# 4. Appendices

## Contents

**Appendix A: Technical Description of Modeling Methodology ..... 3**

**Appendix B: Modeling Performance Assumptions ..... 13**

**Appendix C: Low Carbon Community Pledge ..... 21**

**Appendix D: Sustainability Checklist Recommendations ..... 25**

**Appendix E: OCP Amendment ..... 26**

**Appendix F: Engagement Event Attendees ..... 29**

**Appendix G: Building & Business Sector – Key Comments ..... 31**

**Appendix H: Tools to Support Green Buildings ..... 36**

**Appendix I: Select Resources ..... 41**

# Appendix A: Technical Description of Modeling Methodology

## Introduction to Modelling GHG Emissions

Future energy use and GHG emissions that result in Nelson from the implementation of the policies and actions that comprise the *Low Carbon Path* were forecasted using a dynamic model developed by HB Lanarc called CEEMAP.[1] CEEMAP was created specifically to assist local governments with the task of GHG target setting and policy development. CEEMAP is comprised of four integrated modules: land use-transportation, buildings, solid waste, and agriculture and ecosystems. Within these modules, spatial analysis using ArcGIS and spreadsheets are used to model the effect of various land use, urban form and transportation changes, green building measures and other emission reduction measures over selected time periods (in this case 2007 to 2040).

Forecasting future emissions is challenging due to the number of factors that influence GHG emissions, the interrelationship of some of these factors and the difficulty in estimating how these factors will change with time. GHG modelling is complicated by the fact that long-term emission reductions usually occur in the context of population and economic cycles, an aging building stock, various rates of building replacement and renovation, and the progressive improvement in technological efficiencies. Further complicating the task is considerable uncertainty about the introduction of federal and provincial policy and legislative changes and regional transportation investments. In other words, forecasting energy and emissions should not rely on static assumptions; rather, it should take into account dynamic changes over long time periods. This is what CEEMAP does.

## CEEMAP – Land Use and Transportation

The effect of land use features—such as where people live, work, shop and play—and the characteristics of the local and regional transportation patterns—including the type of cars on the road, how much people drive, walk, cycle and take transit, and the incentives/disincentives for doing each—all combine to determine the amount of energy used and the GHG emissions that are emitted. Research from communities big and small across North America have resulted in the quantification of the relationships between these numerous variables. These relationships were taken into consideration when building CEEMAP. The energy used and GHG emissions emitted as a result of the land use and transportation sectors in the future can be simplified into two main components:

- the distance that vehicles travel expressed in terms of annual **Vehicle Kilometres Traveled** (VKT) and
- the fuel efficiency of the vehicles on the road, or the **Vehicle Tailpipe Emissions** rate.

There is uncertainty involved in calculating both, but by using known relationships and accepted assumptions that impact a) how much people drive and b) the vehicles that they choose to drive, a defensible and transparent forecast of transportation sector emissions can be made.

In its most simple form the land use-transportation sector emissions are calculated according to the formula:

> Total Annual Vehicle Kilometres Traveled **X** Average Vehicle Tailpipe Emission Rate (expressed in terms of grams $CO_2e$ / kilometre) = Total Annual Transportation Emissions (Tonnes $CO_2e$)

[1] Community Energy and Emissions Modeling and Planning tool

These two components are explained below.

### Forecasting Vehicle Kilometres Traveled

#### Key Input Data

There are two key data sources that are crucial inputs to forecasting transportation emissions in CEEMAP:

1. 2007 Community Energy and Emissions Inventory (CEEI) Report. The CEEI draws on the following key data sources:
    - Number of registered vehicles in Nelson, by vehicle type
        - Insurance Corporation of British Columbia (ICBC)
    - Vehicle kilometres traveled, by vehicle type in Nelson
        - Generated from a CEEI model that uses registration data from ICBC, regional fuel sales data and data from the Metro Vancouver AirCare vehicle emission testing program
    - Commute-to-work transportation mode split in Nelson
        - 2006 Census

2. Feedback from stakeholders, staff and a review of previous reports about Nelson:
    - Location of key destinations that residents travel to in the City of Nelson
        - Parks
        - Schools
        - Grocery stores
        - Retail stores
        - Commercial services
    - General Commuting patterns of Nelson residents
    - Local bus routes and service intervals
    - Regional bus routes and service intervals
    - Kootenay Ride Share ridership numbers and patterns
    - Biking and walking infrastructure and activity

#### Calculation Overview

**Baseline**

1. The locations of residences and key destinations was represented spatially in the model
2. For each neighbourhood, the average distance between homes and key destinations was calculated.
3. Annual baseline VKT is divided among the different trip types, resulting in VKT for each trip purpose.

**BAU Forecast**

4. Business-as-usual (BAU) VKT is forecasted for the year 2040 by multiplying the number of projected homes by the average household VKT for the baseline year.
5. Vehicle tailpipe emissions are estimated by projecting current trends in vehicle sales and committed policy changes at the provincial and federal level.

**Low Carbon Path Forecast**

6. Future residential and commercial growth in Nelson, as determined by Nelson staff, is spatially entered into the model and the average distance between the homes in each neighbourhood and each of the key destinations is recalculated.
7. Annual baseline VKT is divided among the different trip types, resulting in VKT for each trip purpose.
8. The impact of land use and transportation strategies on VKT is estimated by consulting peer reviewed literature and case studies on the impacts of strategies.

9. The impact of development and redevelopment in the community on VKT is calculated by looking at the change in average distance between homes in each neighbourhood and key destinations. The change in distance affects the mode of transport that people are likely to use and can be quantified based on known thresholds.
10. A sub-module of CEEMAP forecasts the average tailpipe emission rate of vehicles (roughly equivalent to their efficiency) in Nelson based on local, provincial and national data. These values are multiplied by VKT to achieve annual GHG emissions.

### Detailed Calculation Steps

A more detailed description of the data used and the calculation steps for the land use and transportation VKT and GHG emission results are presented in the following sub-sections.

#### Key Destinations and Trips

Based on data of typical travel patterns in small towns,[2] local input from Nelson, and the Nelson Active Transportation Plan, the types of trips that Nelson residents take were divided into the following key destination categories:

- Work in Nelson
- Work outside of Nelson
- School
- Groceries
- Retail shopping
- Other commercial services (dentist, hardware store, doctor, etc)
- Parks and recreation

All key destinations and the location of homes were then mapped and the distances calculated using the road and sidewalk network. Results were categorized by neighbourhood. For key destinations that are an average distance of less than 800 metres from homes in a neighbourhood, it is assumed that people walk or cycle. If the average distance is greater than 800 metres, it is assumed that people drive or take transit.[3]

#### Work Travel

The number of work trips were estimated by taking into consideration the number of households, vehicle ownership and typical working days in a calendar year. Half of the workers in Nelson were assumed to commute to jobs outside of the City (this includes university students). The average travel distance for commuters that work outside of Nelson was assumed to be 45 km (the distance from Nelson to Castlegar).

#### Non-Work Travel

Trips to key destinations other than work were determined using a weighting system reflective of the travel patterns of a typical household and trip-chaining behaviour (multiple destinations combined into one trip). Trips to school were excluded from this list because it was assumed that the majority of students ride the bus, walk, or bicycle. The following table is a summary of the weighting:

---

[2] References include:

- Transport Canada, "Sustainable Transportation in small and rural communities", Urban Transportation showcase program: sustainable transportation, Issue paper 61, 2.
- Hannah Twaddell and Dan Emerine (2007), Best Practices to Enhance the Transportation-Land Use Connection in the Rural United States, NCHRP 582, Transportation Research Board; http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_582.pdf.

[3] See the Victoria Transport Policy Institute for supporting evidence for the selection of 800 metres as a threshold for walking distance: http://www.vtpi.org/tdm/tdm63.htm; and Alliance for Biking and Walking (2010). *Bicycling and Walking in the U.S.: 2010 Benchmarking Report*, Alliance for Biking & Walking, (www.peoplepoweredmovement.org); at www.peoplepoweredmovement.org/site/index.php/site/memberservices/C529.

| Destination | Trips per Week, One Way | Trip Chaining Modifier |
|---|---|---|
| **"Other" Trips to Downtown** | 6 | 0.5 |
| **Trips to Parks/Recreation** | 6 | 1.0 |
| **Trips to Local Services** | 6 | 0.5 |
| **Trips to Local Retail** | 8 | 0.5 |
| **Trips to Local Food Store** | 6 | 0.75 |

The distance from each household to each key destination is precisely known through mapping using a Geographic Information System (GIS). Average distances were calculated for each neighbourhood and then multiplied by the number of trips to produce total VKT for each neighbourhood, by trip type.

### Reduction in VKT due to Low Carbon Path Strategies

Numerous complex factors determine individuals' travel patterns and mode choice. Likewise, the factors that determine the success of a strategy are also large in number and can be influenced by the City of Nelson and partner organizations by varying degrees. At the stage of planning for this Plan, there is not sufficient detail to be able to predict with any accuracy the impact of the strategies in the Low Carbon Path. In the future, when level of funding, major program design features and other elements have been defined, the impact on emission reductions can be updated. Through consulting case studies that encompass a range of community contexts and program design elsewhere, rough estimates for the impact of each strategy have been made.[4]

#### Distance to Key Destinations

Future land use in Nelson will change the average distance of a household to key destinations, for each neighbourhood. These changes were quantified with a GIS using spatial locations of homes and destinations.

#### Work Trips outside of Nelson

VKTs from work trips outside of Nelson were estimated to be reduced by the following strategies:

- Improved regional transit service – 10% VKT reduction
- Increased participation in ride share services – 10% VKT reduction

#### Key Destination and Works Trips within Nelson

- VKTs from work trips within Nelson were estimated to be reduced by the following strategies:
- Transportation demand management programs (parking, pathways, amenities, facilities) – 5% VKT reduction
- Improved local transit service – 5% VKT reduction

### Vehicle Tailpipe Emission Rate (Fuel Efficiency) Forecast

The second major part of forecasting land use-transportation emissions is creating a defensible estimate of the fuel efficiency of vehicles driven by Nelson residents and businesses in the future. Vehicle efficiency in a community is primarily determined by provincial and federal policies that set limits on vehicle tailpipe

[4] Victoria Transport Policy Institute (2011). "Evaluating Non-Motorized Transport" in the *TDM Encyclopedia.* http://www.vtpi.org/tdm/tdm63.htm

emissions, as well as personal preference largely based on lifestyle choice; city policies and programs have a lesser impact.

