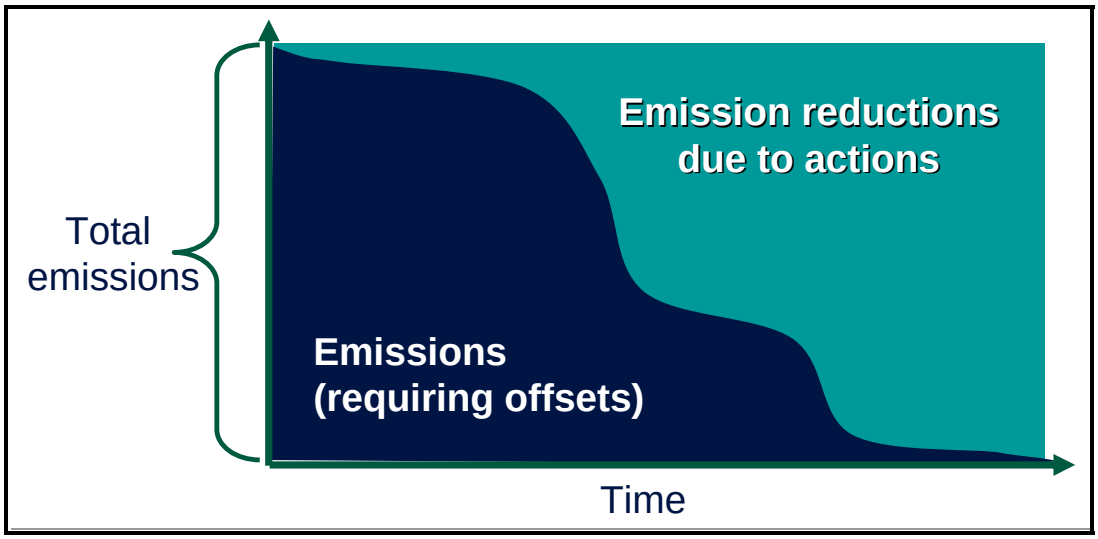
2. **Reduce.** Based on the current and planned inventory of assets and services, a broad range of best practices in areas under corporate responsibility is provided, along with high-level estimates of capital and operating costs and savings, tailored to the context of the RDBN's operations.

3. **Offset.** For those emissions that cannot be reduced, a strategy is proposed for the acquisition of offsets that will minimize costs and funds leaving the Regional

District while supporting the spirit of carbon neutrality and providing local benefits, including regional amenities and business opportunities.

4. **Report.** An initial inventory report has been completed. A spreadsheet has been developed to track indicators established for the RDBN over time. As a tool for evaluation as energy and emissions reductions actions are implemented, this monitoring and reporting system should be updated and reviewed annually.

Figure 1 – Relationship between Emissions Reductions and Offsets



The CEEP provides guidance, under Monitoring and Reporting, on:

1. Setting of appropriate corporate emission reduction targets, with comment on department and functional responsibility, for specific time periods determined in consultation with staff, i.e., from 2010 to 2020; and

2. Recommending specific energy and emission reduction actions over time (immediate to longer term actions), building on progress to date on Facilities and Fleet programs, as well as studies that appear to have a reasonable probability of a satisfactory payback.

Issues considered in the plan are based on:

1. Current reality, including:

    a. Assets and infrastructure;

b. Capital plans; and

c. Operating costs.

2. Opportunities;

3. Best practices and tools;

4. Budget issues; and

5. Linkages of corporate emissions to regional strategies, such as operating practices that reduce vehicle use and infrastructure requirements.

Through the provision of an energy reduction actions evaluation tool and a monitoring and reporting system, the structure of the Plan will readily allow for annual or periodic updates, to integrate emission reduction actions and successes and identify new actions that may be needed to reach desired targets. This may take the form of updates on various GHG reduction actions, such as Building Operations, New Building Policy, or Fleet Management.

The general methodology used to create the CEEP was:

1. Summarize and clarify the provincial statutory requirements and Regional District's corporate policies that are motivating the Regional District to move to energy efficiency, low impact energy sources and carbon neutrality;

2. Engage key internal stakeholders and all Regional District staff in understanding this motivation and their roles in achieving the plan;

3. Develop an internal corporate policy framework on energy and emissions, clearly indicating the roles and responsibilities of specific departments and staff in general, with a view to demonstrating community leadership and moving as quickly as possible to cost-effective energy efficiency actions, available alternative energy sources, and carbon neutrality;

4. Compile a comprehensive list of proven best practices that apply in RDBN's geographic and operational context;

5. Take the existing emissions inventory and create a presentation format that organizes emissions and is clearly understandable to all staff;

6. Identify, after an analysis of existing emissions inventory and using a practical business-case and environmental analysis, priority actions for the Regional District along with an implementation strategy that provides a road map for achieving the plans objectives within the desired target dates;

7. Include in the business case a high level evaluation of the trade-offs between investing in emission reduction actions and the purchase of offsets; and

8. Prepare a presentation and information backgrounder to educate and motivate staff while increasing awareness of the plan to the Board and the general public.

2 Measure – The Energy Baseline

2.1 Emissions Required in the Inventory

In the RDBN's 2009 emissions inventory, a number of questions were raised about what should be included and excluded from the inventory. While the following should not be considered as a legal opinion, and provincial guidelines continue to evolve, the responses (**in bold**) given to the questions raised (*in italics*) represent our understanding of the current guidelines.

In order to complete a Reportable Emissions Inventory the following questions must be addressed:

1. *Are the emissions from the Waste Haul trucks reportable?* **Yes, the operation of traditional services needs to be included in the RDBN total, and the collection of solid waste is a traditional local government service.**

2. *Are the emissions from the skid steers at the Transfer Stations reportable?* **Yes. The collection of solid waste is a traditional local government service, and skid loaders would be considered part of this function. The emissions from landfilled solid waste, although significant, are not included in the inventory. Capturing methane from solid waste can be used as a fuel, providing energy and reducing GHGs, as the product of combustion is CO_2, a less potent GHG.**

3. *Does data related to emissions need to be collected and reported for local recycling groups operations? What about the metal recyclers that collect scrap from the Transfer Stations?* **Yes and no. If the recycler is a subcontractor to the RDBN for waste management, the emissions are included. Once the recycled**

materials have been transferred to the third parties for processing, the local government is no longer responsible for emissions.

4. *Are the emissions associated with the Transfer Station buildings themselves reportable (electricity, etc.)?* **Yes. The collection of solid waste is a traditional local government service, and operation of the transfer station buildings would be considered part of this function.**

5. *Are the emissions associated with field operation supervision or environmental monitoring reportable?* **Yes. All staff business travel, whether for meetings or field operations, other than between work and home, is reportable. If private, non-fleet vehicles are used for business, emissions from these trips are not included. As the RDBN is wishing to demonstrate regional leadership, we recommend that these kilometers and energy/GHG emissions also be tracked and reduced where possible. Environmental monitoring can be a grey area, but if associated with regional district functions of water quality, wastewater quality, solid waste management, would likely be included. If related to a delegated authority, such as air quality or protection of flora and fauna normally conducted by the Ministry of the Environment, these emissions could be excluded.**

6. *Are there any other emissions that must be included?* **Within the traditional service sectors listed above, not all emissions need be captured. While any emissions related to the operation and maintenance of traditional services are included, emissions related to new construction, business travel, employee commuting and materials, such as office supplies, are excluded. It should be noted that the "business travel" exclusion only includes trips by personal vehicles or other modes, such as flying. If business travel is by a fleet vehicle, it must be included in the inventory. From a review of the 2009 Corporate GHG Inventory, it would appear that all of the emissions listed, i.e., approximately 589 tonnes, would be reportable.**

It should be noted that the difference between the cost of offsets and the CARIP rebate (approximately $10,000/year) if all identified emissions were to be offset is modest compared to the amount spent on the energy used to create the emissions. In other words, if relatively modest energy savings actions were implemented, the cost savings from energy conservation would be significantly larger that savings in emission offset costs.

2.2 Current Regional District Operations and Practices

2.2.1 Buildings and Facilities

The RDBN manages a number of key buildings and facilities:

1. RDBN Administration Offices (37 Third Avenue, Burns Lake);
2. Bulkley Valley Regional Pool and Recreation Centre;
3. Fort Fraser and Fort St. James Fire Halls; and
4. Transfer Station operations, with energy consumption as follows:

Figure 2 – Transfer Station Electricity Consumption (2009)

Site	Electricity Usage (kWh)
BLTS	46,597
ADTS	10,718
GITS	9,848
VTS	38,637
SSTS	8,496
STTS	40,653
FSJTS	20,429
TOTAL	**175,378**

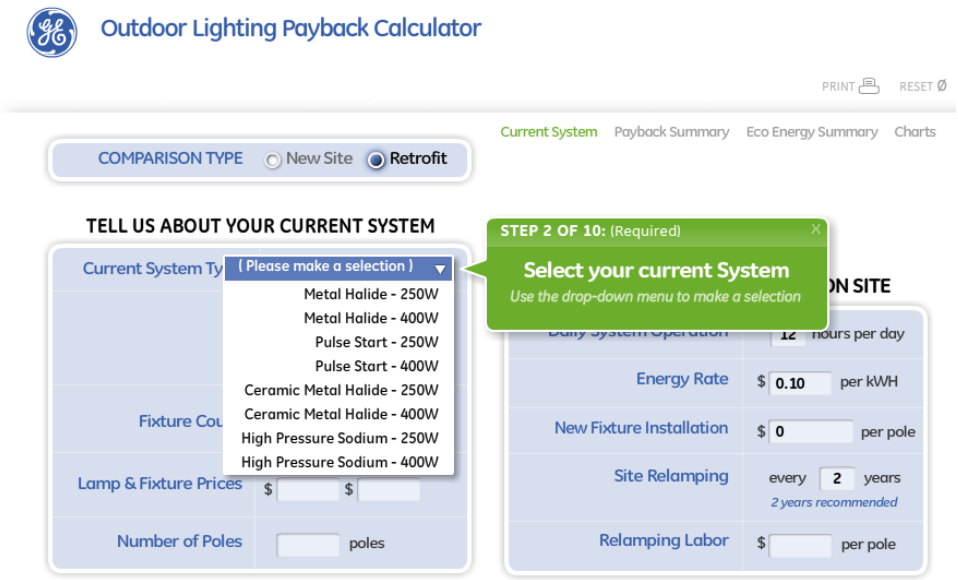
The administration offices and the Bulkley Valley Pool and Recreation Centre have undergone energy efficiency upgrades in recent years. The major energy user is the recreation centre, which is a community-based, family-oriented facility. After almost two decades of planning and fundraising, it was constructed in 1990 at a cost of $1.7 million, meaning that it is in the middle of its useful life. The community raised all of the construction funds, and another $0.5 million of in-kind donations. The RDBN owns the land upon which the facility is built, the building, and all of the capital equipment. The Bulkley Valley Aquatic Centre Management Society has managed and operated the facility but, as an RDBN facility, GHG emissions are now considered to be corporate, regardless of who purchases the fuel sources.

As fire protection services are undertaken on a volunteer basis, fire halls would generally be unmanned other than during training, emergencies and special events. Their energy use should be minimal at most times, other than required security system and minimal heating.

2.2.2 Infrastructure

The RDBN runs a limited set of infrastructure utilities, including Water and Sewer services for Fort Fraser, using 121,500 kWh of electricity for plant operations and pumping. A number of streetlights are also maintained by the RDBN, consuming and estimated 65,000 kWh of electricity. It is assumed that streetlights use high pressure sodium (HPS) lamps and are individually activated by light sensor, which minimizes wasted energy. Recent advances in metal halide lamps, which provide a white rather than orange light, suggest that more useful illumination can be provided for the same energy input as HPS. Light Emitting Diode (LED) lamps are becoming increasingly common, with decreasing capital costs, and use a small fraction of the energy used by HPS or MH lamps, providing a simple payback period in the 5-7 year range in many applications, which can be determined by existing payback calculators.[1]

Figure 3 – Outdoor Lighting Payback Calculator



2.2.3 Solid Waste

A major determinant of existing regional district energy and emissions is the centralization of landfill operations at three landfill sites. Previously, each municipality had its own landfill site, which has been replaced by local transfer stations, where solid waste and recyclable materials are collected and then transferred to the two main landfill sites. While this practice has likely led to efficiencies in terms of operations, and

1 http://www.gelighting.com/na/business_lighting/education_resources/tools_software/outdoor_led_calculator/

potentially the ability to implement larger scale waste management services, such as composting, it increases the distances that solid waste travels to landfill, and consequently energy use and emissions. The two main landfills are:

- Knockholt Western Sub-Regional Landfill; and
- Clearview Eastern Sub-Regional Landfill.

