

EXECUTIVE SUMMARY OF 2007 -2012 REPORTS

COMMUNITY ENERGY AND EMISSIONS INVENTORY (CEEI) INITIATIVE

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Ministry of
Environment

1. CEEI Overview

1.1 Purpose

This document provides local governments with an easy-to-use guide to the Community Energy and Emissions Inventory (CEEI) reporting system, providing basic information on the methodologies used while briefly outlining its potential uses and background. It is intended to serve as a supplementary document to the Technical Methods and Guidance Document for 2007 – 2012 CEEI Reports, which provides in-depth information including data sources and detailed estimation methods.

1.2 What is CEEI?

CEEI is a provincial framework for tracking and reporting energy, greenhouse gas (GHG) emissions and supporting indicators at a community-wide scale. The system establishes and enables inventory baselines, ongoing monitoring and periodic reporting to inform community decision-making and support provincial objectives related to energy use and GHG emissions. This is CEEI's third reporting cycle, and it has now produced local data on energy use and GHG emissions for B.C. local governments for the 2007, 2010 and 2012 reporting years.

1.3 Why is CEEI important?

According to the Intergovernmental Panel on Climate Change, the amount of CO₂ emitted into the atmosphere globally must stay within the temperature rise limit of 2 degrees Celsius above pre-industrial levels in order to avoid runaway climate change. Based on this limit, BC has a legislated GHG reduction target of 80% below 2007 levels by 2050. Since approximately half of BC's GHG emissions are under the direct or indirect control or influence of municipal governments, BC will depend on community-level action and innovation to meet its 2050 target.

CEEI allows local governments to develop and track progress on informed GHG reduction targets, policies and actions. It supports local governments in fulfilling their commitments to measure and report on community-wide GHG emissions under the Local Government Act and the voluntary BC Climate Action Charter (PDF) to which 182 local governments are signatories.

CEEI reports are organized around four primary sectors: buildings, on-road transportation, municipal solid waste, and land-use change from deforestation. These main categories are supplemented by seven supporting indicators tailored to accommodate the needs of community planners (see Section 2.7 below). CEEI reports also include additional information on two "memo items" at the regional district level, which include enteric fermentation from agricultural livestock and emissions from large industrial facilities¹.

CEEI reports are framed around guiding principles which require all data provided be:

1. **relevant** to the decision-making needs of local governments;
2. **consistent** in its methodological application (or practicing thorough documentation of any changes that may occur);

¹ Due to accuracy and/or privacy concerns, memo item emissions categories are provided for information purposes only and are not included in total reported emissions profiles.

3. **accurate** in calculation;
4. **transparent** and easy-to-use; and
5. dedicated to a process of **continuous improvement** through ongoing dialogue with CEEI users, data providers and managers.

1.4 Ways to use the CEEI:

- **Forecasting** – The 2007 CEEI report provides a “base year” of energy and emissions information and background data to assess assumptions and test the accuracy of actions intended to influence emissions. CEEI community-level data can be used to assess alternative forecasts or scenarios (e.g., using building and transportation data, emissions factors and population growth assumptions to roughly forecast energy and emissions levels into the future).
- **Target Periods** – The provincial government has set interim goals and target dates (2012 and 2016) for GHG emissions reductions. CEEI reports are intended to be produced biennially, providing communities with the flexibility to set target periods in common with the Province or choose other dates aligned with community-specific needs or processes (such as Official Community Plans or Regional Growth Strategies review).
- **Monitoring** – CEEI reports allow communities to monitor the progress they are making in reducing energy consumption and GHG emissions. The reports also enable comparisons among jurisdictions, although analysis and comparison should be undertaken with caution as community-level emissions can vary with regional and local conditions.
- **Planning** – CEEI reports act as an important tool for emissions planning and modelling work being undertaken by local governments. These modelling efforts help to inform both traditional and new community planning processes (e.g., Official Community Plans, Regional Growth Strategies, Community Energy and Emissions Plans and Integrated Community Sustainability Plans).

1.5 How are CEEI reports created?

The following generic steps are used to assign and calculate GHG emissions for CEEI reports:

1. Consumption and activity data are received from data providers (if not available from primary sources, data is gathered or derived from other reliable sources).
2. Consumption and activity data are assigned to a local government based on information embedded in the data received or gathered from other sources.
3. Consumption and activity data are converted to standard units – using the emissions factors and global warming potentials for each fuel source or direct emission included in CEEIs.