Modelling the change in on-road vehicle emissions involved combining empirical data on trends of vehicle sales in BC, the age of vehicles on the road and the distribution of kilometres traveled among vehicle types in Nelson and the vehicle emission standards that the BC provincial government has proposed for the years 2011 to 2020, which are based on the legislated standards in California. The following assumptions were used:

- The average age of scrapped cars in future years will be the average age of all cars on the road. In recent years the average age of cars when they are scrapped has been increasing, as the quality of cars has been increasing. At the same time, scrapping rates for older vehicles is likely to increase in the future as more aggressive incentive-based programs are rolled out in order to take older, polluting vehicles off of the road. Nelson could be an outlier in this regard, judging from the CEEI baseline data on vehicle fuel efficiency.[5] Local social marketing programs could be effective in bring Nelson closer to the provincial average.

- In 2007, diesel fuel accounted for approximately 5% of energy expended for passenger transportation in Canada. Because of a lack of data on the stock and sales of diesel vehicles, the effect of the change in fuel efficiency of diesel vehicles on the fleet average fuel efficiency has been excluded. The proposed vehicle emission standards affect all new vehicles sold, including gasoline, diesel, grid-charged battery electric vehicles and all other alternative fuelled vehicles.

- Vehicle sales and the stock of vehicles on the road will follow the same trend line as 2004 to 2006 until 2020, except for light trucks, which will grow at 1% per year. At that point, stock and annual vehicle sales will remain constant.

- From 2008 onwards, it will be assumed that the proportion of kilometres traveled among the vehicle classes will be the same as the proportion in 2007.

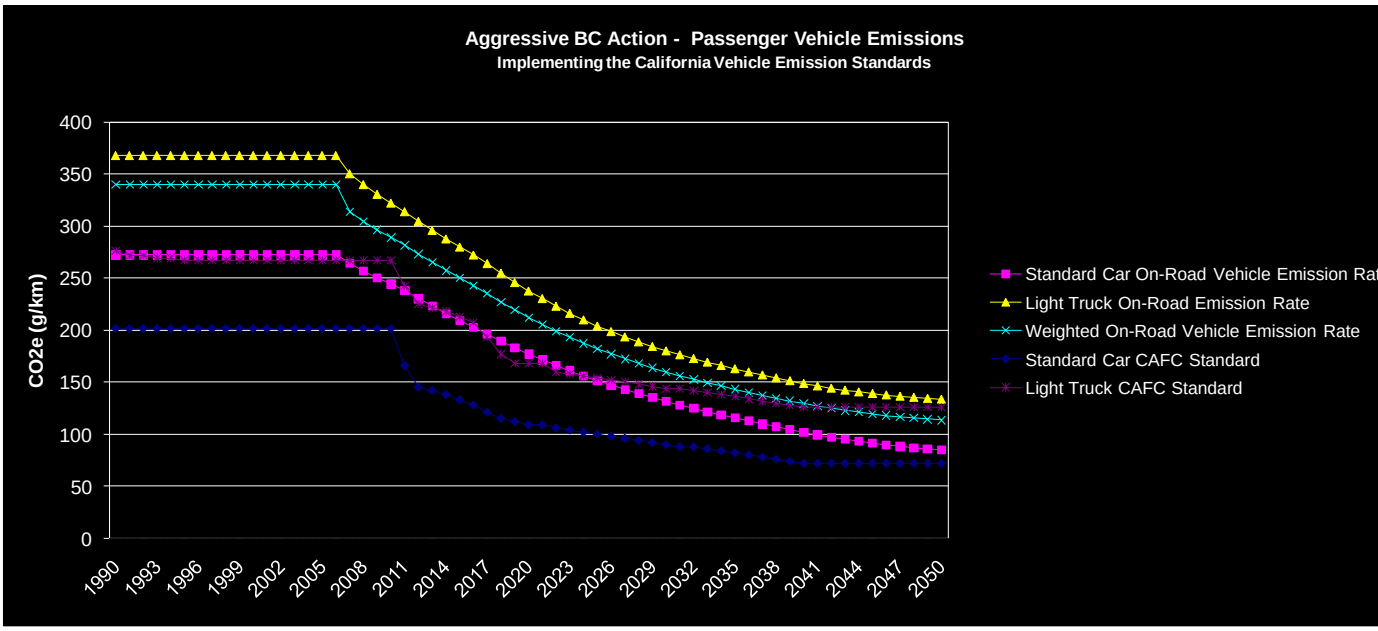
- From 2021 to 2040, vehicle fuel efficiency standards will increase at the same average annual rate as 2011 to 2020. As the policy future beyond 2020 is anything but certain, the increased fuel efficiency that occurs in this time frame could be attributed to other factors including rising oil prices, the implementation of a higher carbon tax or cap-and-trade regulation regime. Under any of these scenarios, the emission reductions shown in the model from 2021 to 2040 should be considered at the most ambitious end of the spectrum of the range of action that the provincial or federal government could take. We have chosen to model this scenario in order to illustrate the likely maximum reductions that could be achieved by provincial/federal action on vehicle emission rates.

- From 2041 to 2050, we have assumed that the vehicle fuel efficiency standards will be the same as 2040.

- From 2011 to 2050 the proposed emission standards will be met. This will require that the vehicle manufactures produce vehicles that have a lab-measured emission rate at the standard and new car buyers purchase the lower emission vehicles.

[5] In 2007, the average fuel efficiency of passenger vehicles in Nelson was 14.5 litres / 100 km, as compared to 13 litres / 100 km for British Columbia.

Figure 1 - Vehicle Emission Rates in Nelson, from historical data and Proposed Vehicle Emission Rate Standards [6]




- The "Weighted On-Road Vehicle Emission Rate" is the value that was used to calculate GHG emissions from VKT. For 2007, 339 g $CO_2$e/km was used (14.5 litres/100 km). In 2020 the weighted average is predicted to drop to 212 g $CO_2$e/km (9.1 litres/100km). In 2040 it will be 129 g $CO_2$e/km (5.5 litres/100km). And in 2050 it will drop to 113 g $CO_2$e/km (4.8 litres/100km).

- A less aggressive tailpipe emission scenario was used for the Business as Usual scenario, with more modest improvements in vehicle efficiency after 2020. The Low Carbon Path and Business-As-Usual scenario weighted-on-road emission rates are compared in the table below.

Table 1 – Weighted-Average Passenger Vehicle Emission Rates (grams $CO_2$e / km)

| Scenario | 2007 | 2020 | 2040 |
|---|---|---|---|
| Business as Usual | 339 | 240 | 209 |
| Low Carbon Path | 339 | 211 | 129 |

Data for 1990 - 2006 were from the following sources:

- Vehicle sales: 1 and 3
- Vehicle stock: 1, 2, 5 and 7
- On-road average fuel consumption: 1, 4, 6 and 7
- Lab-tested new vehicle fuel consumption: 6

- Natural Resources Canada, Transportation End-Use Model, Ottawa, September 2008.
- Statistics Canada, Road Motor Vehicle Registrations, Ottawa, November 1999 (Cat. No. 53-219-XIB); and Statistics Canada, Motor Vehicle Registrations 2000–2006, Table 405-0004, Ottawa, 2008 (CANSIM).

[6] From 2011 to 2050, the Standard Car CAFC Standard and the Light Truck CAFC Standard are the modeled BC emission rate standards, calibrated using Nelson baseline data.

- Statistics Canada, New Motor Vehicle Sales 1990–2006, Table 079-0001, Ottawa, December 2006 (CANSIM).
- U.S. Department of Transportation, National Transportation Statistics, Table 4-1, 2006.
- DesRosiers Automotive Consultants, Canadian Vehicle in Operation Census 1990–2006, Richmond Hill (Toronto), December 2007.
- Transport Canada, Vehicle Fuel Economy Information System 1979–2006, Ottawa, 2007.
- BC Ministry of the Environment 2010. *2007 Community Energy and Emission Inventory, City of Nelson.*

Table 2: Proposed BC Vehicle Emission Rate Standards (Source: Province of BC, Climate Change Plan).

| Year | Passenger Cars & Small Trucks (g $CO_2e$ / km) | L / 100 km eq | Trucks (g $CO_2e$ / km) | L / 100 km eq |
|---|---|---|---|---|
| 2011 | 166 | 7.09 | 243 | 10.38 |
| 2012 | 145 | 6.19 | 225 | 9.61 |
| 2013 | 142 | 6.07 | 221 | 9.44 |
| 2014 | 138 | 5.89 | 218 | 9.31 |
| 2015 | 133 | 5.68 | 213 | 9.10 |
| 2016 | 128 | 5.47 | 207 | 8.84 |
| 2017 | 121 | 5.17 | 193 | 8.24 |
| 2018 | 115 | 4.91 | 177 | 7.56 |
| 2019 | 112 | 4.78 | 168 | 7.18 |
| 2020 | 109 | 4.66 | 165 | 7.05 |

## CEEMAP – Buildings and Energy Supply

Other than transportation, most energy use and emissions occur from the consumption of energy in buildings. The energy used and GHG emissions from the Buildings and Energy Supply sectors can be simplified into three main components:

- The **building land-use characteristics**, including type and size
- The efficiency of buildings, or **Energy Intensity,** expressed as kilowatt-hours equivalent per square meter ($kWh/m^2$)
- The type and source of energy consumed (such as natural gas vs. electricity vs. solar), referred to as the **Fuel Mix**

In general existing building characteristics are known and future building characteristics are determined by land-use planning, so this component is fairly accurate. Efficiency and fuel mix are less certain over the long-term, but by using a combination of building code projections and assumptions made by electrical and natural gas utilities for demand forecasting, a defensible and transparent forecast of building sector energy use and emissions can be made.

In its most simple form the buildings and energy supply sector emissions are calculated according to the following formula for each building type:

> Building area **X** building energy intensity **X** fuel mix **X** emissions/unit of fuel = Total Annual Emissions (Tonnes $CO_2e$)

These three components are explained in more detail below.

### Forecasting Building Characteristics

#### Key Input Data

Residential and commercial building stock, growth, replacement, and characteristics are based on data from:

1. Existing buildings are drawn from the BC Assessment Authority
    - BC Assessment Authority

2. Forecast buildings growth and replacement drawn from stakeholders and existing reports about Nelson
    - City of Nelson staff reviewed development permits
    - Nelson's Official Community Plan

### Forecasting Building Energy Intensity and Fuel Mix

#### Key Input Data

There are two key data sources that are crucial inputs to forecasting building energy intensity, fuel mix, and emissions in CEEMAP:

1. The Natural Resources Canada Comprehensive Energy Use Database (NEUD). The NEUD draws on the following key data sources:
    - Energy intensity and Fuel Use by Building Type
        - Statistics Canada
        - Natural Resources Canada Residential End-Use Model

2. 2007 Community Energy and Emissions Inventory (CEEI) Report. The CEEI draws on the following key data sources:
    - Electricity and Natural Gas Use by Building Category in Nelson
        - Utilities, including Nelson Hydro and Fortis BC
    - Fuel Oil and Wood consumption
        - Estimates based on the number and type of dwellings within each jurisdiction as determined by the BC Hydro Conservation Potential Review. Electricity and natural gas consumption was subtracted from the total, with the remainder assumed to be heating oil, propane, or wood.
    - Building Category (residential vs. commercial/light industrial)
        - Utilities, including Nelson Hydro and Fortis BC

### Calculation Overview

#### Baseline

1. Energy consumption data from the NEUD is modelled for each building type
2. The location, type, and size of each building is spatially in the model
3. For each building, the energy consumed per square meter is multiplied by the building size
4. Fuel type and associated emissions are then applied to each building type
5. Results are calibrated to match the CEEI

#### BAU Forecast

6. Business-as-usual (BAU) was not forecasted for this project

### Low Carbon Path Forecast

7. Future residential and commercial growth in Nelson, as determined by Nelson staff, is spatially entered into the model
8. Changes in energy use, type, and source for dwellings over time is predicted based on building code, technological change, and policies is predicted
9. Energy use, type, source, and emissions factors are applied to new buildings
10. Consulting peer reviewed literature and case studies on the impacts of strategies.