The current level of solid waste disposal per capita in the region is approximately 0.55 tonnes, which is quite low compared to many regional districts in BC and lower than Metro Vancouver, but the total tonnage has increased 20% to over 22,000 tonnes. It should be noted that this number relates to the amount of material collected, and it is possible that, in rural areas, some solid waste is being disposed of locally and unofficially, as opposed to at transfer stations. Zero waste policies have been initiated in RDBN communities such as Smithers, but the impacts of these policies in not known. The other factor is the diversion rate, which is the amount of solid waste that is diverted from landfill through actions such as re-use, recycling, and composting.

Re-use is taking discarded items and giving them new uses, such as old furniture. Each transfer station currently has a "swap shed" where residents and businesses can leave articles in usable condition for others to use and there are non-profit facilities are available to facilitate reuse. Some communities such as Gibsons, have annual "swap days," a community-wide garage sale.

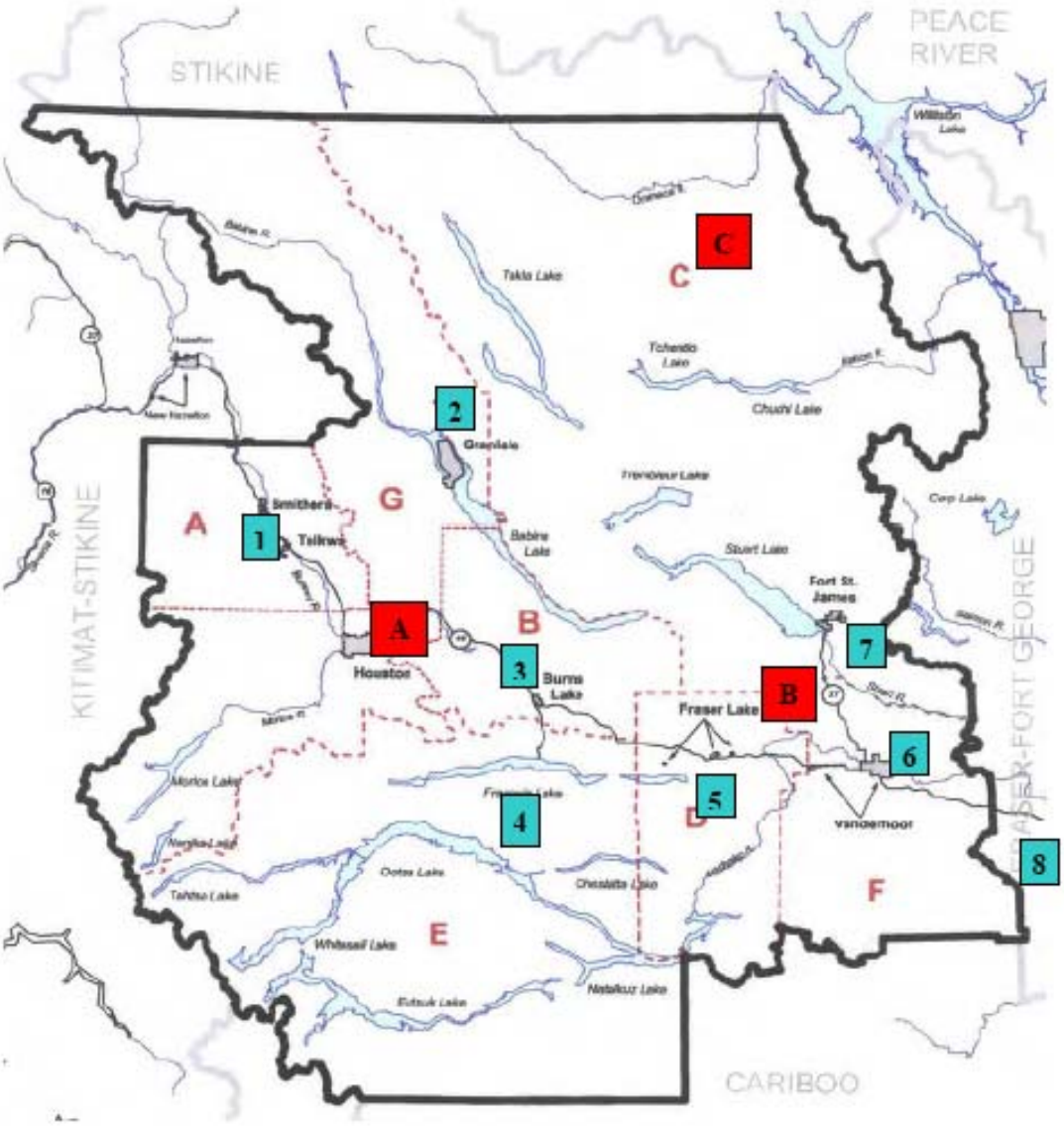
Recycling is taking materials, such as paper, plastics, and metals, and converting them into new products where facilities exist. Each transfer station and landfill has recycling facilities, but there are limited local resources for processing and distance to facilities is a barrier to more widespread recycling.

Composting is taking organic matter that normally decomposes and creates methane, a powerful greenhouse gas, and turning this into a product that can be used for fertilizer. Organic matter typically accounts for about 40-50% of household and business waste. While many households in the RDBN may be composting, there is no regional composting facility and it is assumed that most organic waste is collected and transferred to landfills. Wood debris is collected at transfer stations, but is currently open-burned, creating additional GHGs.

The regional district has recently experimented with lighter aluminum trailers, replacing heavier steel trailers, for transferring solid waste to landfill. The effect of this initiative on fuel efficiency is not yet measured, but it is assumed that this action, combined with driver training and aerodynamic fairings and skirts on trucks, could save 5-10% in fuel and emissions.[2]

[2] Manufacturers statistics, e.g., http://www.windyne.com/ or http://www.freightwing.com/

Figure 4 – Map of Active Solid Waste Facility Locations



Legend	
Transfer Stations	**Landfills**
1 – Smithers/Telkwa	A – Knockholt
2 – Granisle	B – Clearview
3 – Burns Lake	C – Manson Creek
4 – Southside	
5 – Area "D" (Fraser Lake Rural)	
6 – Vanderhoof	
7 – Fort St. James	
8 – Berman Lake – Operated by Regional District of Fraser Fort-George	

2.2.4 Fleet Vehicles and Travel

The fleet is a mix of gasoline and diesel powered vehicles. The current fleet profile is:

Figure 5 – Current Fleet Profile (2010)

Make	Model	Year	Used For	Fuel
Ford	F-150	2004	Environmental Services - Environmental monitoring, leachate collection/treatment systems, hauling pumps and other equipment as required. Highway and landfill/transfer station driving.	Gas
Pontiac	Vibe	2004	Admin, Planning, Dev. Services & Emerg. Serv. - staff driving to meetings, conferences & out of town functions, taking multiple Directors to functions. Mostly highway use	Gas
Chevrolet	Equinox	2005	Building inspector going to on site inspections, mostly highway driving some dirt roads	Gas
Ford	F-150	2006	Environmental Services - Landfill/transfer station inspections, Fort Fraser water/sewer inspectins repair. Hauling pumps and equipment as required. Highway and landfill/transfer station driving.	Gas
Ford	Escape	2008	Admin, Planning, Dev. Services & Emerg. Serv. - staff driving to meetings, conferences & out of town functions, taking multiple Directors to functions. Mostly highway use	Gas
Kenworth	T800	2008	Environmental Services Tractor Fleet - Western Waste Haul (485 ISX Cummins Diesel) - highway/landfill/transfer station driving	Diesel
Kenworth	T800	2008	Environmental Services Tractor Fleet - Western Waste Haul, Wood Waste Haul, Backup for West/East Waste Haul (485 ISX Cummins Diesel) - highway/landfill/transfer station driving	Diesel
Ford	Escape	2010	Building inspector going to on site inspections, mostly highway driving some dirt roads	Gas
Ford	Escape	2010	Admin, Planning, Dev. Services & Emerg. Serv. - staff driving to meetings, conferences & out of town functions, taking multiple Directors to functions. Mostly highway use	Gas
Ford	F-350	2011	Environmental Services - 1 ton with flat deck. Move equipment including bobcats (using trailer) as required. Used when heavy hauling requirements are needed. Highway and landfill/transfer station driving.	Diesel
Kenworth	T800	2011	Environmental Services Tractor Fleet - Eastern Waste Haul (485 ISX Cummins Diesel) - highway/landfill/transfer station driving	Diesel

A summary of RDBN services and operations is included as Appendix 1.

2.3 Summary of existing Energy Use and GHG inventory

Corporate energy use and GHG emissions result primarily from the following sources:

1. RDBN Buildings and Facilities, including the administration building, recreation centre, and solid waste transfer station operations.
2. Solid Waste transfer to landfills and management of solid waste within landfills.
3. RDBN fleet vehicles and board meeting travel.

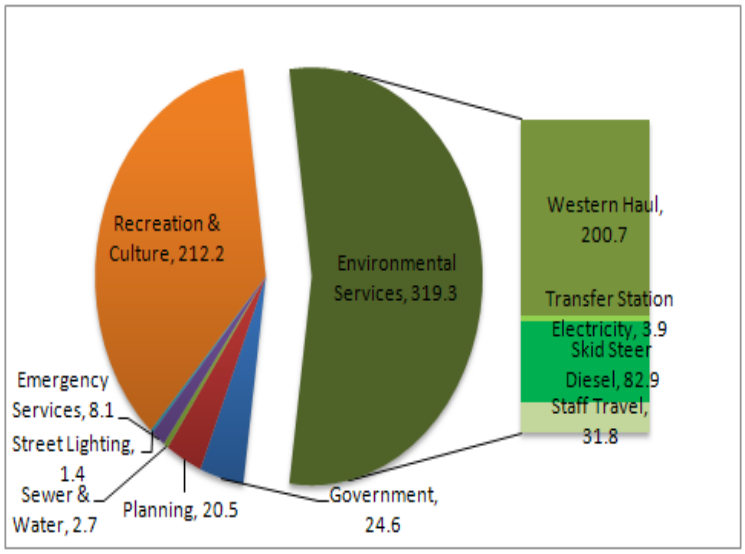
In terms of costs, from the documents provided, current energy spending for 2010 was about $280,000, or approximately 3% of the total RDBN budget:

Figure 6 – 2010 Energy Spending

Regional District of Bulkley Nechako Energy Spending			
Document	**Fuel Type**	**Dates Covered**	**Expense**
2010 Truck Fuel.pdf	Vehicle Fuel	Jan 31, 2010-Dec 31, 2010	$74,645.39
2010 Transfer Station Fuel.pdf	Vehicle Fuel	Feb 12, 2010-Nov 10, 2010	$27,686.24
Bulkley Valley Pool 2010.pdf	Natural Gas	2010	$64,000.00
	Electricity	2010	$35,000.00
2010 Utilities RDBN.pdf	Electricity	Jan 4, 2010-Dec 31, 2010	$79,337.82
	Natural Gas		
	Propane		
Total			**$280,669.45**

A breakdown of GHG emissions by functional area is:

Figure 7 – GHG Emissions by Operational Category (2009)

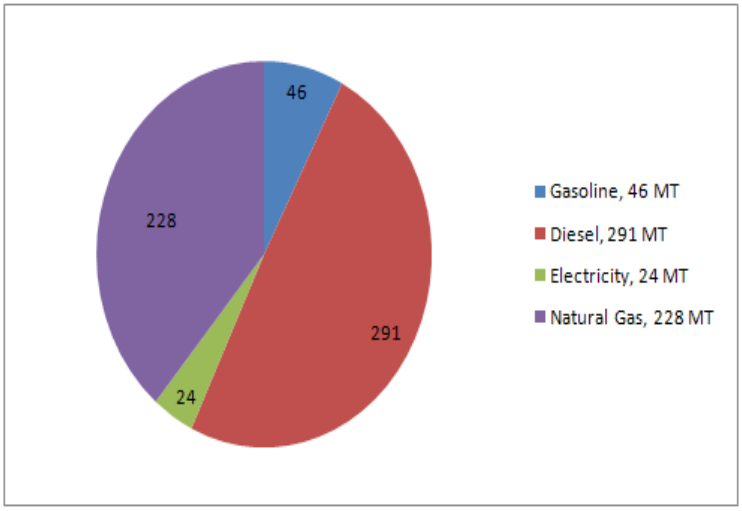


*Note: Does not include emissions from Eastern Waste Haul or recycling

The sum of current emissions is 590 tonnes of CO_2^e, which would cost $14,750 to offset, if not reduced, at $25/tonne of CO_2^e . Future operation of the recreation centre and the operation of the eastern waste hauling may affect this value.