Sources:

- Natural Resources Canada, Comprehensive Energy Use Database (NEUD), British Columbia, August 2010.
- BC Assessment Authority, Residential Role for City of Nelson
- BC Assessment Authority, Commercial Role Custom Report for City of Nelson
- BC Ministry of the Environment 2010. *2007 Community Energy and Emission Inventory, City of Nelson*.

## CEEMAP – Solid Waste

All members of residents and businesses consume food, goods, materials and use services, which results in solid waste. Organic waste from kitchen scraps, back yards, and restaurants often ends up in the landfill, where it decomposes in the absence of air, generating methane-- a potent greenhouse gas. Diverting organic waste to compost bins can greatly reduce the amount of methane generated. In addition, methane gas can be captured and combusted at the landfill itself where appropriate equipment is installed, reducing the amount that is released to the atmosphere.

To model emissions from solid waste within CEEMAP, there are two major inputs:

- The greenhouse gas **Emissions Factor** associated with waste, measured in tonnes $CO_2$ equivalent per tonne of solid waste sent to landfill, and
- **Landfill Gas Capture**, represented as a percentage of gas captured and combusted at the landfill

Both of these inputs are driven by a combination of behaviour (how much organic waste is sent to landfill) and regulation (landfill gas capture regulation will require capture in the future).

> Total Annual Waste Sent to Landfill (tonnes) **X** Emissions Factor ($CO_2$e per tonne) **-** landfill gas captured (%) **=** Total Annual Emissions from Solid Waste (Tonnes $CO_2$e)

### Forecasting Emissions from Solid Waste

#### Key Input Data

There are three key data sources that are crucial inputs to forecasting waste emissions in CEEMAP:

1. 2007 Community Energy and Emissions Inventory (CEEI) Report. The CEEI draws on the following key data sources:
   - Volume of waste sent to landfill (baseline year)
     - As reported by Regional Districts (total waste for the landfill divided by population)
     - Excludes waste from demolition and land clearing where possible
   - Emissions Factor (baseline year)
     - For most landfills, including RDCK landfills, this is based on an estimate using generic/average values. Because a recent waste composition study has not been conducted

for RDCK landfills, nor for Nelson's waste stream, the impact of actions that reduce specific types of waste (i.e. food waste) cannot be calculated separately. The impact of waste diversion activities should therefore be taken as estimates only.

2. Diversion and landfill gas capture rates for future years drawn from a combination of reports and plans for the RDCK and the province
    - Reduction in Waste Generation (per capita) estimates
        - Based on best estimate of impact of provincial and federal government extended producer responsibility programs.
    - Waste diversion estimates
        - Draft RCDK Resource Recovery Plan & RDCK Organics Management Strategy
        - Discussion with RDCK staff

3. Landfill Gas Capture rate estimates
    - BC Landfill Gas Management Regulation requires capture percentage for landfills that generate more than a certain threshold of landfill gas
    - Generation at landfill estimated in:
        - RDCK Resource Recovery Plan: Landfill Consolidation and Waste Transfer System Financial Modeling
        - Inventory of Greenhouse Gas Generation from Landfills in British Columbia

### Calculation Overview

#### Baseline

1. Emissions factor and tonnes disposed drawn from CEEI to calculate baseline emissions

#### BAU Forecast

2. Not completed for this project

#### Low Carbon Path Forecast

3. Baseline waste generated *per capita* is reduced based on policy assumptions through discussions with Nelson staff
4. Waste diversion % is applied, reducing organic waste sent to landfill (this reduces landfill gas generation)
5. Landfill gas capture % is applied, reducing the amount of methane emissions further

**Sources:**


- BC Ministry of the Environment 2010. *2007 Community Energy and Emission Inventory, City of Nelson.*
- SNC-Lavalin 2010. *RDCK Resource Recovery Plan: Organics Management Strategy.*
- SNC-Lavalin 2010. *RDCK Resource Recovery Plan: Landfill Consolidation and Waste Transfer System Financial Modeling.*
- RDCK 2010. *Draft Resource Recovery Plan.*
- MJ Waste Solutions and Gary Liss and Associates 2003. *Zero Waste Action Plan for City of Nelson.*
- Golder Associates 2008. "Inventory of Greenhouse Gas Generation from Landfills in British Columbia". Prepared for BC Ministry of the Environment.
- BC Ministry of the Environment 2011. *Landfill Gas Management Regulation*.

# Appendix B: Modeling Performance Assumptions

The tables in this appendix list the specific performance assumptions that were used in CEEMAP to model the Nelson Low Carbon Path

### Annual Redevelopment Rate - Residential

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **Single Family Residential** | 0.25% | Annual % of residential buildings that are redeveloped into a **more intensive** form of residential development. Community wide. |
| **Townhome Residential** | 0.50% | |
| **Low Rise Residential** | n/a | |

### Annual Replacement Rate

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **Single Family Residential** | 0.50% | Annual % of residential buildings that are redeveloped into a **more intensive** form of residential development. Community wide. |
| **Townhome Residential** | 0.50% | |
| **Low Rise Residential** | 0.50% | |
| **Commercial** | 0.5% | |

### Annual Commercial Floor Space Growth Rate

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **2020** | 0.30% | The total community projected commercial floor space growth rate between the milestone year and the **previous** milestone year. |
| **2040** | 0.30% | |
| **2050** | 0.30% | |

### Existing Development, Commercial

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **2007** | 320,000 | Floor Space (m2) in BASE YEAR ONLY. Should be identical across scenarios. |

### Existing Development, Single Family

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **2007** | 7,945 | Unit Count in Base Year Only - should be same across scenarios |

### Existing Development, Attached

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **2007** | 2,195 | Unit Count in Base Year Only - should be same across scenarios |

### Existing Development, Low Rise

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **2007** | 2,085 | Unit Count in Base Year Only - should be same across scenarios |

### Average Unit Size

| Single Family Residential | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **2007** | 178 | The average size of new construction. Measured in m2. |
| **2020** | 160 | |
| **2040** | 160 | |
| **2050** | 160 | |
| **Townhome Residential** | **Low Carbon Path** | **Explanation & Guidance** |
| **2007** | 131 | The average size of new construction. Measured in m2. |
| **2020** | 131 | |
| **2040** | 131 | |
| **2050** | 131 | |
| **Low Rise Residential** | **Low Carbon Path** | **Explanation & Guidance** |
| **2007** | 94 | The average size of new construction. Measured in m2. |
| **2020** | 94 | |
| **2040** | 94 | |
| **2050** | 94 | |

### Persons per Household

| Single Family Residential | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **2007** | 2.50 | The number of occupants per housing unit. Check to ensure that person per household aligns with population growth and unit growth. |
| **2020** | 2.50 | |
| **2040** | 2.50 | |
| **2050** | 2.50 | |
| **Townhome Residential** | **Low Carbon Path** | **Explanation & Guidance** |
| **2007** | 1.90 | The number of occupants per housing unit |
| **2020** | 1.90 | |
| **2040** | 1.90 | |
| **2050** | 1.90 | |
| **Low Rise Residential** | **Low Carbon Path** | **Explanation & Guidance** |
| **2007** | 1.70 | The number of occupants per housing unit |
| **2020** | 1.70 | |
| **2040** | 1.70 | |
| **2050** | 1.70 | |

### Unit Mix of New Housing

| Single Family Residential | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| 2007 | 60.0% | Unit Mix (split) of New Housing for Milestones 1-3 |
| 2020 | 18.0% | |
| 2040 | 4.0% | |
| 2050 | 4.0% | |
| **Townhome Residential** | **Low Carbon Path** | **Explanation & Guidance** |
| 2007 | 18.0% | Unit Mix (split) of New Housing for Milestones 1-3 |
| 2020 | 41.0% | |
| 2040 | 48.0% | |
| 2050 | 48.0% | |
| **Low Rise Residential** | **Low Carbon Path** | **Explanation & Guidance** |
| 2007 | 22.0% | Unit Mix (split) of New Housing for Milestones 1-3 |
| 2020 | 41.0% | |
| 2040 | 48.0% | |
| 2050 | 48.0% | |

## Building Types, Fuels & Performance

### Energy Intensity

| Single Family Residential | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| 2007 | 203 | Average energy intensity of existing construction. Measured in kWh/m2/yr. |
| **Townhome Residential** | **Low Carbon Path** | **Explanation & Guidance** |
| 2007 | 187.2 | Average energy intensity of existing construction. Measured in kWh/m2/yr. |
| **Low Rise Residential** | **Low Carbon Path** | **Explanation & Guidance** |
| 2007 | 187.2 | Average energy intensity of existing construction. Measured in kWh/m2/yr. |
| **Commercial** | **Low Carbon Path** | **Explanation & Guidance** |
| 2007 | 355 | Average energy intensity of existing construction. Measured in kWh/m2/yr. |

### Building Energy Policy Reduction Factor (Beyond Code)

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **Single Family Residential** | 2.0% | Incremental % reduction in energy intensity due to local government (non-code) policy. |
| **Townhome Residential** | 2.0% | |
| **Low Rise Residential** | 2.0% | |
| **High Rise Residential** | n/a | |
| **Suites** | n/a | |
| **Commercial** | 2.0% | |
| **Industrial** | n/a | |

### District Energy Consumption Reduction Factor

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **Single Family Residential** | n/a | The % net building energy efficiency gain from connecting to District Energy Systems. Connecting to District Energy can increase a building's energy efficiency relative to an individual heating/cooling system. This is because individual must often operate at part loads, a less efficient means of operating, whereas district energy typically has less energy efficiency losses at part loads. |
| **Townhome Residential** | n/a | |
| **Low Rise Residential** | 10% | |
| **High Rise Residential** | 10% | |
| **Suites** | n/a | |
| **Commercial** | 10% | |
| **Industrial** | n/a | |

### Current Building Fuel Split

| Single Family Residential | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **% Electricity** | 36% | The % of building energy demand currently supplied by these fuel sources. |
| **% Natural Gas** | 58% | |
| **% Heating Oil** | 6% | |
| **Townhome Residential** | **Low Carbon Path** | **Explanation & Guidance** |
| **% Electricity** | 36% | The % of building energy demand currently supplied by these fuel sources. |
| **% Natural Gas** | 58% | |
| **% Heating Oil** | 6% | |
| **Low Rise Residential** | **Low Carbon Path** | **Explanation & Guidance** |
| **% Electricity** | 36% | The % of building energy demand currently supplied by these fuel sources. |
| **% Natural Gas** | 58% | |
| **% Heating Oil** | 6% | |
| **High Rise Residential** | **Low Carbon Path** | **Explanation & Guidance** |
| **% Electricity** | 54% | The % of building energy demand currently supplied by these fuel sources. |
| **% Natural Gas** | 22% | |
| **% Heating Oil** | 12% | |
| **Commercial** | **Low Carbon Path** | **Explanation & Guidance** |
| **% Electricity** | 44% | The % of building energy demand |

| | | |
|---|---|---|
| **% Natural Gas** | 56% | currently supplied by these fuel sources. Do note list wood as this is considered carbon neutral - therefore the fuel mix will not add to 100% |
| **% Heating Oil** | 0% | |

### Annual Energy Efficiency Retrofit Rate

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **Single Family Residential** | 2.00% | % of buildings receiving retrofits annually. |
| **Townhome Residential** | 2.00% | |
| **Low Rise Residential** | 2.00% | |
| **Commercial** | 2.00% | |

### Retrofit Energy Efficiency Average Improvement

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **Single Family Residential** | 30% | Average % reduction in energy intensity of existing retrofitted buildings.<br><br>HB Lanarc has data for residential buildings' average efficiency improvements in some Canadian Provinces and regions. |
| **Townhome Residential** | 30% | |
| **Low Rise Residential** | 30% | |
| **Commercial** | 30% | |

### Annual Renewable Energy Retrofit Rate

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **Single Family Residential** | 1.0% | % of existing buildings retrofitted to incorporate renewable energy annually. |
| **Townhome Residential** | 1.0% | |

### Annual District Energy Connection Retrofit Rate

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **Low Rise Residential** | 0.04% | |
| **Commercial** | 0.04% | |

### Renewables

| Single Family Residential | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **2020** | 75% | This is the share of all new construction since Baseline equipped with renewables. USE RENEWABLE AND DES BUILDING COUNT SHEET IN MODEL, COMBINED WITH CLIENT SUGGESTIONS, TO FIND THIS PERCENTAGE. |
| **2040** | 80% | |
| **2050** | 100% | |
| **Townhouse** | **Low Carbon Path** | **Explanation & Guidance** |
| **2020** | 75% | |
| **2040** | 80% | |
| **2050** | 100% | |

### ANNUAL DISTRICT ENERGY SHARE FOR NEW CONSTRUCTION

| Low Rise Residential | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| 2020 | 40.00% | This is the share of all new construction since Baseline equipped with DES Should be used with formula on right. |
| 2040 | 40.00% | |
| 2050 | 40.00% | |
| **Commercial** | **Low Carbon Path** | **Explanation & Guidance** |
| 2020 | 10.00% | |
| 2040 | 10.00% | |
| 2050 | 10.00% | |

## Emissions Factors of Fuel and Travel

### Electricity Emissions Factor (kg CO2 / MWh)

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| 2007 | 3 | CO2 emissions (measured in kg) per MWh of electricity consumed. |
| 2020 | 3 | |
| 2040 | 3 | |
| 2050 | 3 | |

### Natural Gas Emissions Factor (kg CO2 / MWh)

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| 2007 | 183 | CO2 emissions (measured in kg) per MWh of natural gas consumed. |
| 2020 | 183 | |
| 2040 | 183 | |
| 2050 | 183 | |

### Heating Oil & Propane Emissions Factor (kg CO2 / MWh)

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| 2007 | 236 | CO2 emissions (measured in kg) per MWh of heating oil consumed. |
| 2020 | 236 | |
| 2040 | 236 | |
| 2050 | 236 | |

### Renewable Thermal Energy

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| 2007 | 0.6 | CO2 emissions (measured in kg) per MWh of renewable thermal energy consumed. |
| 2020 | 0.6 | |
| 2040 | 0.6 | |
| 2050 | 0.6 | |

### District Thermal Energy

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **2007** | 183 | CO2 emissions (measured in kg) per MWh of renewable district energy (thermal) consumed. |
| **2020** | 61 | |
| **2040** | 61 | |
| **2050** | 61 | |

## Solid Waste Management

### Total Tonnes of Waste Generated

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **Baseline Year** | 7,260 | The total tonnes of waste generated in a community (includes all waste sent to landfill, waste to energy facilities, and wastes recycled, composted or otherwise diverted). |

### Tonnes of Waste Disposed to Landfill

| | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **Baseline Year** | 4,840 | The tonnes of waste disposed to the landfill. |

### Waste Flows

| 2007 | Low Carbon Path | Explanation & Guidance |
|---|---|---|
| **Landfill** | 67% | The percent of total collected waste that is diverted to either landfill, 'waste to energy', or recycling / diversion. |
| **Waste to Energy** | 0% | |
| **Recycling / Landfill Diversion** | 33% | |
| **2020** | **Low Carbon Path** | **Explanation & Guidance** |
| **Landfill** | 50% | The percent of total collected waste that is diverted to either landfill, 'waste to energy', or recycling / diversion. |
| **Waste to Energy** | | |
| **Recycling / Landfill Diversion** | 50% | |
| **2040** | **Low Carbon Path** | **Explanation & Guidance** |
| **Landfill** | 25.00% | The percent of total collected waste that is diverted to either landfill, 'waste to energy', or recycling / diversion. |
| **Waste to Energy** | | |
| **Recycling / Landfill Diversion** | 75.00% | |
| **2050** | **Low Carbon Path** | **Explanation & Guidance** |
| **Landfill** | 10.00% | The percent of total collected waste that is diverted to either landfill, 'waste to energy', or recycling / diversion. |
| **Waste to Energy** | | |
| **Recycling / Landfill Diversion** | 90.00% | |
| | **Low Carbon Path** | **Explanation & Guidance** |

| | | |
|---|---|---|
| **2007** | 0% | The annual average % methane captured from landfills.<br><br>**Note:** Landfills emit methane, a potent greenhouse gas. Landfills are capped to capture some of the emitted methane. |
| **2020** | 0% | |
| **2040** | 75% | |
| **2050** | 75% | |

**Emissions (tonnes) per tonne of solid waste disposed**

| | **Low Carbon Path** | **Explanation & Guidance** |
|---|---|---|
| **2007** | 0.13 | This is an emissions factor per tonne of waste sent to landfill. It should be entered manually. |
| **2020** | 0.13 | |
| **2040** | 0.13 | |
| **2050** | 0.13 | |

# Appendix C: Low Carbon Community Pledge

The City was interested in community based social marketing to support this initial Climate and Energy planning process. A pledge is a particularly appropriate community based social marketing tool at this early planning stage. Other community based social marketing activity could be developed as strategies become better defined, such as a commercial/residential retrofit strategy or further enhancements to the active transportation plan.

Written, public sustainability commitments can increase the likelihood of lifestyle change. Ideas and aspirations from diverse stakeholders in the community, on Council and amongst staff helped shape an initial pledge and then gain feedback on a draft.

This Pledge is designed for individuals as well as private, public and social organizations. Ideas for rolling out the pledge are outlined below.

### Pledges: The Rationale

A recent study found participants were three to four times more likely to implement energy retrofits if asked when they planned to implement retrofit measures. Making an explicit commitment to retrofit by a certain date increased the chances of a behavioral change.

In another study, focused on increasing bus ridership, a written commitment to ride the bus was more effective in changing behavior than financial incentives (free bus tickets).

Hallmarks of a successful pledge:

1. **Signed, written commitments** are more effective than verbal commitments

2. **Commitments made publically,** or in a group, are more effective than those made privately

3. Commitments which **actively involve the person** through engagement or participation are more effective than those which do not

4. It is preferable to use **existing points of contact** to secure commitments

5. Commitments should be **combined with other social marketing** techniques, not used as stand-alone measures

Source: Mckenzie-Mohr, Doug. “Commitment: From Intention to Action” in Fostering Sustainable Behavior: Community-based Social Marketing http://www.cbsm.com/pages/guide/commitment

# Nelson Low Carbon Community Pledge (Final Draft)

Nelson has a long tradition of conscientious collaboration confronting challenges and opportunities. The economic vitality of our downtown, our 100-year old hydro-electric utility, and our vibrant community organizations are evidence of this tradition.

I am joining local businesses, organizations and citizens in pledging to protect the climate and promote sustainable energy to address some of this century`s greatest challenges.

As a community, we spend more than $30 million every year on fuel for transportation, and on heating and powering our homes, offices and schools. This spending could double in a decade, driving up transportation costs, utility bills, food and other goods and services. Taking action to improve energy efficiency, increase renewable energy, and reduce resource consumption and waste will help protect the climate by reducing carbon emissions, keep more money in the community supporting local jobs, and make our community more resilient.

I will take action in the following ways to help make Nelson a low carbon community: (Check your actions).

**I will improve energy performance** in my home, work, or school:

- ☐ Turning down the heat and turn off lights when not needed
- ☐ Replacing my furnace or improving insulation
- ☐ Using low impact renewables like a solar hot water system or an energy efficient wood fireplace
- ☐ Other:_____

**I will Think Global and Shop Local:**

- ☐ Increasing the share of locally made/ grown products I buy
- ☐ Increasing the amount of locally made/ grown products I sell
- ☐ Choosing to vacation or recreate in the region versus traveling afar
- ☐ Other:_____

**I will increase my transportation sustainability:**

- ☐ Replacing at least one car trip a week with a walk or bike trip
- ☐ Taking at least one trip this year with Nelson Ride Share
- ☐ Replacing two business trips this year with telephone, web or video conferencing
- ☐ Other:_____

**I will reduce the waste I generate:**

- ☐ Composting food and yard waste
- ☐ Finding products I can re-use in the community or ensuring useful products I don`t need can be re-used
- ☐ Increasing the size of my vegetable garden
- ☐ Other:_____

**Name:** Jo Nelson **Signature:** Jo Nelson **Date:** Fall, 2011

## Roll Out Opportunities

Pledge roll out has a number of options, influenced by scale, imagination and resources. The following ideas are the sum of insights from the stakeholder engagement process and the consultant.