In terms of GHG emission energy sources, the breakdown is:

Figure 8 – GHG Emissions by Energy Source (2009)



These graphs show clearly that the largest proportion of corporation emissions is for heating at the recreation centre by natural gas and solid waste transfers by trucks. Secondary sources are passenger vehicles (staff and board) for business trips by gasoline powered vehicles and the heating and lighting of buildings by electricity. Other infrastructure and utilities, including transfer station machinery, water and sewer systems, and street lighting amount for a relatively small, but non-negligible amount of energy and emissions.

A summary of RDBN GHG emissions is attached as Appendix 2.

2.4 Energy and Emissions Drivers and Constraints

2.4.1 Electricity Costs

BC Hydro has asked the B.C. Utilities Commission to approve an increase in electricity rates of more than nine per cent this year, and rates could rise by 33 to 50 per cent over the next five years, according to figures released in the 2011 provincial budget with projected additional rate increases for the subsequent three years of six, 12 and six per cent, respectively. BC Hydro has indicated that the increases are necessary so that it can upgrade its infrastructure and switch to renewable energy sources, through programs such as Independent Power Producers. With current average electrical tariffs for local government at approximately $0.065/kWh in 2011, this could increase the cost of electricity to between $0.075 and $0.085/kWh by 2015.[3]

Figure 9 – Predicted Future Electricity Prices

Year	Annualized Average Rate (cents/kWh)	Year Over Year change
2009	5.48	
2010	5.78	5.47%
2011	6.48	12.19%
2012	7.12	9.82%
2013	7.81	9.73%
2014	8.35	6.91%
2015	8.47	1.45%
Cummulative increase 2009 to 2015	**2.99**	**54.7%**

Another cost factor related to electricity is the BC Carbon Tax, as discussed below, which is based on emissions factors for different energy sources. As BC has been a net importer of electricity purchased from the North American grid, and the proportion of these imports generated by fossil fuels have varied, RDBN's Carbon Tax could increase in the future. Currently, the emissions factor for electricity is relatively stable.

[3] Resort Municipality of Whistler Estimates

2.4.2 Petroleum Products (Gas and Diesel)

While some conservative organizations such as the U.S. Energy Information Administration (EIA) and International Energy Agency were suggesting in 2010 that a barrel of crude will climb to only $125/barrel by 2035, as little as 2 years ago prices reached $200/barrel and, before the 2009 economic crisis, many analysts predicted that this could reach $300/barrel within a decade. Oil closed at $108/barrel on April 1st, 2011, up over $30 from a year ago. Needless to say, predicting energy prices is not an exact science, but it would be prudent for RDBN to do a sensitivity analysis of oil costs between $100 and $300/barrel, perhaps using $200/barrel as a mid-point to determine future costs of petroleum products. Of course, the cost of crude oil is only part of the cost of petroleum-based fuels. The current cost components are[4]:

- Taxes: ~$0.31 (rural areas)
- Distribution and Marketing: ~$0.05-$0.15
- Refining: ~$0.17 cents
- Crude oil: ~$0.50-$0.65 cents

Figure 10 – Trends in Oil Prices

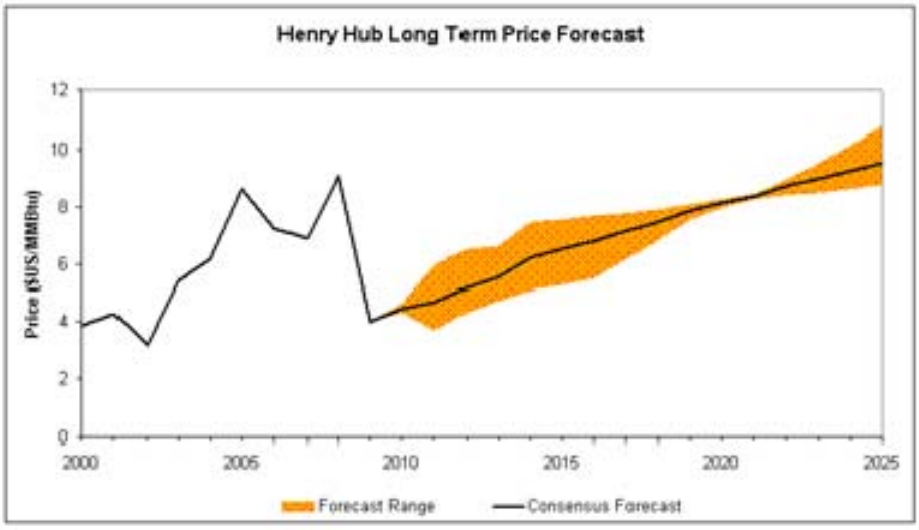
[4] http://www.bcaa.com/wps/portal/BCAA/newsroom/drivers_issues?rdePathInfo=xchg/bcaa-com/hs.xsl/2009.htm

Using these cost components, and assuming taxes remain constant, a doubling of crude oil costs would increase gas and diesel prices by approximately $0.50/litre. This should be considered when making decisions about vehicle purchases in the future, particularly in full lifecycle analysis when lower capital costs can easily be offset by higher fuel costs. For example, if a vehicle has an estimated service life of 150,000 km, gasoline at $1.75 litre would add $7,500 to the lifecycle cost of owning the vehicle compared to the current cost of ~$1.25 at an average fuel efficiency of 10 liters/100 km. This would make a more expensive, more fuel efficient vehicle more attractive, particularly when GHG emissions and carbon offset requirements are factored in.

2.4.3 Natural Gas

Based upon data from the U.S. Energy Information Agency (EIA) and several expert consultants, it is expected that the benchmark "Henry Hub wholesale price"[5] will rise gradually over the period 2010 to 2025. Noteworthy is the very tight grouping around the long-term consensus forecast, which indicates strong agreement among industry experts. While some of this predicted price increase is explained by inflation, which is typically estimated to be between 1.5 and 2.0% per year, it is still possible that natural gas prices could increase in constant dollars by 50-100% over the next 15 years. Given the significant amount of natural gas used by the pool facility, this additional cost should be considered against the costs of energy retrofit projects rather than simply the rate of return on investment based on constant fuel costs, which is the standard approach.

Figure 11 - Predicted Future Natural Gas Costs



[5] The "Henry Hub" index is the pricing point for natural gas futures contracts traded on the New York Mercantile Exchange (NYMEX).

2.4.4 Carbon Taxes

British Columbia currently has a carbon tax, based on CO2 equivalent emitted by a fuel source, which is currently based on a cost of $20/tonne for CO_2^e is $0.0445/litre for gas, $0.0511/litre for diesel and $0.038/$m^3$ for natural gas.[6]

While this cost is currently offset by CARIP rebates, there is a cost to reduce emissions or purchase offsets, as will be discussed below, in order to become carbon neutral in corporate operations, which is a condition of CARIP. It is not clear if the CARIP rebates will continue indefinitely, particularly if the carbon tax is increased or replaced.

There is little certainty at this point about the future of carbon taxes, whether "cap and trade" or an emissions-based approach such as currently exists in BC, or whether applied at the provincial or federal level. There is, however, general agreement among economists that the actual cost of offsetting GHG emissions to reduce BC's GHG emissions to provincial target levels needs to be around $200/tonne, or about 10 times higher than current levels in BC, which would be a factor in future energy prices.

2.5 Proposed Corporate Energy and Emissions Policy Framework

Three scenarios were developed that have the potential to achieve 10%, 20%, and 30% reductions in energy and emissions if all actions in the scenarios were fully implemented and the studies recommended determined the more advanced actions to be technically and financially feasible. These have been named "The Basics," "Best Practices," and "Leadership."

> **The Basics.** Includes the actions necessary to begin reducing emissions within the RDBN's corporate portfolio using readily available practices and technology. The greatest impact items in this scenario are a gradual improvement in fleet performance, immediate updates to facilities, reduced business trips through using next-generation web meeting and vehicle technologies, and waste reduction strategies.
>
> **Best Practices.** These actions are considered best practices in energy and emissions reductions. While some of the practices and technology may be new to the RDBN, they have been applied with success in other jurisdictions. The greatest impact items in this scenario is fuel switching for the vehicle fleet and

[6] http://www.fin.gov.bc.ca/tbs/tp/climate/A4.htm The term CO_2^e stands for the equivalent GHG impact of carbon dioxide gas (CO_2), the common unit for measure of GHGs. The unit "tonne" stands for metric ton, i.e., 1000 kg, referred to as MT in some publications.

the gradual implementation of all building retrofit projects that have a 7 year or less payback period, depending on the availability of capital.

Leadership. The actions necessary to place the RDBN in a leadership position with respect to emissions reductions. The greatest impact items would be aggressive reductions in solid waste transportation, extensive use of remote meeting technology, and major renewable energy upgrades to the administration offices and recreation facility, which are likely to have a longer payback period.

2.6 Review of High Level Opportunities

The following classes of high level opportunities were identified for further investigation based on the RDBN's energy and emissions baseline:

1. **Buildings**
    a. Energy efficiency measures, including insulation, such as thermal blinds, and controls to reduce unnecessary energy use, such as motion sensors; and
    b. Heating and cooling systems, including solar hot water, air and ground-source heat exchangers, waste heat recovery, and high efficiency boilers.
2. **Fleet and Travel**
    a. "Right-sizing" the fleet, ensuring that the right replacement vehicles are purchased to meet RDBN needs;
    b. Vehicle enhancements, including drag-reduction measures, speed limiters, and lightweight trailers for solid waste transfer vehicles; and
    c. Driver training and vehicle logbook tracking, such as tire pressure checks, smooth acceleration and deceleration, and vehicle mileage.
3. **Environment**
    a. Reducing solid waste volumes and transfer trips;
    b. Increasing diversion rates, including composting;
    c. Improving long-haul truck efficiencies through aerodynamic and weight reduction measures; and
    d. Exploring a solar powered aerator at Fort Fraser sewage lagoons.

4. **Infrastructure and Utilities**

    a. Continually improving efficiencies of water and sewer systems and pumps; and

    b. Moving to metal halide or LED street lighting over time.

5. **Corporate Operations**

    a. Promoting electronic meetings where possible, including web meetings and teleconferencing; and

    b. Improving efficiency of staff trips, e.g., trip linking, working from home where trip distances may be reduced.

These steps are discussed further below and the results of this analysis are included in Key Recommendations and Implementation.

3 Reduce - Energy and Emissions Reduction Actions

3.1 Staff Energy and Emissions Workshop

Key RDBN staff was asked to review the operations and current emissions profile within their business units and to identify potential actions. In addition to actions identified by staff, based on their knowledge of RDBN assets and operations, a number of potential best practices from other jurisdictions were identified by WCS staff for applicability to the RDBN context and reviewed with staff in a workshop.

Those actions identified by staff and from best practices that best addressed the RDBN's objectives and corporate were then combined into the proposed energy efficiency and energy source actions summarized in Appendix 3 - The Corporate Energy and Emissions Plan Action Evaluation Matrix.

These actions were evaluated against a wide range of criteria established in consultation with the project steering committee. The criteria were categorized as "General Evaluation" and "Risk and Financial Criteria." Rough order of magnitude costs and benefits, or "cost class" were identified to support a business case, where possible.

3.1.1 General Evaluation Criteria

The framework was based on a number of criteria identified by the RDBN, including:

> **Emissions Reductions Potential.** Ranking from low to high, this refers to the ability of the action to reduce emissions overall.

Energy Reduction Potential. Ranking from low to high referring to the ability of the action to reduce energy use overall.

Initial Cost. Gives an indication of the cost to initiate the action (e.g., study cost or capital cost) will be low or high.

Operating Costs. Gives an indication of the ongoing costs to maintain the action will be low or high

Savings. Indicates if the action will produce a large or small savings.

Staff requirement. Does the action require a single or multiple staff resources?

Risk. Risk is generally defined as the probability of a negative event happening multiplied by the consequence of the action happening. For this criteria, risk is associated with the potential that the implementation of the action may not succeed with either significant operational or financial implications.

Flexibility. If the action is completed, does it present a flexible platform for further movement toward sustainability?

Organizational Capacity. Evaluates if the internal capacity is high or low for the action

Health Impact. Evaluates if the health implications of taking this action are negative, neutral, or positive.

Customer Service Impact. Evaluates if the action will have a positive impact or a negative impact on service delivery

Overall Assessment. This is a general assessment of whether it is reasonable to proceed with detailed study or implementation of the action... It is not a "weighted" value, as some criteria are more important than others, e.g., capital costs

3.1.2 Risk and Financial Criteria

The following additional criteria were considered related to implementation and costs:

What's Required. The basic implementation requirements and the next steps to move forward with the action.