**Scale & Audience**

The scale could be a small and audience focussed involving primarily key stakeholders who have participated in the planning process who are approached to take the Pledge and it is released at a media event following adoption of the Plan. Alternatively, it could be much larger scale where it might be "launched" by key stakeholders and further circulated throughout the community to businesses, non-profit organizations, public sector organizations as well as citizens.

Stakeholders had a preference for larger scale and at the same time recognized that resources for the entire Plan are constrained and it was important to priorize actions.

The Pledge could be circulated in convenient private and public locations across the City, including businesses, recreation centre, schools, as well as the City website.

Some organizations that sign on could potentially encourage sign on by their membership, e.g. the Rotary Club or a retirement home. If the school board and potentially its Destination Conservation initiative chose to get involved, it may be possible to encourage circulation of the Pledge through the school system.

**Coordination**

Many stakeholders recommended this initiative be coordinated collaboratively between the City and West Kootenay Environmental Society with active engagement by the Chamber of Commerce. The degree of collaboration necessary depends on desired scale and resource availability.

**Media Potential**

The Pledge has potential to attract media and, in turn, broader community interest with the launch and then subsequent sign-ons by other prominent organizations and businesses. Other sign-ons that could attract media attention include the oldest person in Nelson interested in a better future for his/her grand children, a popular former Mayor, local MP, MLA.

Publication of all signatories – not just high profile institutions and individuals – but enough people to fill an entire page or centre spread of the local newspaper could give great profile to the pledge. It would also increase the likelihood that signatories follow through with their actions – see Pledges: The Rationale. Similarly, the Pledge and signatories could be displayed somewhere prominent like the Recreation Complex, Touchstones Museum or High School lobby..

**Format**

If the Pledge is a small scale initiative, it would likely be circulated in digital and hard copy format to key stakeholders.

If the initiative was large scale, it may be appropriate to have a web-based form that could be populated online where other resources are identified that complement the actions.

**Program Integration**

If the Pledge is a larger scale initiative, its impact will be maximized if it is integrated with other City climate and energy initiatives, e.g.

Promoting the Pledge through Climate Smart training with local businesses and non-profits, and promoting Climate Smart Training through the Pledge.

As initiatives like the Retrofit Program take greater definition, the Pledge would promote this program and vice versa. Similarly –

Stakeholders were interested in a low carbon "Education and Outreach Hub" to provide guidance and identify support across all energy and climate-related activity. Some stakeholders conceived this as online, others as location-specific with human resource support, some as both (see Community Wide Measures: B. Engage with Citizens...) The Pledge could be central to this work for a brief period.

If a larger scale initiative is conceived and it is part of a broader education and outreach agenda supporting programs and policies, continuity and profile could be created across programs by establishing a climate and energy brand, e.g. Nelson: Low Carbon Community with "I'm a Low Carbon Nelson Business" plaque/sticker on the windows of Climate Smart participants, "I'm a Low Carbon Nelson Citizen" sign on the doors of retrofitted homes, "I'm a Low Carbon Driver" stickers on electric cars and/or Ride Share drivers...

Research reveals that individuals and organizations that have already take some action are more likely to take more. For this reason, it is worthwhile maintaining a privacy-protected database of signatories and contact information to periodically apprise them of new opportunities as they become available.

# Appendix D: Sustainability Checklist Recommendations

Currently, the checklist includes several points related to energy and emissions. These are generally high level and consequently provide limited specific guidance. Increasing the level of detail on energy would support improved building energy efficiency as well as help build capacity to understand the key elements of energy & emissions performance. However, this would impact the length and potentially the perceived complexity of the checklist, and could increase the weighting of building energy/emissions vs. other sustainability aspects. Relative to some other sustainable development checklists, the social/cultural aspects have a greater weighting.

One option would be to create a "breakout" section on building energy that is more detailed, that sums a longer list of points, then divides it back into the main checklist to avoid increasing the weighting.

Indicators currently addressing energy & emissions are identified as follows, with suggestions for strengthening following.

### Current Energy & Emissions Related Points (Environmental Indicators)

4. Pursue LEED/green building BPs, energy/water efficiencies

5. Onsite renewable energy

7. Climate sensitive design features

12. FortisBC Powersense initiatives pursued

### Suggested Enhancements

The following would be examples of how the existing points could be reworked and strengthened, with some enhancements and reorganization. These examples may require further adjustment and elaboration.

- Utilize building energy modeling to achieve energy performance that is better than required by the BC Building Code
- EnergySTAR or high efficiency appliances: e.g., refrigerators, clothes washers, dishwashers
- Efficient lighting systems: this may include efficient light sources and controls
- High efficiency water fixtures, that go beyond minimum BC Building Code requirements
- Utilize passive design techniques to decrease energy consumption – e.g., solar shading, natural ventilation
- Incorporate onsite renewable energy sources such as solar or geothermal
- Include FortisBC PowerSense Residential/Commercial energy saving initiatives

To revise this checklist, further investigation and consideration should be given to structuring and weighting of points, and increasing the level of detail; this may be informed by checklists developed by other communities.

# Appendix E: OCP Amendment

The language that follows below is presented as recommended text for updating the City of Nelson's Official Community Plan to include the greenhouse gas emission reduction objectives and targets that have been developed as a part of this Community Climate and Energy Plan.

THE CORPORATION OF THE CITY OF NELSON

Bylaw No. XXX

A bylaw to amend the "City of Nelson Official Community Plan Bylaw No. 3114, 2008"

The Council of the Corporation of the City of Nelson, enacts as follows:

1. This bylaw shall be known and cited for all purposes as the "_____".

2. Schedule A, is amended by adding the following:

**Section 18: Energy and Greenhouse Gas Emissions**

**18.1 Overview**

Nelson has a long tradition of conscientious community building, from downtown economic vitality to our 100 year old hydro-electric utility and the vibrant diversity of community organizations. Today, our community is vulnerable to the twin risks of global warming and steadily rising, volatile energy prices. Low Carbon Path to 2040 is a plan to strengthen the resilience of our community by minimizing these threats. The Plan builds on the City's complete, compact, highly-liveable character and heritage building preservation. It is informed by and will help shape existing municipal priorities including implementation of the community's Path to 2040 Sustainability Strategy. The Plan is comprised of strategies (policies) and actions for each sector. Defensible targets underpin these strategies and can be used to guide implementation, monitoring and evaluation, as well as meet the City's legislative requirement to the Province to include greenhouse gas reduction targets, policies and actions in its Official Community Plan.

**18.2 Targets**

The Low Carbon Path to 2040 will enable Nelson to achieve the following community-wide targets over a 2007 baseline by 2040:

- 57% reduction in per capita GHG emissions (from 7 to 3 tonnes per year)
- 43% reduction in community-wide GHG emissions
- 26% reduction in community-wide energy use

**18.3 Objectives and Targets, by Sector**

## Land Use

**Objective**
Create sustainable land uses that maximize opportunities for diverse, low-carbon transportation options, green buildings and low carbon energy supply.

**Key Target**
By 2040, 80% of dwellings are within a 10 minute walk from local services

## Transportation

**Objective**
Enhance the convenience and comfort of active and low carbon transportation modes

**Key Targets**
By 2040, active transportation (walking and bicycling) constitutes the largest share of local trips
By 2040, average household vehicle kilometers traveled is reduced 33% from 2007

## Buildings

**Objective**
Strengthen the energy and emission performance of Nelson's current and future building stock

**Key Targets**
Increase building energy retrofit rate for existing buildings to 2% by 2020
Renewable energy is installed in 75% of new buildings constructed annually by 2020

## Energy Supply

**Objective**
Develop cost effective, local, reliable, low impact energy supply

**Key Targets**
Maintain emissions from electricity at 2007 levels
Connect 70,000 square meters of floor space to District Energy by 2040

## Solid Waste

**Objective**
Approach "zero waste" by maximizing resource reduction, reuse, recycling, and recovery for all waste types

**Key Target**
By 2020, Increase organics diversion rate to 50%

## Community Wide

**Objective**
Strengthen the City's institutional capacity and mechanisms to support implementation



**Key Target**
By 2015 all City departments have integrated qualitative assessment of greenhouse gas emissions into their planning and budgeting processes.

READ a first time by the Council on the

_____

READ a second time by the Council on the

_____

READ a third time by the Council on the

_____

RECONSIDERED and finally adopted by the Council,

signed by the Mayor and City Clerk and sealed with the Corporate Seal on the

_____

Mayor

_____

City Clerk

# Appendix F: Engagement Event Attendees

The Plan's vision, strategies and actions have been strongly shaped by the input of Council, staff, community stakeholders and the broader public through the following engagement streams;

- **Project Steering Committee:** This steering committee provided direction and feedback on process and substance with representation from Council, Administration, Development Services, Nelson Hydro, Fortis, and West Kootenay Environmental Society.
- **Council:** As well as Steering Committee representatives, other councilors and the Mayor participated in workshops, providing input on all sectors.
- **Staff:** Development Services staff managed the project. Key staff from Operations and Engineering, and Administration participated in workshops, providing input on strategies they would likely play a role implementing.
- **Business Community:** The City collaborated closely with the Chamber of Commerce to involve businesses in identifying relevant strategies pertaining to them and maximizing local economic benefit.
- **Development Sector:** Local builders, developers, architects, energy auditors, engineers and renewable energy experts provided input on buildings and energy supply strategies.
- **Community Stakeholders**: A wide diversity of public, private, and non-profit organizations covering social, environmental, economic and cultural interests offered input on all strategies.
- **Public:** An open house early on in the process was hosted to get feedback from additional, interested members of the community.