Cost Class. In many cases, it is not possible to accurately estimate costs, as these will vary with local conditions, but an Order of Magnitude cost is given, where possible

Payback Period. This is an estimate of the simple payback period based on experience in other jurisdictions, which may vary for the RDBN.

Appendix 3 also provides a description of the ranges used for evaluation of these criteria.

3.2 Specific Energy Efficiency and Energy Supply Actions

While a wide range of actions based on staff suggestions and best practices were reviewed at the staff workshop against the established criteria and summarized in The CEEP Action Evaluation Matrix, additional details are provided on specific actions below.

3.2.1 Buildings and Facilities

There are a number of general actions that should be applied:

1. **Lighting**
    a. Replace older fluorescent lighting with T8 fixtures;
    b. Replace all incandescent lights with fluorescent lights; and
    c. Use occupancy sensors in low-use areas, such as washrooms or storage, and consider motion sensors for security lighting.
2. **Heating and Cooling**
    a. Replace zone thermostats with programmable thermostats, particularly where facilities are generally used for specific periods of the day or week, such as meeting rooms;
    b. If not converting to renewable energy sources in major buildings, upgrade low efficiency boilers and furnaces to higher efficiency over time;
    c. Consider air-source heat pumps to augment heating sources in existing buildings;
    d. Explore integrating RDBN offices with the proposed District Energy system being studied by the Village of Burns Lake. This action is discussed further below.
    e. Explore adapting the recreation centre to accommodate:
        i. A geoexchange system, perhaps with a horizontal geoexchange field in part of the nearby golf course;

ii. Upgrading Heat Recovery Ventilators (HRVs) to capture most heat from the warm, humid pool air to heat other parts of the complex;

iii. Using waste heat from the nearby ice rinks; and

iv. Consider thermal solar panels for domestic hot water in summer and for augmenting space heating throughout the year.

Figure 12 – Bulkley Valley Pool and Recreation Centre

3. Building Envelope

a. Upgrade insulation whenever building envelop repairs are done, seeking a minimum R20 in walls and R40 in ceilings;[7]

b. Replace windows over time with low-e glass with an R-value of 4 or more. Standard double pane glazed windows have an R-value of about 1.5 to 2 and single pane has an R-value of only 0.85.

c. Check and update weatherstripping on doors and windows annually;

d. Explore the use of thermal curtains or cellular shades for large windows to reduce night-time heat loss. Even if programmable thermostats reduce heating at night, energy losses through uncovered windows can be extreme. These can

[7] R-value is a measure of the capacity of a material, such as insulation, to impede heat flow, with increasing values indicating a greater capacity.

effectively double the insulation value of windows, which are generally the greatest source of building heat loss; and

e. Explore opportunities for using passive design features,8 particularly the use of landscaping (planting of deciduous trees on southern exposures) to reduce heat loads in summer while allowing passive solar gain in winter.

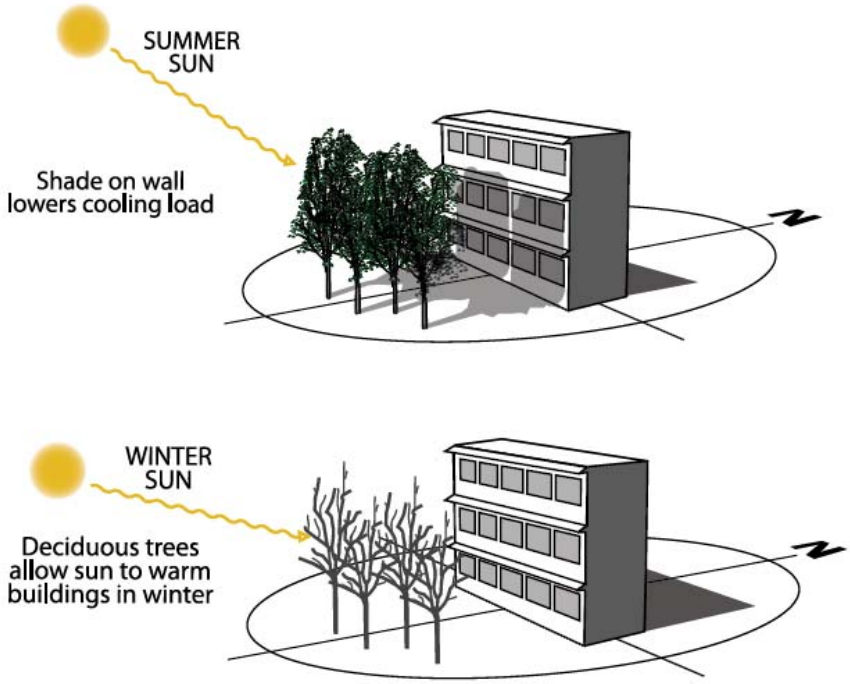
Figure 13 - Cellular Shades

Figure 14 - Solar Hot Water Panels - North Vancouver

Source: City of North Vancouver

[8] See, for example, www.vancouver.ca/sustainability/documents/PassiveDesignToolKit.pdf

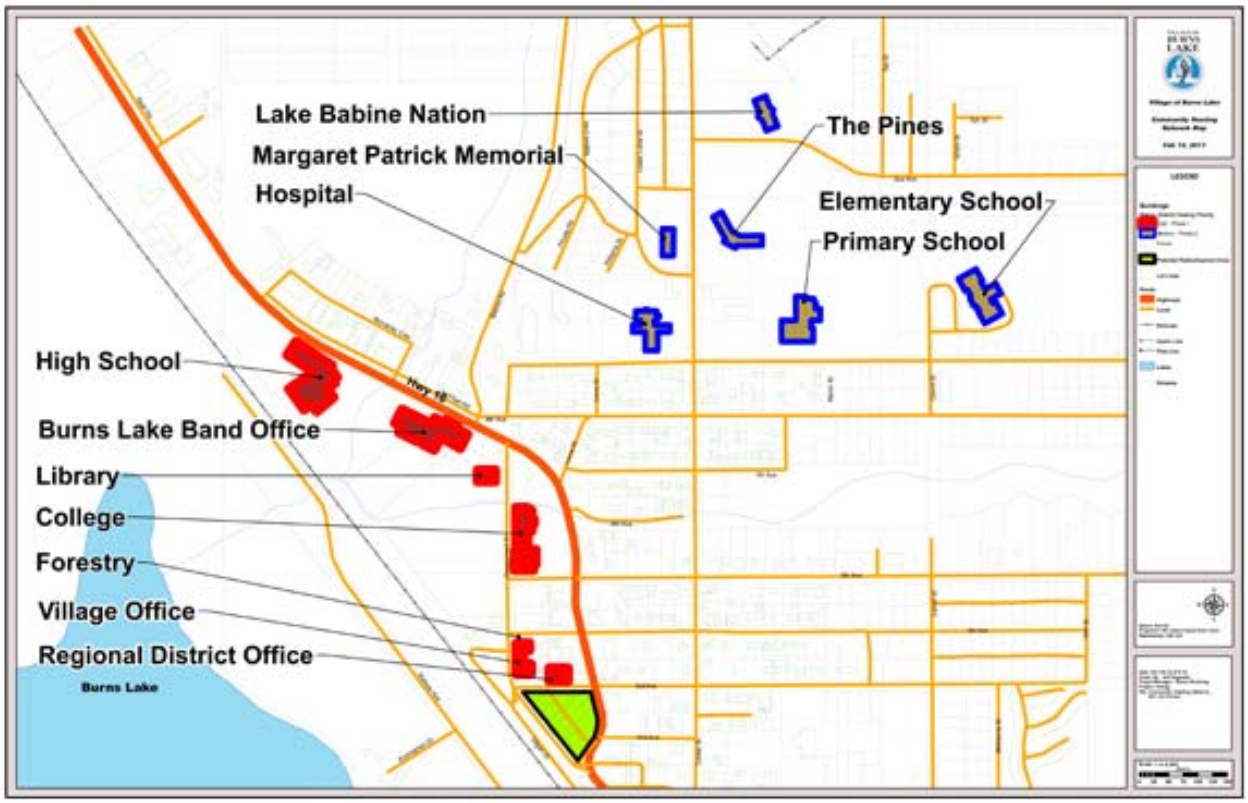
Figure 15 - Passive Design Principles



There are two major opportunities for significant energy and emissions reductions, the administration offices and the recreation centre.

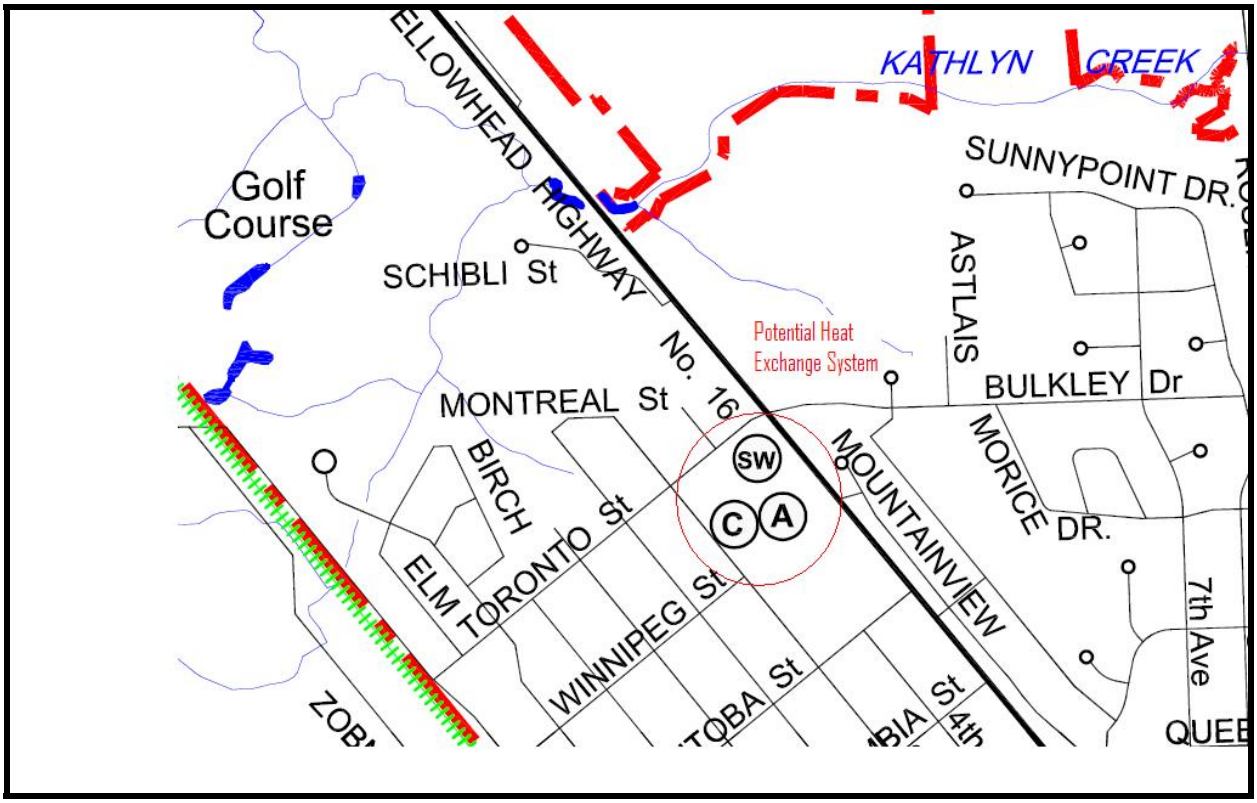
For the administration offices, while still in the pre-feasibility phase, the DE system currently being studied for Burns Lake has a number of clear advantages. The offices are in close proximity to the Burns Lake offices and other proposed sites in the DE service area there is a ready supply of low CO_2^e biomass in the region from pine beetle damaged wood and waste wood from forestry processing, which would provide a resilient, low cost energy source for the foreseeable future. There are also potential issues associated with DE, such as the capital cost, time required to engineer and implement the system and the need for integrating the DE system with a piped hydronic (hot water) system for the offices, which may require major building alterations and the installation of new physical plant such as heat exchangers. In general, district energy systems, particularly where low cost fuel is available, provide the lowest lifecycle costs while lowering GHG emissions. There is also the potential that investment in such a system could qualify for carbon offset credits for partners on the project.

Figure 16 – Proposed Burns Lake Community Heating Network



For the recreation centre, a combination of geoexchange, solar hot water panels and heat exchange with nearby ice rinks could provide the majority of heating and domestic hot water requirements for the centre. While a feasibility study would be needed to determine the cost-effectiveness of these options for the centre, the technology for heat exchange between pools and ice rinks is now common, and there are also numerous examples of solar hot water and geoexchange systems being installed in recreation centres. As for the district heating system above, there are capital costs associated with implementing these systems, but the rate of return on the investment is high, particularly if it is expected that the current centre has a long lifetime. Appendix 4 has a case study showing how these technologies were applied to upgrade the Meadow Park Recreation Centre.

Figure 17 – Potential Heat Exchange between BV Recreation Centre and Ice Rinks



3.2.2 Fleet

From the fleet profile, is appears that most driving is on highways or paved roads, with some off-road/dirt road driving. This indicates that there is an opportunity to consider using gas-electric hybrid front-wheel drive vehicles, properly equipped with snow tires and chains for winter driving, for most needs. One passenger vehicle with four wheel drive capability could be reserved for trips on rough roads and for severe winter driving conditions.

There is currently no biodiesel in use in the fleet. Some concerns have been raised by staff about the use of biodiesel in cold climates. While it is true that additional precautions need to be taken to prevent problems in winter, many jurisdictions in cold climates are using biodiesel successfully.[9] The benefits of biodiesel include improved fuel efficiency, fewer particulates in emissions, and lower GHG emissions. It is also

[9] http://www.biodiesel.org/cold/

possible to generate biodiesel from local waste products, such as used cooking oils from regional restaurants and institutions.[10]

Vehicle technologies are rapidly evolving, and hybrid versions of SUVs (Ford Escape equivalents) and light trucks (F150 and F350 equivalents) are now significantly increasing production levels, which should improve availability, reliability (e.g., for servicing), and pricing in coming years as the RDBN's fleet rolls over. Hybrid vehicles are more fuel efficient for longer, highway-oriented trips, which addresses most of the RDBN's travel needs.

One specific suggestion resulting from staff input was the potential installation of devices on the long haul truck fleet to improve aerodynamics. There are a number of options available for reducing draft and streamlining truck cabs. While the scope of this report cannot give recommendations in this area due to the technical specifications of the trucks and devices installed. In general, if a conservative estimate of fuel savings is applied, such as 5%, provides a simple payback period of 5-7 years, it would seem to be a reasonable investment.

The RDBN has not currently undertaken a fleet audit using external agency, such as the Fraser Basin Council's E3 Fleet Program, which could provide additional insights on how to optimize the mix of vehicles in the fleet and how to operate them. A simple way of improving driver habits is to circulate a memorandum to staff with driving tips, such as those available through NRCan,[11] logging all distances travelled and fuel consumed by each vehicle and driver. When there are significant differences in fuel efficiencies, staff can be reminded about how driver behaviour can make a significant difference in fuel consumption.

3.2.3 Infrastructure

While energy used in infrastructure, such as street lighting and pumps for water, drainage, and sewage is usually small compared to buildings and transportation (<~5% of total energy), there are opportunities for improvements and leadership.

Examples include switching over to LED lights and more efficient pumps when existing equipment reaches the end of its operating life.

In one significant potential saving, RDBN staff has identified opportunities with respect to using solar power for the operation of RDBN sewage lagoons in Fort Fraser.

[10] http://en.wikipedia.org/wiki/Biodiesel_production

[11] http://www.ecodriver.org/downloads/EcoDriverFuelEffDrivingTips.pdf

3.2.4 Other Corporate Operations

Business travel and meetings have been identified as significant sources of energy use and emissions from the RDBN's corporate operations. With only one transit route available in the region with minimal frequency and large distances, several actions can be used to make improvements:

1. Reducing the number of in-person meetings;
2. Use of internet technology to support remote attendance at meetings;
3. Linking trips, such as site inspections or purchases, wherever possible; and
4. Carpooling to meetings.

Web meetings allow participants to access voice and presentations images remotely. Software to achieve this, such as Fuse Meeting or GoToMeeting, has recently become increasingly affordable at under $50/month for up to 25 users. Web meetings are easy to set up and quite reliable. For closed meetings, access can be password protected.

Full, high resolution videoconferencing is more expensive and somewhat more difficult to implement, but technologies and prices are improving constantly, so it is recommended that options be revisited regularly to determine if options have become affordable. Low cost, lower resolution options for video conferencing are also available, such as Skype, which is free for two users, optionally with web cams, to communicate. This allows guest speakers to present "live" and interact with meeting participants.

Many organizations have used this technology for meetings and have successfully brought in guest speakers to address community meetings by Skype that were well received by the audience and could engage the public in Q&A. A simple version of video conferencing with multiple users is available when "face to face" contact is desired using simple web cams with Skype for less than $10/month, or $5 for a "day pass," although resolution is reduced and update time for images can be relatively slow.

Figure 18 – GoToMeeting Web Meeting Software Example

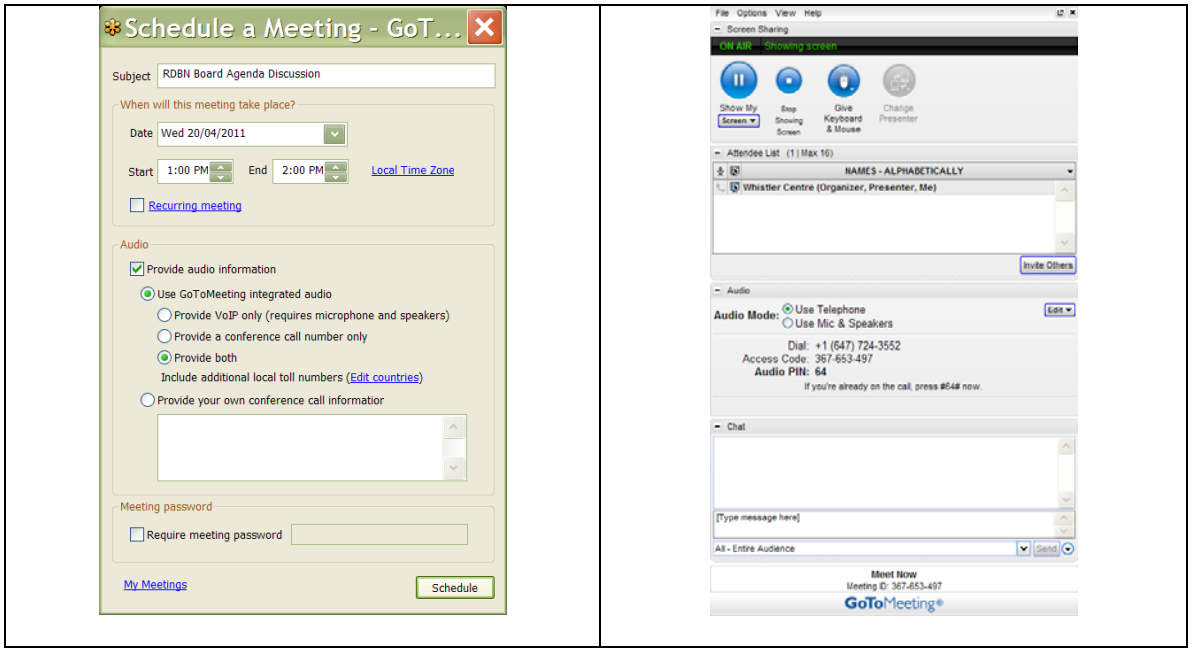
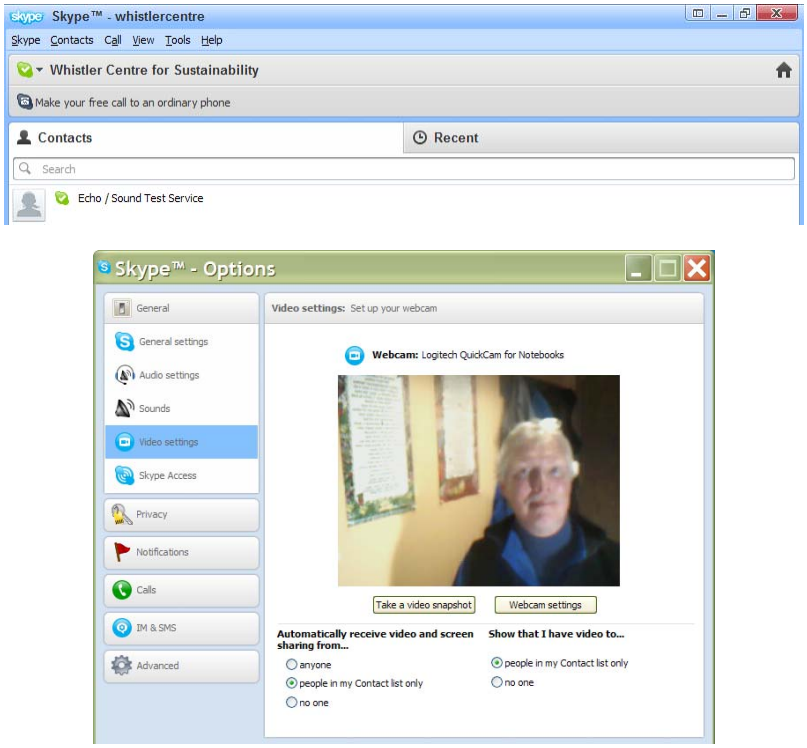


Figure 19 – Basic Video Conferencing Software



3.3 Impacts of Land Use and Facility Location

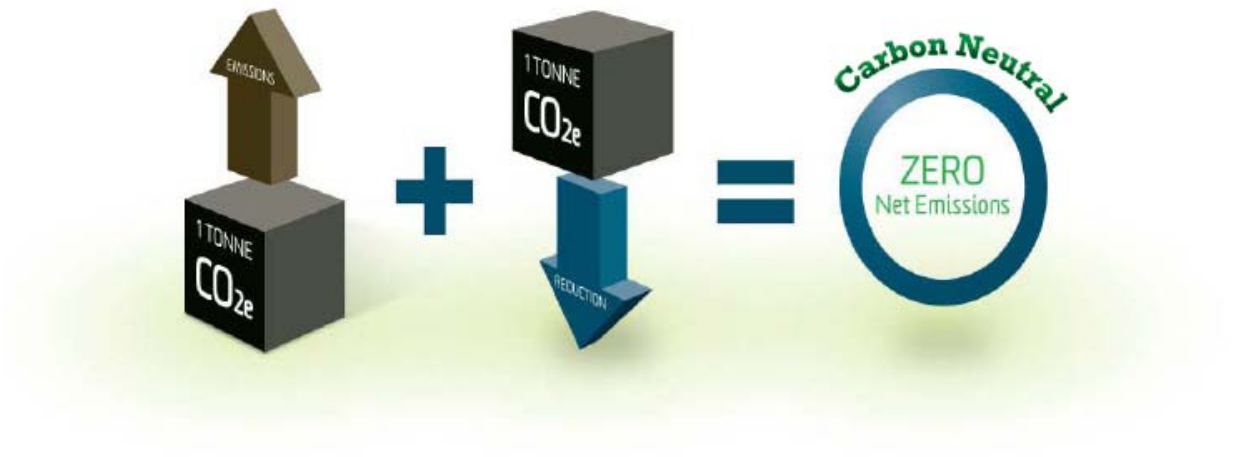
The primary impacts of land use and facility location is on the distances involved in the transfer of solid waste and business trip travel. The distance between Smithers and Vanderhoof is approximately 275 km, requiring about 3 hours of travel time. Each major community has a transfer station, and the two landfill sites are approximately half way between Burns Lake and Smithers and Burns Lake and Vanderhoof, meaning that local residents do not need to travel far to reach transfer centres, and trucks hauling solid waste do not need to travel more than ¼ of the distance between major RDBN centres. The only way that the solid waste transfer distances could be reduced would be to revert to having landfills in each community, which would increase operational costs. Besides improving vehicle fuel efficiencies, the best way to improve solid waste energy and emissions reductions is to reduce solid waste and trips to the landfills.

With administrative offices located in Burns Lake, approximately half way between Smithers (145km from Burns Lake) and Vanderhoof (130km from Burns Lake), travel time for meetings is most equitable for the single-office model used by the RDBN. One opportunity that could be explored would be the promotion of employees working from home for part of the week, particularly those who need to travel for business, such as planners and building inspectors, when site inspections are closer to their homes than the RDBN offices.

4 Offset – Acquiring Offsets to Become Carbon Neutral

In simplest terms, to be “carbon neutral” as called for in BC’s Climate Action Charter, the amount that the RDBN needs to offset is the total of current emissions plus growth in emissions minus any emissions reductions initiatives.