The following people were involved in engagement activities.

| | |
|---|---|
| Abyra Brynne | Brynne Consulting, Agricultural Area Plan for RDCK |
| Alton, John | West Kootenay Eco Society |
| Angel, Renee | Interior Health Authority |
| Best, Leah | Touchstones Museum and Archives |
| Boston, Alex | HB Lanarc, Climate/Energy Action Plan Project Manager (consultant) |
| Brewer, Greg | Citizen, Business Owner |
| Brillon, Marc | Ellenwood Homes |
| Carr, Laurie | Multi-Stakeholder Workshop #2 |
| Charlesworth, Kim | Councillor, City of Nelson, Environ Cttee; Climate/Energy Steering Cttee |
| Cherbo, Robin | Councillor, City of Nelson |
| Comte, Bertrand | Multi-Stakeholder Workshop #2 |
| Cormack, Kevin | Climate/Energy Steering Cttee |
| Delfiner, Gary | Local Business Owner/Builder (Speedy Auto Glass Building) |
| Demers, Jessie | Multi-Stakeholder Workshop #2 |
| Dobie, David | Architect, David Dobie Design |
| Dooley, John | Mayor, City of Nelson |
| Fair, Kathy | |
| Fillion, Allen | Multi-Stakeholder Workshop #2 |
| Flemming, Lindsay | Youth |
| Galbraith, Fiona | Corporate Climate Action Coordinator, City of Nelson |
| Harold, Mark | Renew Technologies |
| Hill, Peter | Terasen Gas |
| Hurst, Doug | Builder/Developer Workshop #2 |
| James, Adam | Community Energy Association, Facilitator (consultant) |
| Johnson, Dallas | City, Planner, Climate/Energy Steering Cttee |
| Karrasowitsch, Dave | Selkirk Power |
| Kaup, Steven | Studio 9 Architecture and Planning |
| Hare, Philip | Builder/Developer Workshop #2 |
| Kaup, Steven | Builder/Developer Workshop #2 |

| | |
|---|---|
| Kiss, Paula | The Building Tree |
| Klassen, Kim | Working Group # 5 (Path to 2040) |
| Knox, John | Local Realtor |
| Kozak, Deb | Councillor, City of Nelson |
| Lack, Jeremy | Kootenay Local Agricultural Society |
| Loh, Thomas | Architect |
| Love, Alex | Nelson Hydro; Climate/Energy Steering Cttee |
| Lundeberg , Wayne | Columbia Basin Trust |
| McDonnell, Bill | Multi-Stakeholder Workshop #2 |
| MacLeod, Allan | Builder/Developer Workshop #2 |
| Macdonald, Donna | Councillor, City of Nelson, Environ Cttee; Climate/Energy Steering Cttee |
| Miller, Shandi | |
| Moore, Kathy | Councillor, City of Rossland |
| Moore, Pam | Interior Health Authority |
| Munn, Dawn | Citizen |
| Nissen, Monica | School Board |
| Packham, Laura | Carbon Management |
| Park, Rona | Multi-Stakeholder Workshop #2 |
| Popoff, Ron | Interior Health Authority |
| Precious, Russell | Agricultural Area Plan for RDCK |
| Prior, Tom | Multi-Stakeholder Workshop #2 |
| Reasoner, Mel | WKES; Climate/Energy Steering Cttee/ Working Group # 5 (Path to 2040) |
| Sawkins, Gerry | Energy Advisor |
| Schmidt, Christine | Nelson and District Youth Centre |
| Schumidt, Wilfred | Sundance Homes |
| Sellers, Kirt | Interior Health Authority |
| Shaw, Freya | Kootenay Local Agricultural Society |
| Smith, Jen A. | Multi-Stakeholder Workshop #2 |
| Sobie, Paula, | Kootenay Local Agricultural Society |
| Southam, John | City, Building Inspector |
| Southam, Theresa | Working Group # 5 Facilitator (Path to 2040) |
| Thompson, Tom | Chamber of Commerce |
| Thomson, Alan | Advisory Planning Commission |
| Taylor, Rod | Multi-Stakeholder Workshop #2 |
| Turgeon, Julie | Studio 9 Architecture and Planning |
| Turgeon, Sylvain | |
| Ward, Peter | Builder/Developer Workshop #2 |
| Weston, Blair | Fortis; Climate/Energy Steering Cttee |
| White, Richard | Working Group #2 (Path to 2040) |
| Wolge, Uli | Regional District of Central Kootenay |
| Woodward, Wayne | Sundance Homes |
| Woolsey, V. | Planner |
| Zeigler, Nathan | Engineer |

Organizational affiliations are for reference. Some attendees may have attended as individuals rather than as representatives of organizations.

# Appendix G: Building & Business Sector – Key Comments

The following key comments from separate building and business sector workshops in the first of two rounds of consultations shaped the strategies developed in the Plan. These comments could be useful in providing guidance for more detailed planning. More extensive consolidated comments are available.

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### Our Homes, Our Offices, Our Climate, Our Community
Nelson Building Sector Consultation Comments Summary
Wednesday, December 8

The City hosted a workshop with members of the building sector to solicit input on a community plan to reduce greenhouse gases and advance energy sustainability. Stakeholders included a variety of players in the building sector such as developers, builders, architects, renewable energy specialists, as well as City Council and staff. The meeting's primary consultation objective was:

> *Preliminarily explore barriers and potential breakthroughs for advancing low carbon buildings within the context of the Community Climate Action & Energy Plan*

With further analysis, including high level evaluation of the technical, resource, economic, policy potential, these ideas will help shape a draft Plan. For the purpose of the workshop, low carbon buildings focused on the envelope, building/site-scale renewable heat, and passive building/site design for new and existing buildings.

Concurrent and rotating discussions in small groups explored a range of policy tools, and barriers and breakthroughs to preferred actions.

## Municipal Policy Tools Discussion Highlights

Stakeholders discussed a wide range of municipal policies categorized by type: capacity building, financing, regulatory and voluntary tools.

### Capacity Building Tools: Highlights

- High interest in *building performance labelling* at point of sale or re-sale as a potential tool for increasing interest in performance for builders, real estate agents, prospective owners
- *City staff capacity building* would be necessary for diverse staff constituencies (permitting staff, inspectors, planners, engineers…) with some unique requirements for each including finance, rating systems, role of internal policy tools.
- *Building sector capacity building* was felt to be necessary and important in a focussed manner but not something the City should do in a comprehensive manner given its limited resources and other well positioned organizations, e.g.
    1. Some *Canadian Home Builders Association chapters* have strong green building training programs such as *Central Interior* which annually builds a *Built Green* training house. East Kootenays currently exploring the estiablishing a chapter and there may be an opportunity to collaborate.
    2. The Kootenay Leaf of the Cascadia Green Building Council has a very active local presence.
- Modest interest/opportunity in developing a *sustainability or neighbourhood block*, beyond the Waterfront, as a way to explore integrated energy options (buildings, energy supply, transportation).
- Modest interest in using a *recognition and rewards program* to acknowledge sustainable building leadership

### Financial Tools: Highlights

- *Property Tax Exemptions* may potentially incent higher performance in some circumstance but generally *builders* would *not* be incented for new buildings because they would not benefit. The tool would likely work better for retrofitting existing buildings.There are, however, revenue implications for the City.

- There is wide interest in low/no interest loans offered through *revolving funds* to finance energy innovations in new and existing buildings that would be paid back based though energy savings, but no immediate ideas on how to seed such a fund.
- There is high interest in using *Local Improvement Charges* to finance green buildings if the Province would permit the use of this tool. (Residents/businesses would pay back the upfront costs through savings based on a charge added to property tax. The LIC would stay with owner rather than property.)
- There was strong interest in *Nelson Hydro Upfront Financing* for new or existing building energy innovations that would be paid back through utility bills. One modest barrier identified was the ownership lifecycle being reasonsably short it would not work with some constituencies who move/change ownership a lot unless the "loan" stayed with the property.
- There was some interest in how *Local Offset Strategy* could be developed to help support energy innovations that could then be used to allow the City to achieve its corporate carbon neutral objective or other public institutions like the School Board or Health Authority.
- There was modest interest in using *Density Bonusing* to incentivize energy performance – not because it would not be effective, rather because of the limited local opportunities.
- Some builders were not in favour of incentives that penalized conventional builders directly or indirectly. However, other builders, architects and energy auditors felt any incentive that worked effectively to increase the share of higher performance buildings, and offset the higher upfront costs, were needed.

### Regulatory & Voluntary Tools: Highlights

- Cost is the biggest hurdle to implementing green building options (architect)
- Many options are cost prohibitive when incentives removed
- Option to require energy audit at time of sale and provide tax break based on any upgrades made before or after the sale.
- Possible maximum residential building size bylaw
- General consensus by those already designing and building high performance buildings that a strong regulatory approach is the best way drive change – need new bylaws to meet goals – needs to be policy, bylaw, or regulation to be effective. Playing field must be level.
- Allow buyout of rezoning requirements to be used in fund for sustainability projects
- Bylaws like solar ready requirement need an option to opt out for specific sites where it doesn't make sense – e.g buildings with no useful solar resource due to topography, etc. One size does not fit all.
- In many cases incentive programs make renewable or green options appear like they don't make sense on their own when in fact they have lower life cycle costs and do make business sense but first cost orientation, and incentives split between builders and owners make these investments prohibitive.
- Alternative building techniques like straw bale or cob aren't covered by the building code and therefore require engineering that increases cost
- Option to devalue total construction costs for building permit by the amount spent on improvements beyond building code requirements.
- Option to make the sustainability checklist mandatory and have the score trigger development fee rebates
- Currently there appears to be few bylaw impediments so bylaw review not a high priority, according to inspector
- Covenants – building inspector noted that lawyers/realtors weren't making prospective buyers aware of the covenant and that people purchased lots and were surprised and disappointed when they applied for a building permit.
- Many building related policies and standards would be better done provincially – don't want Nelson to stand out from the crowd and discourage development
- Requiring buildings to be electric vehicle ready (provide suitable conduit from service panel to garage) may be worth while in the near future
- Increase density by allowing laneway housing in OCP
- People seem to strongly prefer cash rebates to low interest loans (Terasen)

## Breakthroughs and Barriers: Highlights

Stakeholders discussed actions they would like to take in the community, and the barriers and breakthroughs to taking action.

| **Actions** *sector would like to take* | **Barriers** *obstructing action* | **Breakthroughs** *opportunities to overcome those barriers* |
|---|---|---|
| Build Energy Efficient Homes | Cost (need to foot bill at start) | Need for a regional coordinator to gather and disseminate information or post information at City Hall (non-biased entity, familiarity with code and products) |
| | resistance from clients/hard to get buy in from clients | Opportunity to lobby for local Chapter of Canadian Homebuilder Association (no local group right now, but East Kootenay is looking into one?). Wilf to call the Homebuilder Association for more info. Would help development community stay up to speed on innovative methods re: energy efficiency |
| | takes time to educate clients to encourage uptake of green building | |
| | takes time away from business to educate self | |
| | not enough rebates or incentives | |
| | products/methods changing constantly | |
| | easy to stick to gravy train | |
| Have a strong business mandate for performance buildings | hard to keep up to date with new practices and building codes and rules are constantly changing | Sessions like this morning's where developers/builders/architects can gather and share ideas |
| | fear of loss of clients | lots of local talent for green building |
| Promote efficient use of space and design when planning homes for clients (build for optimal size - passive systems/insulation) or performing retrofits | fundamentals = easy but if going beyond typical, takes time to educate clients and program costs can be expensive (i.e. Built Green) | opportunity in town for a great deal of consultant work (many older homes) |
| | cost increases to client | increasing familiarity in town with atypical building |
| | need for education of clients - idea that bigger = better (trend of consumption) | |

## Our Commerce, Our Climate, Our Community
Business Sector Consultation Comments: Summary
Wednesday, December 8

The City of Nelson and Nelson and District Cham**be**r of Commerce co-hosted a meeting to solicit input from local business and those interested in economic development including City Councillors and staff to help inform development of a community plan to reduce greenhouse gases, and advance energy sustainability. The meeting's primary consultation objective was:

- *Preliminarily explore trends that will impact the local economy and should be considered in a local action plan,*
- *Preliminarily identify actions local businesses would like to take and resources needed to strengthen the energy and emission profile of their businesses.*

With further analysis, including high level evaluation of the technical, resource, economic, policy potential, these ideas will help shape a draft Plan. A summary precedes the consolidated comments.

### Major Trends, Challenges & Opportunities

Participants identified the following 10-20 year trends and associated challenges and opportunities will influence the local economy and should be considered in *local* energy sustainability and GHG reduction planning.

- **Energy prices**, notably gasoline and diesel but also electricity are expected to rise. This will increase transportation costs and the costs of most goods including food – most of which are heavily oil dependent.
- **Certain rapid technological changes** with commensurate cost reductions create some local opportunities:
  1. **Renewable heating and green building innovations** can improve energy and emission performance, and provide some employment opportunities.
  2. **Information technologies** are increasingly permitting people to work or run businesses remotely.
- **Some workforce and demographic changes** will have significant economic and social implications:
  1. Amongst the many implications of an **aging population** is less mobility and an ongoing need to easily access goods and services.
  2. A bulge of **business owners will retire** not far off into the future and there is a risk these local businesses will not continue.
  3. A growing percentage of the **local work force lives outside the City** due to housing affordability and lifestyle choice. There are GHG implications, and economic vulnerability with rising fuel costs.
  4. A growing percentage of **people are able to work or run businesses remotely** – economic and entrepreneurial nomads.
- Expected **climate changes** include reduced water availability, hotter summers, and higher forest fire risks.

### Potential Actions

The following actions were identified to minimize risk and maximize opportunity associated with these trends

- Promote green buildings and renewable energy to improve energy and emission performance of existing buildings, and strengthen this local industry.
- Strategically promote local/regional goods production, food and agriculture for example, to reduce vulnerability at the margins to rising cost of goods.
- Encourage people who can work or run businesses remotely to locate in Nelson. Develop the needed infrastructure.
- Reduce local economic vulnerability to rising transportation costs through increased housing affordability and more efficient regional transportation including more energy efficient vehicles, ride sharing and improved transit.
- Attract or promote young entrepreneurs to fill the gap that will be left by retiring local business people.
- Establish adaptation plans to major climate change risks such as increasing the efficiency of water use, and extending setbacks from forest.


## Low Carbon Business Plan Top Priorities

The following priority actions and considerations were identified to reduce GHGs and use energy more sustainably in local businesses.

| **Actions**<br>Actions businesses would like to take | **Barriers**<br>Challenges to taking action | **Breakthroughs**<br>Opportunities that support action | **Local Resources**<br>Exist: ☑ To develop: ☒ |
|---|---|---|---|
| **Buildings** | | | |
| **Energy Retrofits****** <br>• → envelope/window efficiency <br>• Improve heat supply including high efficiency furnaces, heat pumps, biomass/solar thermal heating | • High upfront costs / time <br>• Rental buildings <br>• Unique heritage buildings needs <br>• Federal rebates eliminated <br>• Knowledge | • Long term savings <br>• Reduce long term risk <br>• Increase building value <br>• Significant local forest supply <br>• Keep money in community | • Local, knowledgeable contractors ☑ <br>• Nelson Hydro could potentially develop a retrofit program ☒ <br>• Certified energy auditors: trades with right skills/certs may not exist |
| **Travel & Meetings** | | | |
| **High Tech Meeting Options****** <br>• Take advantage of technologies for meeting alternatives, e.g. web meetings, low tech video (skype), and high tech video conferencing | • Knowledge of technology <br>• Client confidence in technology <br>• Doesn't replace face to face meets <br>• Rapid changing technologies – soon may be widely available | • Savvy tech people live here <br>• Local companies/orgs likely use video conferencing, e.g. Community Futures, CBT, City, Fortis/Terasen <br>• Save money | • Training ☒ <br>• Internet is local ☑ <br>• Local Biz Centre, Community Futures or library provide video conference for low/no cost |
| **Low Emission Vehicles****** <br>• High efficiency vehicle purchase, e.g. LEV, hybrid, electric… | • High capital cost / Low selection <br>• Need all wheel drive year round <br>• Limited electric charging locations | • Reduce operation and maintenance costs | |
| **Procurement** | | | |
| **Buy Local******* <br>• Buy locally made, grown where possible and feasible | • Often higher cost <br>• Local quality not always best <br>• Availability of goods <br>• Locally sourced is not locally made | • Better/expanded businesses <br>• Support local economy <br>• New business venture <br>• Educating staff | • Lots of local entrepreneurs, skilled people ☑ |
| **Low Carbon Purchasing Policy***** <br>• Factor energy and emissions into purchasing | • Price premium <br>• lowest cost not least CO2 intensive <br>• Product carbon footprint info <br>• Educating staff | • Educate/provide guidance to staff, suppliers | |
| **Operation & Maintenance** | | | |
| **Education & Training***** <br>• Educate workers, clients <br>• HVAC, Power down, lights off | • Disinterest <br>• Time, effort, money <br>• Landlord/renter | • Interest, concern | • Shared program ☒ |
| **Cross Cutting Priorities** | | | |
| **Business GHG Reduction Plan***** <br>• Complete Inventories, plans, monitoring | • Low energy price <br>• Time <br>• Knowledge | • Energy saving result in cost saving <br>• Staff morale <br>• Sr Management Engagement is key | • Shared program ☒ |

# Appendix H: Tools to Support Green Buildings

A list of tools to promote green, high efficiency buildings is provided below. These tools supplement the Buildings sector strategies described in the Plan, and are divided into four distinct categories:

1. Capacity Building Tools
2. Financial Tools
3. Voluntary Tools
4. Regulatory Tools

Each category lists a variety of tools, and provides a qualitative description assessing ease of implementation and impact, as well as providing examples of local governments using these measures. This was intended as a starting point from which the City can select the tools most appropriate to Nelson's context.

# Capacity Building Tools

| Tools | How Does it work? | Ease of Implementation | Potential Impact | Example of Local Governments |
|---|---|---|---|---|
| Building Labelling | At point of sale or resale, buildings are labelled with an EnerGuide rating | Moderate<br>Requires partnerships with local realtor board | Low | City of Prince George |
| Build Municipal Staff Capacity | A wide range of staff (permitting staff, inspectors, planners, engineers) can benefit from training with some unique requirements for each including finance, rating systems, role of internal policy tools | Easy<br>Strategic Considerations<br>- Develop capacity in systems with common barriers (Solar hotwater, geoexchange)<br>- Develop capacity with green building certification systems cited in policies (LEED, BuiltGreen, R2000 etc) | Medium | City of Red Deer<br>City of Vancouver<br>RM Whistler |
| Sustainability Block or Neighbourhood | City and developer collaborate to develop a high sustainability block or neighbourhood that addresses building performance and low carbon energy, as well as sustainable transportation, low waste, sustainable site and location designs. | Moderate- Hard<br>Vancouver Olympic Village! | Moderate-High<br>Can be powerful educational experience for developers, city staff, and broader public. | Town of Banff: Bison Courtyard<br>City of Victoria: Dockside Green<br>RM Whistler: Athlete's Village |
| Recognition and rewards for green building or energy leadership | An award or recognition program is created to recognize local leaders and the buildings they build. An elite program would recognize a small number of builders. An extensive program would recognize more buildings meeting a minimum standard, e.g. EG 82, providing plaques for buildings, seal for building sites, etc.. | Easy | Low | City of Toronto<br>City of New York<br>City of San Antonio (Texas) |
| Training for Building and Development Industry | Builds capacity in different parts of building and development sector in planning, technologies, material sourcing, rating systems.<br><br>Can focus on new or existing buildings | Moderate<br>Strategic Considerations<br>-Training may not be done by municipality, but a college or in collaboration with utility | Low-High<br>Depends on roll out | Northern Lights College: Solar Thermal Installer Theory<br><br>City of Vancouver weatherization training<br><br>BC Hydro and Fortis BC have done some training. |

# Financial Tools

| Tools | How Does it work? | Ease of Implementation | Potential Impact | Example of Local Governments |
|---|---|---|---|---|
| Acreage Assessments | Levied on new developments to pay for infrastructure.<br>- Reduced fees provide an incentive to offset incremental costs for green building | Moderate<br>Strategic Considerations<br>Cost schedules must be finely tuned to accurately reflect cost savings to the Local Government from reduced infrastructure costs, and to incentivize energy efficiency | High<br>Comprise a high proportion of development costs. Reductions provide a real incentive to developers. | City of Kelowna |
| Property Tax Exemption | Local Governments can partner with lending institutions, to promote existing energy efficiency lending programs | Moderate<br>Strategic Considerations<br>- Green building certification standards (LEED, BuiltGreen, etc), or equivalent, are appropriate.<br>- Reduces community revenue | Varies<br>Sometimes little take-up. | Maple Ridge |
| Revolving Fund | A Revolving Fund finances energy efficiency improvements in either new or existing buildings. Loans are repaid from energy savings | Difficult<br>Strategic Considerations<br>- Requires inexpensive capital for fund<br>- Quality assurance of building programs | High<br>Financing a substantial barrier to green buildings | City of Toronto-Toronto Atmospheric Fund |
| Local Improvement Charges | An LIC would allow a municipality or a private lender to finance residential or commercial efficiency or renewable retrofits and then make the payback through a charge on the property tax. The LIC would stay with the property rather than the owner. In the US this is called a Property Assessed Clean Energy (PACE) bond. | Difficult<br>Strategic Considerations<br>- Have experience with LICs<br>- Gauge Provincial response | High<br>Financing a substantial barrier to green buildings | LICs under consideration by:<br>City of Dawson Creek<br>City of North Vancouver<br>District of Mission<br>City of Vancouver<br>and other municipalities across Canada |
| Development Cost Charge Reductions or Waivers | DCC waivers or reductions are linked to environmental performance as assessed by a sustainability checklist or other means, including proximity to downtown to discourage | Quite straightforward procedurally but if DCC account is already low or waivers/reductions already used as incentives elsewhere, unlikely to occur. | Development cost charges are a significant cost to developers so DCC reductions/waivers could provide a significant incentive. | City of Kamloops<br>City of Penticton<br>City of Kelowna |
| Development and Building Permit Fast Tracking | Reduces taxes for green developments. | Easy to Moderate<br>Strategic Considerations<br>- Various fast-tracking protocols exist. Some automated.<br>- Local Governments have multiple priorities. Green buildings must be prioritized to affect market pressure to go green.<br>- Can work in conjunction with a sustainability checklist / Green Building rating system<br>- Changes in file administration processes are needed to ensure that 'green' applications make it to the top of the pile | Medium-High<br>Developers often respond to fast-tracking more than cash incentives, or density bonusing | City of Port Coquitlam |
| Density Bonusing | Reduce approvals time for applications meeting green criteria.<br>- Effective in markets with strong building demand | Easy to Moderate<br>Strategic Considerations<br>- Set acceptable uplift levels<br>- Develop clear guidelines for development planners to negotiate density bonus.<br>- Can work in conjunction with a sustainability checklist / green building rating system | Medium-High<br>Density should be allocated only in appropriate neighbourhoods, compact, complete, alternate transport accessible | City of North Vancouver |