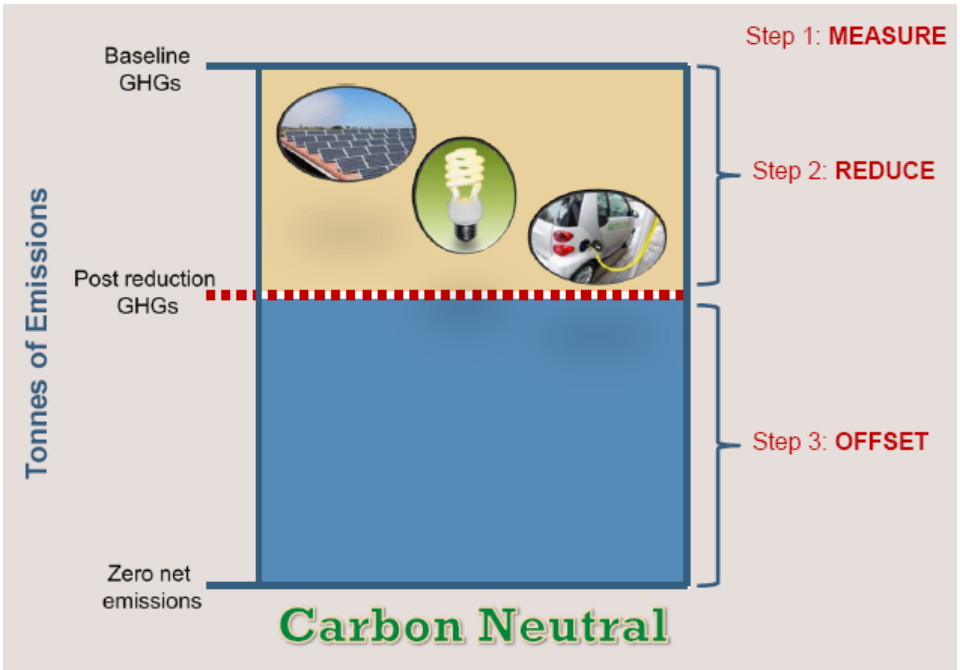
Figure 20 – Carbon Neutrality Schematic



Adapted from Pacific Carbon Trust

Offsetting is the last step in the GHG reduction process, after measuring the emissions baseline and reducing emissions as much as possible in a cost-effective manner.

Figure 21 – Steps to Becoming Carbon Neutral



Province of British Columbia

The emissions that the RDBN needs to report on relate to "traditional" local government services, which include:

- Administration and governance;
- Drinking, storm, and waste water;
- Solid waste (collection, transportation and diversion);
- Roads and traffic operations;
- Arts, recreation, parks, and cultural services; and
- Fire protection.

There are some notable exceptions of emissions which do not need to be offset, including air travel, other emergency services, and landfill emissions, but these should still be monitored and considered in order to demonstrate community leadership.

There are three basic ways to acquire offsets:

1. **Purchase** offsets from a qualified supplier that follows the requirements set by the provincial government.
2. **Finance** approved projects in the community from a list of "pre-approved" proposed by the province's Green Communities advisory committee. It should be noted that this project list is still under development and projects cannot involve RDBN assets, as any GHG reductions for these assets would have already counted as a reduction in emissions needing to be offset. The current proposed list includes:
    a. Fuel switching for vehicles, e.g., Airport fleet, police vehicles, buses;
    b. Building energy efficiency retrofits, e.g., Social housing, residential, commercial, airports;
    c. Solar hot water retrofit, e.g., Social housing, residential, commercial, airports; and
    d. Roadside side organic waste diversion, if provided in the future.
3. Developing local projects that meet the evaluation criteria and can be validated. This is a complex process that requires considerable technical expertise. In general, if an initiative cannot generate a significant reduction, (~2,000 tonnes or more of reductions per year, currently valued at $40,000/year), it may be difficult to justify project development and validation costs.

Offsets are generated from changes made to avoid or absorb (sequester) carbon dioxide (CO_2), or any of the main greenhouse gases (including methane, nitrous oxide, hydrofluorcarbons, perfluorocarbons and sulphur hexafluoride). Typically these GHG-reducing activities fall under three categories:

- Renewable energy;
- Energy efficiency, such as industrial energy efficiency or switching from oil to natural gas; and
- Emissions storage or carbon "sinks," i.e., absorbers.

4.1 Estimated Offset Requirements

BC Carbon Tax rates will increase over the next four years, based on the dollars per tonne of CO_2^e emissions, as set out below:

- July 1, 2009 - $15 per tonne of CO_2^e emissions;
- July 1, 2010 - $20 per tonne of CO_2^e emissions;
- July 1, 2011 - $25 per tonne of CO_2^e emissions; and
- July 1, 2012 and every year after - $30 per tonne of CO_2^e emissions, or roughly double the initial (2009) rate that current CARIP rebates are based on.

The most recent estimate (2009) of emissions by department and for the RDBN is:

Figure 22 – 2009 Emissions by Department

Department	Emissions (CO_2e) MT	Cost to Offset at $25/MT
Government	24.6	$ 615.00
Planning	20.5	$ 512.50
Environmental Services	319.3	$ 7,982.50
Sewer & Water (Fort Fraser)	2.7	$ 66.75
Emergency Services	8.1	$ 202.50
Street Lighting	1.4	$ 35.00
Recreation & Culture	212.2	$ 5,305.00
RDBN Total	**589**	**$ 14,719.25**

Based on current CO_2^e emissions of 589 tonnes and a conservative 10% reduction in emissions, the RDBN will need to offset approximately 530 tonnes of CO_2^e emissions after 2012 at $25/tonne, or approximately $13,250/year.

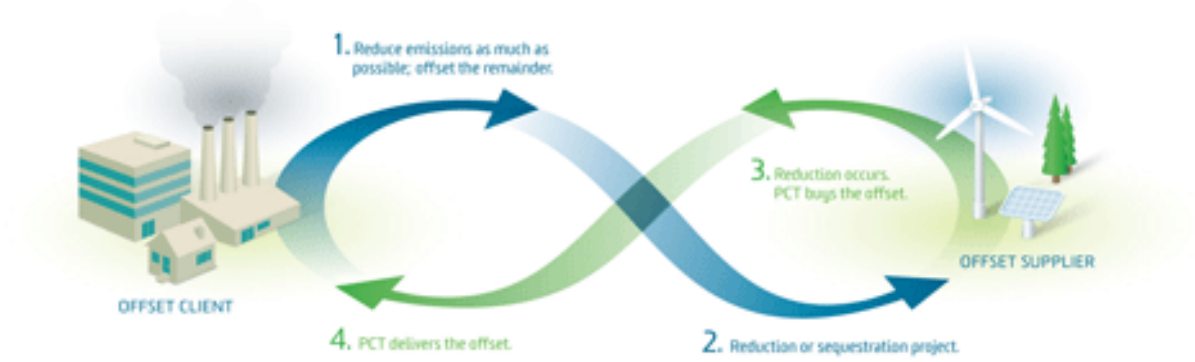
Equally important, with current energy expenditures of approximately $280,000, a 10% reduction in energy would ultimately result in savings of approximately $28,000/year in 2010 dollars, more if energy costs escalate in the future, as expected.

4.2 Current Policies and Best Practices in Carbon Offsets

In British Columbia, the guidelines for what constitutes a valid offset are defined and monitored by the Pacific Carbon Trust, a crown corporation established by the Province to ensure consistency, transparency, and a level playing field for all provincial agencies and local governments.

Standards have been established by PCT to ensure that a true, long term reduction in GHGs is achieved. All PCT offsets are in compliance with the BC Emission Offsets Regulation, ensuring real climate change solutions through high quality offsets built on recognized international standards. The process for using offsets from the PCT is:[12]

Figure 23 – Pacific Carbon Trust Methodology



There are several characteristics accepted worldwide that describe offsets of sound environmental integrity, or "high quality," – additionality, verification, permanence, no leakage and counted once. These are the basis for provincial regulation in this area.

> **Additionality** - is a test to ensure that the greenhouse gas emission offsets in question are an incremental benefit of the offset project, and not the outcome of business as usual. In other words, the project faces economic, investment or technological barriers to implementation that are overcome or partially overcome by the money from the sale of offsets.

[12] http://pacificcarbontrust.com/BCOffset/WhatisaCarbonOffset/tabid/95/Default.aspx

Verification – is an assurance by an independent third party that the greenhouse gas reductions claimed have genuinely taken place.

Permanence – refers to the ability of the project to maintain the greenhouse gas removals over time. For example, a forest that has been accounted as a carbon sink could re-release carbon into the atmosphere later if the forest burns down or the trees die, resulting in a release of methane.

No Leakage – is an unintended change in greenhouse gas emissions or removals in another location, but resulting from the project, so that the overall level of emissions has not been fully reduced.

Counted Once – this specification is required to avoid the sale of a project's greenhouse gas reduction to more than one buyer. Public disclosure of documentation for offset projects can reduce the chances of this occurring.

If the purchaser of offsets wishes to create their own projects, there is a rigorous validation process. Unless these offsets are significant, the cost of the offsets is likely to be higher than if the offsets are purchased from PCT. The advantage of the local offset approach is that investments can be made to assist local communities rather than communities elsewhere in the province or beyond.

4.3 Recommended Approach to Offsets

While the Carbon Tax is currently based on the equivalent of $20/tonne, PCT sets the price of offsets for CO_2^e reduction at $25/tonne, which is a market-based value. The Carbon Tax will go to $25/tonne in July 2011 and $30/tonne in July 2012. A number of approaches have used by BC communities for offsetting, including:

1. Purchasing offsets directly from PCT. This is the simplest, most straightforward method of acquiring offsets, but does not give the local government control over the source of offsets.

2. Purchasing offsets from PCT-recognized offset providers, which can provide local government with options over what type of offset project is undertaken, and where the project is undertaken.

3. Purchasing offsets from external providers who are certified under international standards. This allows local government the flexibility to support a wider range of projects, for example, some jurisdictions seek to acquire offsets that support poorer developing countries as opposed to supporting projects in first world countries that are far larger emitters of GHGs.

4. Purchasing offsets from a mixture of these providers. Whistler, for example, purchases approximately half of its offsets from PCT-recognized providers,

selecting projects of greatest interest, and international “gold standard” providers supporting development projects.

5. Developing validated local offsets. As discussed previously, project development and validation costs are high, and the RDBN’s offset requirements do not justify this investment, unless an identified offset project is so large that it could offer offsets to other jurisdictions and become a revenue generator.

It is recommended that the RDBN purchase offsets, either directly from PCT, a PCT-recognized provider, and/or a certified international standard provider. It should be noted that no RDBN project, such as a renewable energy project, is likely to considered as an offset, as any reduction in emissions resulting from the project would simply reduce the amount needed to offset, i.e., the emissions reductions is only “counted once.”

5 Report - Monitoring and Reporting

5.1 Potential Scenario Target Ranges

The RDBN corporate GHG inventory document noted that:

> *It is not, enough to have an emission reductions strategy without having emission reduction targets. Targets can be established in one of two ways (or a combination of both):*
>
> *• Visionary targets (or the top-down approach) - Whereby emissions reduction targets are established and then the means by which these reductions will be realized are determined.*
>
> *For example: "We want to cut emissions by 20%, how can we do that?"*
>
> *• Pragmatic targets (or the bottom-up approach) - Whereby specific reduction strategies are researched and the amount of emissions reduction associated with these strategies is determined. Then the reduction target is set according to this amount.*
>
> *For example: "If we implement reduction strategy X, we will realize a reduction of 20%therefore that is our target."*

Within the scope of this plan, it is not possible to do accurate estimations on most actions without a detailed technical study, e.g., energy retrofits to the recreation centre or changes to the vehicle fleet. Possible target ranges have, however, been identified

for each of the energy reduction scenarios described above. The actual degree to which these targets can be realized depends on how aggressively the RDBN acts on the actions identified and on the amount of financial and staff resources available. As shown above, even with current energy prices, the cumulative savings would allow for significant investments, which must be balanced against the RDBNs other priorities and risk tolerance. With anticipated major price increases expected for most energy sources, the potential savings are expected to be greater.

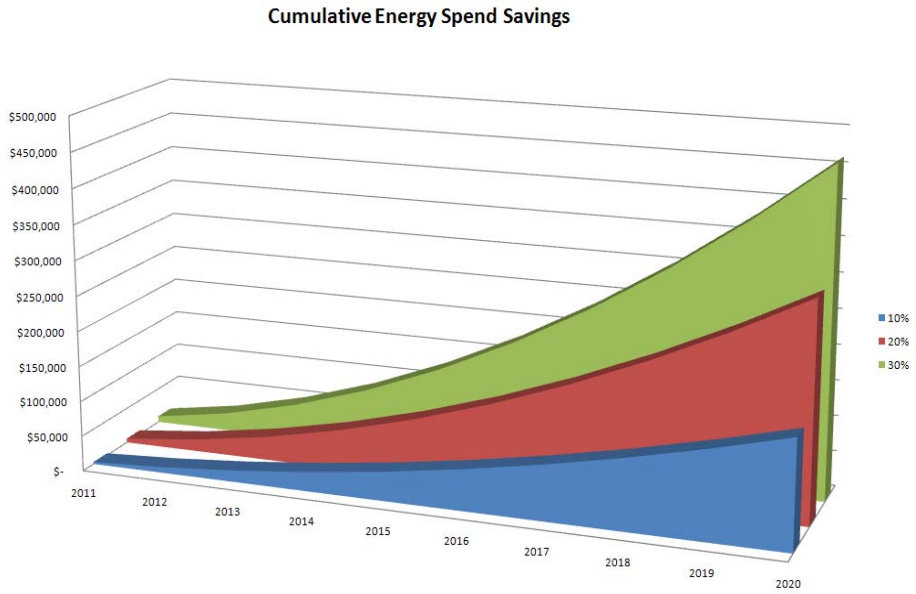
The Basics. In this scenario, if all actions are adopted, a 10% reduction in energy and emissions may be possible.

Best Practices. If combined with The Basics, a 10-20% reduction in energy and emissions may be possible, depending on the availability of capital to undertake more significant projects.

Leadership. If combined with The Basics and Best Practices, a 20-30% or greater reduction or more in energy and emissions may be possible. An aggressive waste reduction and efficiency campaign combined with a more detailed study and implementation of energy reduction and renewable energy actions at the recreation centre will be required to realize these reductions.

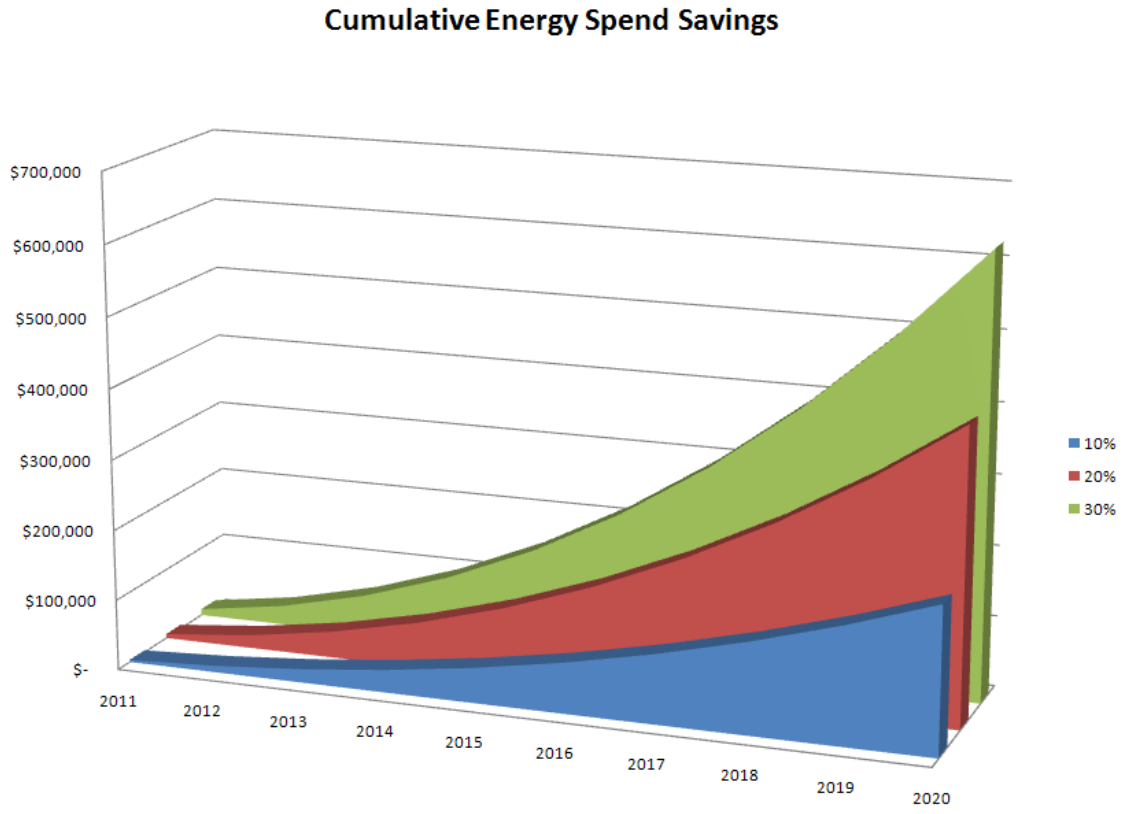
Based on these scenarios and current spending on energy, without factoring in anticipated energy price increases, we see that 10, 20, and 30% reductions in energy would result in between $100,000 and $450,000 of savings over a 10 year period.

Figure 24 - Potential Energy Savings for 3 Scenarios



If prices increase by 50% or more during the life of this plan, as is anticipated, the cumulative savings are even more dramatic.

Figure 25 - Potential Energy Savings for 3 Scenarios with Price Increases



5.2 Potential Indicators

Indicators are a key component of a successful CEEP, tracking progress and effectiveness of actions, allowing actions to be defined or refined over time to meet objectives.

Indicators should be:

- Readily available;
- Available for the long term;
- Understandable and clearly related to CEEP objectives; and
- Comparable to other jurisdictions.

Although it is not critical to track all indicators initially, key indicators should be selected and monitored regularly, and the set of indicators can be expanded over time as resources permit. The data collected in the 2009 GHG inventory, for example, can be used initially as a baseline for initial indicators.

The following potential indicators are specific to the RDBN's operations and support monitoring of the three potential energy and emissions reductions scenarios. "Primary Indicators" track key trends, while "Secondary Indicators" provide additional insight or guidance. The potential indicators have been categorized as:

- General;
- Buildings and Facilities;
- Vehicle Fleet;
- Environmental Services;
- Infrastructure; and
- Corporate Operations.

General. These are high level indicators which are useful for determining "the big picture" of overall corporate energy and emissions, but do not provide much insight into the specific determinants of energy and emissions, which are captured below for each major source of energy use and emissions. These indicators also include the % use of renewables, which is a good indicator of how the RDBN is moving towards energy resilience and lower impact energy sources.

Primary Indicators

Total Energy Use (GJ). The sum of all energy sources multiplied by their energy content.

Total GHG Emissions (tonnes CO_2^e). The sum of all energy sources multiplied by their emissions factors.

Renewable Energy (%). Percentage of energy coming from renewable sources, including hydro, biofuels, wind, solar (heating or photovoltaics), etc.

Secondary Indicators

Total Energy Costs. This indicator demonstrates how well the RDBN has succeeded in reducing energy use and moved towards more resilient, lower cost energy sources for all purposes.

Energy by Energy Source (GJ). For electricity, natural gas, gas/diesel.

GHG Emissions by Energy Source (tonnes CO_2^e). For electricity, natural gas, gas/diesel.

Buildings and Facilities. Energy efficiency and energy sources will be the primary determinants of how much energy is being used, and the environmental impacts of the energy being used.

Primary Indicators

Building Energy Use (GJ). Sum of electrical and natural gas, used multiplied by their nominal energy content.

Building Energy Intensity (GJ/m^3). Sum of electrical and natural gas used, multiplied by energy content of each source, divided by floorspace of all buildings. This is the most precise, all encompassing measure of whether energy efficiency actions, including conservation, are effective.

Building GHG Emissions (tonnes CO_2^e). The amount of each fuel type used multiplied by the emissions factor for the fuel.

GHG Emission Intensity (tonnes CO_2^e/GJ of Energy Used). This is a good indicator of success in switching to renewable and lower emission fuels. For example, if geoexchange and/or solar hot water heating is used for the recreation facilities, the same amount of energy may be consumed but emissions can be significantly reduced.

Secondary Indicators

Building Energy Costs. This indicator demonstrates how well the RDBN has succeeded in reducing energy use and moved towards more resilient, lower cost energy sources in buildings.

Energy Intensity for Major Buildings (GJ/m3). Priority buildings are administration facility and recreation centre. This allows the RDBN to more accurately track how energy efficiency actions are working for specific locations.

Vehicle Fleet. The three major factors to track and influence are how far fleet vehicles travel, how fuel efficient they are, and the types of fuel they are using.

Primary Indicators

Fleet Energy Use (litres or GJ). Sum of all fuels used multiplied by their energy content.

Vehicle Kilometers Travelled (VKT). This is a sum of odometer readings for the entire fleet, which is an indicator of how efficient staff and Board members are planning their trips, e.g., trip-chaining, seeking other alternatives, e.g., web meetings, or reducing the demand to travel, e.g., reducing solid waste volumes.

Average Fleet Fuel Efficiency (litres or GJ/100km). This indicator is a direct measure of the efficiency of vehicles in the fleet over time, as well as the types of fuels used and driver behaviour.

Fleet GHG Emissions (tonnes CO_2^e). Total of fuel sources multiplied by emissions factors.

GHG Emission Intensity (tonnes CO_2^e/GJ of Energy Used). This indicator shows how vehicle technologies and fuels have been selected to minimize GHG emissions, e.g., the use of a gas-electric hybrid for passenger vehicles will not only increase fuel efficiency, but the GHG emissions/km travelled. This indicator spurs innovation in vehicle choice, such as the use of electric vehicles for local use.

Secondary Indicators

Fleet Energy Costs (Constant (2010) $). This indicator demonstrates how well the RDBN has succeeded in reducing energy use and moved towards more resilient, lower cost energy sources for vehicles.

Vehicle Kilometers Travelled, by Trip Purpose and/or Business Unit (VKT). This indicator provides more insight into how the RDBN conducts business in specific areas, such as building inspections, solid waste management, or board meetings.

Environmental Services. A major determinant of energy and emissions is the number of trips required to transfer solid waste to landfills and recycling facilities.

Primary Indicators

Total or Per Capita Solid Waste (tonnes or m^3). This is a clear indicator, by weight and/or volume, of how much waste is being produced that needs to be transported, and the impacts of information and awareness campaigns, and possibly regulation, on individual behaviours.

Solid Waste Diversion Rate (%). In addition to the total amount of solid waste produced, the more materials that can be reused, recycled, or composted, the less there will be that needs transport to landfill.

Organics in Solid Waste (%). This is a good indicator of the effectiveness of efforts to encourage residential and business composting and to reuse other organics, such as paper or waste wood, for other purposes. This indicator will also reflect the volume of solid waste that needs to be transported and methane reductions from landfills.

Infrastructure. These indicators are related to lighting, water, drainage, and sewer system operations.

Primary Indicators

Infrastructure Energy Use (GJ). Sum of all energy used for street lighting, pumping, water systems

Infrastructure GHG Emissions (tonnes CO_2^e). Sum of all energy sources used for infrastructure multiplied by emissions factors.

Corporate Operations. A major operating budget item is for staff and board travel.

Primary Indicators

Total Remote Meeting Attendance (%). This is the number of persons attending meetings remotely, through methods such as teleconferencing or web meetings. With the increasing availability, quality, and cost-effectiveness of technologies for web meetings, the need for face-to-face meetings is reduced. An alternative measure would be the average VKT/person-meeting, i.e., the average distance that meeting attendees are travelling to attend meetings.

Website "Hits" for Energy and GHG Emission Reduction (#). This indicator demonstrates the effectiveness of outreach and awareness campaigns aimed at residents and businesses to reduce their energy use and emissions.

Secondary Indicators

Remote Meeting Attendance, by Meeting Type (%). Persons attending meetings remotely by type of meeting, including Board meeting, staff meetings, or public meetings.