# Voluntary Tools

LANARC

| Tools | How Does it work? | Ease of Implementation | Potential Impact | Example of Local Governments |
|---|---|---|---|---|
| Promote and Support the use of Green Building Standards | Provide educational material and/or staff assistance regarding green building programs such as LEED and Built Green. | If staff support is provided, requires resources for staff training or new position. | Low to Medium<br>Will require motivated developer/builder. | City of Vancouver provides an EnerGuide specialist to assist developer (Vancouver requires a higher EnerGuide rating.) |
| Promote Retrofit Incentives | Promote Federal EcoEnergy Home Retrofit Program. Flyers, workshops, subsidizing home assessments, etc | Easy | High<br>Allows greater energy efficiency gains than affecting new construction.<br>Promotion garners 2 times higher uptake of retrofit programs. | Provide information and/or sponsor workshops:<br>City of North Vancouver<br>District of North Vancouver<br>City of Port Moody<br>Resort Municipality of Whistler |
| Support 3rd Party Green Loan Programs | Local Governments can partner with lending institutions, to promote existing energy efficiency lending programs | Easy<br>Strategic Considerations<br>- Lending institutions have the capacity to manage loans<br>- Focus on larger buildings; greater capital costs, potential gains, & economies of scale | High<br>Financing a substantial barrier to green buildings | VanCity Savings Credit Union- has been green lending packages for energy retrofits in businesses, stratas and single family homes. RBC Energy Saver™ Loan for Home Renovations |
| Sustainability or Green Building Checklist - Mandatory | Part of development/rezoning permitting process. If voluntary, has educational value. If mandatory, a minimum score is required. May be associated with incentives. | Easy to Moderate<br>Strategic Considerations<br>- Compatibility regulations/incentive schemes that can be made more stringent over time are important | Varies<br>Checklists without regulations/incentives less effective | City of Port Coquitlam<br>City of Surrey<br>City of Port Moody<br>City of Nelson<br>City of Kamloops<br>District of North Vancouver (under development) |
| Eco-Industrial Park | Zoning and Development Guidelines encourage integrated systems and services; reduces energy, water and resource inputs | Depends on many local factors. Primarily a longer term strategy. | Potentially High<br>Depends on extent and type of local industries. | Hinton, AB, Eco-Industrial Park: Innovista<br>District of North Vancouver: Maplewood |
| Development and Building Permit Fee Rebates | Return a portion of fees for applications meeting green criteria | Easy to Moderate<br>Strategic Considerations<br>- Works in conjunction with a sustainability checklist / Green Building rating system<br>- Results in lost revenue, unless additional fees are added | Varies<br>Depends on value of rebate.<br>A greater incentive for larger projects, with higher fees | District of Saanich |

# Regulatory Tools

| Tools | How Does it work? | Ease of Implementation | Potential Impact | Example of Local Governments |
|---|---|---|---|---|
| Review Building Related Bylaws - Eliminate Barriers to Green Building | Many bylaws present unnecessary barriers to green buildings. | Moderate<br>Strategic Considerations<br>- Review approvals history; what held up green projects? | Medium-High | City of Vancouver<br>City of Calgary<br>Corporation of Delta |
| Covenants- Green Building Policy | Register covenants requiring green building performance. Typically at re-zoning or sub-division, especially at sale of Government owned land. | Moderate to Hard<br>Strategic Considerations<br>- Requires substantial legal work<br>- Provincial regulations dictate possible provisions.<br>- Implement policy support green building covenants generally; use when impact is high (ie large subdivision or rezoning) | Medium to High | City of Nelson |
| Green Building Rezoning Policy | Adopt performance standards, to guide staff during rezoning negotiations. | Easy<br>Strategic Considerations<br>- Standards should evolve, to stay ahead of the Provincial/Federal regulatory curve. Green building rating systems (LEED, BuiltGreen, etc), or equivalencies, are appropriate.<br>- Higher building performance demanded from properties with advantageous rezonings.<br>- Generally guaranteed through a voluntary covenant | Medium to High<br>Depends on the extent of demands at rezoning. Density should be allocated only in appropriate neighbourhoods; compact, complete, alternate transport accessible | Bowen Island Municipality<br>City of Coquitlam |
| Solar-Ready Bylaw | BC pilot underway now. May be voluntarily adopted. Local governments may mandate all new single family dwellings within their communities be solar hot water ready. | Easy<br>Province has prepared content as part of provincial building standards. | Medium | Over 10 BC local governments endorsed for inclusion; nearly 20 more have signed on. |
| Design Guidelines | Specify building forms and character, encouraging passive solar design. Specify onsite renewables. | Moderate<br>Strategic Considerations<br>- Some uncertainty around local government authority<br>- Consider local environmental conditions (latitude, temperatures, etc). Energy modeling to determine best guidelines appropriate.<br>- Guidelines for different building types (low-rise, high-rise, residential, commercial, high internal heat load, etc) are appropriate, allowing for best passive design applications | Low to Medium<br>Does not address envelope performance and mechanical systems. However passive design can significantly affect energy and emission performance, particularly when combined with on-site renewable energy system. | District of Saanich (Pre Bill 27 where some new authority was granted)<br>District of Tofino (under development) |
| Compact Complete Communities – OCP Policies | Land use intensity can be increased using land use tools. Smaller unit sizes improve per capita energy performance and various attached forms improve thermal performance. Forms include:<br>• Hidden density: laneway cabins<br>• Gentle density: row housing<br>• Invisible density: secondary suites | Depends on many local factors. Primarily a longer term strategy.<br>Strategic Considerations<br>Appeal to community priorities in addition to energy efficiency - healthy neighbourhoods, options for walking or biking, local access to amenities, a range of housing, etc<br>Density needs to be transit/alternate transport accessible. | Very High<br>Probably the greatest impact of any strategies Local Governments can use to advance buildings' energy performance. | Many communities have policies to reduce sprawl and encourage compact growth. |

# Appendix I: Select Resources

The following Select Resources provide supplementary information for some of the strategies and actions discussed in this Plan. Resources are organized by sector and, where appropriate, by strategy. This is not intended as a comprehensive list; rather, it reflects areas in which the City was particularly interested in learning more, or that the authors felt would be highly beneficial in the implementation stages of the plan.

## Land Use Resources:

**Development Permit Area and Design Guideline Best Practices**

*Passive Design Toolkit Best Practices*
City of Vancouver
http://vancouver.ca/sustainability/documents/PassiveDesignToolKit.pdf

*Climate Consultant 4.0 Develops Design Guidelines for Each Unique Climate*
Murray Milne, Robin Liggett, Andrew Benson, and Yasmin Bhattacharya, UCLA Department of Architecture and Urban Design
http://www.energy-design-tools.aud.ucla.edu/papers/ASES09-Milne.pdf

*Aldergrove Core Design Guidelines*
Township of Langley, 2010
http://www.tol.ca/files/web_files/planning/CommunityPlans/Bylaw_1802_Aldergrove.pdf

*Urban Design Compendium*
The Housing Corporation, Urban Design Alliance
http://www.urbandesigncompendium.co.uk/

*Sustainable Urbanism: Urban Design With Nature*
Douglas Farr, 2009

*District of Saanich Community Design Guidelines*
District of Saanich, 2007

*Sustainable Urban Design and Streetscape Best Practices*
City of Olympia, 2009
http://www.ci.olympia.wa.us/imagine-olympia/focus-areas/~/media/Files/Imagine%20Olympia/Downtown-BMPs.ashx

*Development Permit Area Guidelines*
BC Climate Action Toolkit
http://www.toolkit.bc.ca/tool/development-permit-area-guidelines

## Buildings:

**Retrofits**

*Enabling Investments in Energy Efficiency: a study of energy efficiency programs*
Merrian C. Fuller, 2009
http://erg.berkeley.edu/info/thesis/Fuller_2009_ResiFinancing%20ERG%20Final%20Paper.pdf

*Retrofitting a City:* A Guide for Municipalities to Implement a Building Retrofit Program
Canada Mortgage and Housing Corporation, 2001
http://publications.gc.ca/collections/collection_2011/schl-cmhc/NH15-447-2001-eng.pdf

*Various Articles*
Clean Energy Works Portland
http://www.cleanenergyworksoregon.org/

*Various Articles*
Efficiency New Brunswick
http://www.efficiencynb.ca/home.html

## Energy Supply

*Renewable Energy Guide for Local Governments in British Columbia*
Community Energy Association, 2008
http://www.communityenergy.bc.ca/resources/cea-publications-0

*District of North Vancouver Riverside Drive Turbine PRV Station - Micro-Hydro Power Generation for a Closed Potable Water Distribution System*
Brian Harrington, District of North Vancouver, 2010
https://www.bcwwa.org/resources/resource-library.html?view=resource&resource=98

## Cross Cutting & Community Wide:

**Community Based Social Marketing Resources**

*Community Based Social Marketing* is marketing focussed on behavioural changes for a social good. Sometimes just called "social marketing," a leading Canadian environmental psychologist in the field has successfully re-branded the work as *Community Based Social Marketing* or *CBSM.*

While there are many commercial marketing insights applied to social marketing, there are other learnings from psychology, sociology, and anthropology and related disciplines such as communications theory.

In this Plan, social marketing is discussed under *Community-Wide Measures, Strategy B. Engage with Citizens, Businesses, Non-Profits and Public Sector Organizations to move down the Low Carbon Path.* There is a best practice and best process vignette, entitled *Education, Outreach and Social Marketing.*

The following are useful resources related to social marketing.

*Tools For Change*: A good resource financed by NRCan for an Ottawa-based "Green Community Initiative" and authored by a consultant (Cullbridge) It focusses on CBSM for health, environment, and safety issues. It includes case studies, tools (the term CBSM uses to refer to specific devices, tactics) and resources organized by issue.
http://www.toolsofchange.com

*Fostering Sustainable Behavior:* A good resource developed by consultant, academic and leading CBSM practitioner Doug Mckenzie-Mohr. The site includes a chapter by chapter outline of the book he co-authored, *Foster Sustainable Behaviour*, as well as articles, tools (the term CBSM uses to refer to specific devices, tactics), and case studies.
http://www.cbsm.com

*Social Marketing Institute :* A health focussed site with general resources, the most useful of which is its "related sites" page.
http://www.social-marketing.org/relatedsites.html