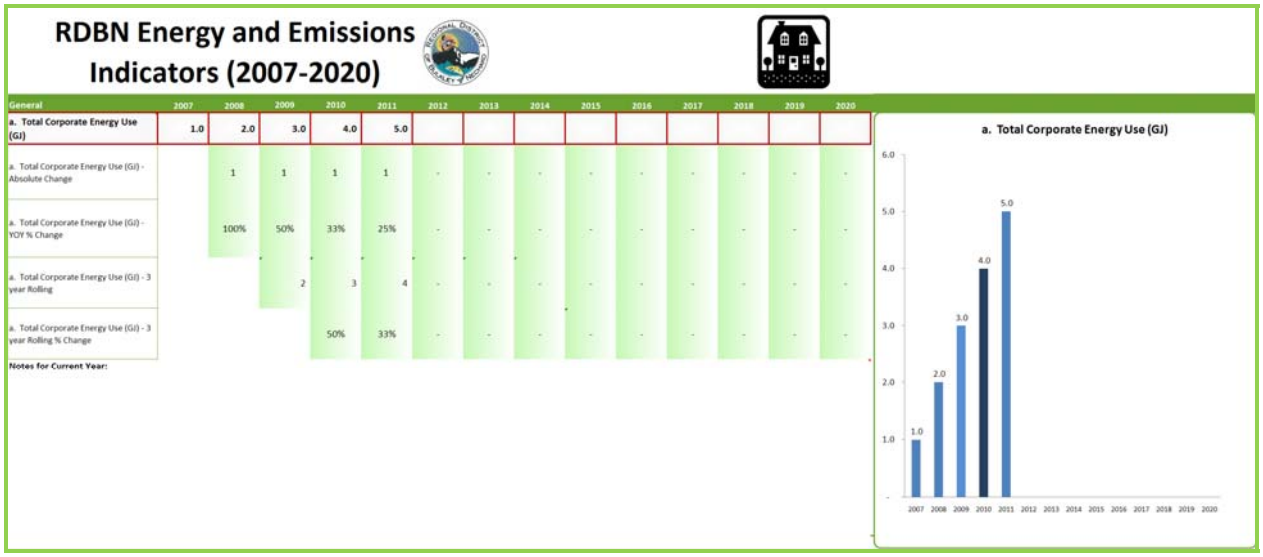
5.3 Proposed Monitoring and Reporting System

Most of the recommended indicators should be either readily available within RDBN records, easily calculated from available data, or constitute best management practices and should be measured, such as diversion rates for solid waste. One indicator that may currently be considered to be non-traditional, but is rapidly being monitored by many organizations, is the energy and emissions reductions due to the use of alternative meeting methods, which requires meeting attendance to be recorded by method (in person or remote), and the VKT, energy, and emissions savings resulting from attending remotely.

The provided monitoring and reporting system spreadsheet includes all recommended indicators, along with data entry sheets up to 2020, trend representations using several methods, and a graphical representation of trends. These can be easily copied for use in RDBN reports or the regional district web site.

Figure 26 – Monitoring and Reporting System Home Page

Figure 27 – Monitoring and Reporting System Data Entry Page



It is recommended that the trends for these indicators be measured and reported on annually, along with a summary of actions being implemented to influence them. Annual action planning should be undertaken with representatives of all departments to review energy and emission trends, the effectiveness of actions, and the refinement of existing actions or introduction of new actions.

6 Summary and Conclusions

The Corporate Energy and Emissions Plan has identified that energy is a significant component of the RDBN's budget and that the organization is highly dependent, as most local governments in BC, on non-renewable energy sources that are expected to increase rapidly, consuming a greater portion of the budget. At the same time, the fossil fuels used for building heating and transportation are contributing to the Greenhouse Gases that have been identified as a major cause of climate change, which has seriously impacted the region.

To show leadership on climate action, as well as to reduce energy costs and move towards greater energy resilience, a number of energy and emission reduction actions have been identified in the CEEP. In the short term, the RDBN will not be carbon neutral,

and so will need to purchase about $13,250 of carbon offsets in order to meet its commitments under BC's Climate Action Charter, assuming a 10% reduction in energy consumption. It is recommended that the RDBN purchase these from the Pacific Climate Trust or other approved supplier rather than attempt to develop its own approved offsets, which can be a costly process.

The good news is that the required carbon offset purchase will be largely offset by the province's Climate Action Revenue Incentive Program rebate, and even modest savings in energy from the application of identified actions should be significantly greater than the cost of offsets. The cumulative savings from energy efficiency actions will help in funding major capital programs, which will result in even greater savings in the future. The rough order of magnitude cost and payback period for identified actions is given in the CEEP Action Evaluation Matrix.

6.1 Key Recommendations and Implementation

As a result of a review of evaluation criteria and additional analysis, a package of actions for each of the three scenarios was identified. To realize potential energy and emissions reductions, the RDBN will need to confirm which actions they wish to proceed with and how quickly they wish to proceed based on organizational capacity and resources.

Some actions will clearly need additional study, such as major renewable energy upgrades to the administration offices or recreation centre, before the full cost-benefit and payback period can be determined, while other investments will depend on available capital budgets. In all cases, a simple but effective analysis of proposed actions using the provided Lifecycle Energy Cost-Benefit Quick Analysis Tool can help confirm if the payback period for investments is acceptable. A sample of this analysis is shown in Appendix 5.

Figure 28 – Summary of Recommended Actions

Step One: The Basics

Department	Number	Action	What is required?
Government (1000)	G1	Measure, monitor, and report GHG emissions each year, by source and department.	Continue with the reporting format that has already been established by the RDBN. Staff time will need to be allocated annually to amalgamate the fuel consumption data for all areas of the corporate inventory.

	G2	Monitor energy performance of current and upgraded facilities.	Break down the energy performance information of each building in its inventory and compare the results against the expected performance at the time of upgrades. This could be an addition to the RDBN's annual energy and emissions inventory.
	G3	Implement an anti-idling policy.	Complile information from other regional districts (for example, RDOS) with anti-idling policies and draft a policy that fits the requirements of the RDBN. Distribute the draft policy to staff for feedback, and have the final version passed by the RDBN Board.
	G4	Use electronic communications, and teleconferences and web meetings for meetings that do not require face to face format.	Staff will need to research the technological options that meet the needs of the RDBN's geographical constraints. Options range from having web cameras purchased for all staff and director computers up to creating a videoconferencing facility.
	G5	Promote use of locally recycled and reused goods by RDBN.	Best practices suggest to begin with using recycled paper in all operations. An inventory of common goods purchased by the RDBN will be necessary to identify the possibility of using recycled goods were they are currently not being used. A draft policy will be the next step and/or incorporation into an exisitng or new RDBN purchasing policy. If feasible, this should be led by a group of RDBN staff who are involved in purchasing decisions.

	G6	Evaluate alternative energy or innovative technologies as purchasing criteria at the time of all major equipment replacements.	Alignment with the Public Sector Accounting Board (PSAB 3150) is recommended. There are three major steps for implementing PSAB 3150: 1. Inventory; 2. Valuation; and 3. Amortization. Before valuation and amortization can be determined, it is necessary to establish the useful life of each tangible capital asset. Full details of the process are found in the PSAB Guide to Accounting for and Reporting for Tangible Capital Assets.
	G7	Incorporate carbon costs into general accounting procedures for each department to improve accountability and encourage innovation.	Update accounting software to accurately reflect the cost of carbon in each RDBN department. Standard reporting templates and procedures need to be developed.
	G8	Identify funding partnerships with BC Hydro, Tersasen, the Community Energy Association, the Province, federal government, and others.	Check BC Hydro's Business Program Eligibility tool and other available funding sources to determine the energy saving programs available to the RDBN.
	G9	Adopt a policy for energy efficient office behaviour, in all facilities - e.g. turning off lights and computer monitors in offices, applying energy saving settings for computers	Compile some best practices information in energy efficient office behaviour and draft an office policy that meets the needs of the RDBN's circumstances. Common practices include: placing reminders around the office to turn off lights and computers while not in use up to purchasing and installing software to automatically power down equi pment when not in use.

Environmental Services (5000)	E1	Establish a procedure for the full life cycle analysis of various vehicle options at the time of purchase.	Evaluate the expected uses and fuel efficiency of new vehicle options at the time of purchase, to determine the vehicle with the lowest energy use and emissions that meets the RDBN's needs.
	E2	Conduct driver awareness and training program for fuel efficiency and monitor fuel efficiency for each vehicle.	Formal training can be done or staff can be referred to a number of online information sources or courses. Log books will need to be maintained for each vehicle with records of trip purpose, origin, destination, distance, and driver.
	E3	Evaluate compactor technology at transfer stations to achieve greater densities and less hauling requirements to east and west area landfills.	Investigate and acquire energy efficient compactors to reduce volumes and associated necessary trips.
	E4	Region-wide education and awareness campaign of the benefits of composting programs to reduce solid waste volumes and methane.	A number of education and awareness campaigns can be easily adapted. Workshops can be held to introduce kitchen and backyard composting techniques combined with Bear Aware messaging.
	E5	Corporate and community solid waste reduction outreach and awareness campaign including reduce, recycle, reuse strategies.	Due to the geographic size of the RDBN and the unknown drivers of waste, an implement of further waste reduction strategies will reduce waste in the region and transportation costs and emissions.
Water + Sewer (6000)	W1	Investigate installation of solar powered aerator at Fort Fraser sewage lagoons.	A study will need to be conducted of costs, benefits, and suitability of the technology for the RDBN climate.
Recreation + Culture (10000)	R1	Investigate utilizing waste heat from arena for heat BV Pool.	A study will need to be conducted. Many precedents exist of heat recovery systems for arenas and pool complexes.

	R2	Investigate solar hot water heating options for BV Pool.	A study will need to be conducted. The Resort Municipality of Whistler worked with BC Hydro and commissioned an Energy Audit of Meadow Park Sport Centre (MPSC), resulting in a renewable energy retrofit using solar hot water panels and geoexchange. MPSC was chosen for the study as it had the highest cost of heating per square foot, and was the building with the highest source of emissions in the corporate inventory. The study cost $10,000-$20,000.
	R3	Investigate geoexchange heating options for BV Pool.	A study will need to be conducted. The Resort Municipality of Whistler worked with BC Hydro and commissioned an Energy Audit of Meadow Park Sport Centre (MPSC), resulting in a renewable energy retrofit using solar hot water panels and geoexchange. MPSC was chosen for the study as it had the highest cost of heating per square foot, and was the building with the highest source of emissions in the corporate inventory. The study cost $10,000-$20,000.
	R4	Insulation upgrades and energy efficiency actions for administration offices and BV Pool.	Ongoing upgrades.

Step Two: Best Practices

Department	Number	Action	What is required?
Government (1000)	G10	Adopt a purchasing policy to include the most energy efficient equipment available with a simple payback of 5-7 years or less within available capital budgets	Research sustainable purchasing policies for Local Governments, beginning with examples such as the Resort Municipality of Whistler. In order to maximize the GHG reduction benefit, the purchasing policy will need to factor carbon accounting. It is recommended that a group of RDBN staff guide the creation of the purchasing policy. The RDBN Board will need to approve the final version.
	G11	Consider installing air source heat exchangers for administrative offices if Burns Lake community Heating Network is not technically or economically feasible.	An HVAC study will need to be conducted to determine how to combine the system with existing heating sources. If Burns Lake district energy system shown to be feasible, air source heat exchangers would be redundant.
Environmental Services (5000)	E6	Explore biodiesel options for the RDBN diesel fleet.	Staff time will be required to research biodiesel use in other regions with similar cold climates.
	E7	Conduct a full E3 Fleet evaluation and implement recommendations.	E3 is a national program that all fleets with all types of vehicles can join. A fleet can become a member to access system resources and later choose to take the next step by having a detailed fleet review of its operations. After a fleet review has been conducted, a fleet can apply for a “green rating” in which an independent auditor will conduct an in-depth review of a fleet’s operations against the E3 Rating Guidelines.

	E8	Modify trucks with fuel saving actions, i.e., lightweight trailers and roof and side fairings.	Add fuel saving devices to vehicles.
	E9	Investigate region-wide composting programs to reduce solid waste volumes and methane emissions from the landfill.	The RDBN will need to conduct a study on the feasibility of composting in the region and potential methane reduction, which could be accepted as a carbon offset.

Step Three: Leadership

Department	Number	Action	What is required?
Government (1000)	G12	Investigate remote electronic meeting technology for most (50-75%) of meeting attendance.	Implementation of the recommendations from staff research on videoconferencing options.
	G13	Investigate advanced electronic meeting and/or videoconferencing equipment.	Implementation of the recommendations from staff research on videoconferencing options.
	G14	Connect administrative offices or with Burns Lake community Heating Network, if available.	Offices would need to be adapted to accept the hot water source distributed by the system.
	G15	Install governors on RDBN vehicles, particularly long-distance trucks, to disallow speeding and minimize fuel use.	Governors will need to be purchased and installed in all fleet vehicles. A set maximum speed will need to be agreed upon.
Environmental Services (5000)	E11	Use biodiesel in the RDBN fleet as local fuel sources become available.	Fleet adaptation and fueling facilities will be required.
Water + Sewer (6000)	W1	Install solar powered aerator at Fort Fraser sewage lagoons.	Replacement of aerator.

Recreation + Culture (10000)	R5	Complete a renewable energy retrofit for the recreation centre (using solar hot water, geoexchange, and/or waste heat recovery system).	An energy study will be required.

7 Appendices

Appendix 1 – Summary of RDBN Operations

Appendix 2 – Corporate GHG Emissions Inventory

Appendix 3 – CEEP Action Evaluation Matrix

Appendix 4 – Whistler Meadow Park Sports Centre Case Study

Appendix 5 – Lifecycle Energy Cost-Benefit Quick Analysis Tool