1.6 Emission types:

CEEI reports include direct and indirect emissions². Gases included in reporting are carbon dioxide (CO₂), methane (CH₄), and nitrous oxides (N₂O). Emissions are listed in tonnes carbon dioxide equivalent (CO₂e). The grand total listed in CEEI reports states the amount of energy and CO₂e for core sectors (not

² *Direct emissions* are the result of consumption of an energy type by an end user (which results in GHG's being emitted directly into the atmosphere), while *Indirect emissions* are the result of consumption of an energy type by an energy utility upstream of consumption by the end user. For example, the use of natural gas to fire a boiler to heat a building or of gasoline by a vehicle driver is a direct emission, whereas the use of electricity by an end user (e.g., to heat a building or to charge a battery) is an indirect emission

including memo items), for each energy type and direct emission source, as well as the total combined energy and CO₂e.

For more in-depth information on terms referenced in CEEI reports, including “standard units of measurement”, “emissions coefficient”, and “global warming potential” see [Section 12 \(Glossary of Terms\)](#) of the CEEI Technical Methods and Guidance Document.

2. CEEI Methodology per sector

2.1 Residential, Commercial and Industrial Buildings Sector

CEEI reports include emissions produced by all utility-provided electricity, natural gas, and piped propane consumed within a local government boundary- where confidentiality provisions allow. Total energy for each of the residential, commercial, and industrial subsectors is based on the consumption of electricity and natural gas for each connection.³ Findings are then subcategorized by residential and commercial (or small-medium industrial) buildings.

Consumption data from electricity, natural gas and piped propane use is directly available from utilities, but data on the usage of heating oil, delivered propane and wood is not. The use of these fuels is estimated by calculating the total energy required for heating and other uses, then subtracting the electricity and gas consumption from this total. The remainder is then attributed to heating oil, propane or wood, using a ratio for each based on other available data.⁴

CEEI reports categorize industrial emissions according to sector and emissions process. For a complete list of these categories, see [Table 4](#) of the CEEI Technical Methods and Guidance Document.

Because of confidentiality issues, utilities withhold data when a single customer exceeds 50% of the municipality’s total consumption for a subsector. Since large industrial customers can dominate energy consumption within a municipality, the ability of CEEI to provide accurate data on large industrial facilities is variable. For this reason, industrial facilities have now been included as a “memo item” in CEEI reports. From 2012 onward, [BC’s Reporting Regulation](#) will allow for large facilities covered by the regulation to be included in CEEI reports, enhancing transparency for large industrial utility emissions.⁵

2.1.1 Accuracy

The information provided by utilities is considered to be very accurate overall. However, there are accuracy issues associated with the manner in which the utilities assign customers to building

³ For residential and commercial subsectors, “connection” refers to number of customers, while for industry “connection” refers to the number of facilities.

⁴ For access to the report “Residential Heating Oil, Propane, and Wood Heat Estimates for BC Communities”, December 2009 by Energy Efficiency Consulting for the CEEI Working Group; please contact climateactionsecretariat@gov.bc.ca

⁵ BC’s Reporting Regulation requires that all operations with 25,000 tonnes or more of (CO₂e) emissions per year report their emissions through an accredited third-party verifier.

subcategories (e.g. residential, commercial, and industrial). The most significant of these is that multi-family buildings are often considered to be 'commercial' by gas utilities.

Since information for volumes of wood, heating oil, and propane is estimated, data for these fuels should be used with caution. For large industrial facilities, data is considered to be very accurate however due to the confidentiality issues stated previously gaps in data coverage can affect the accuracy of reported emissions within the sector.

2.2 On-Road Transportation Sector

CEEI follows a resident-based approach in calculating emissions from the transportation sector. This provides a finer level of detail that captures both the types of vehicles present in the community, and the average fuel consumption rates of vehicle classes. CEEI uses ICBC fleet population data which provides information on every registered vehicle in British Columbia. This information is then cross-referenced with data from Canada Post, so that vehicles can be attributed to their respective jurisdictions. 2007-2012 CEEI reports indicate "connections" of vehicle, which refers to a count of all vehicles on the road, factoring in the amount of use per year, meaning the "full year equivalent" number of vehicles. For example, 2 vehicles registered for half a year each would equal one connection.

Vehicles are then classified into personal and commercial categories. Personal vehicles include small cars, large light duty trucks, vans and SUVs. Commercial vehicles are separated into medium duty vehicles (Class 3-7) and heavy duty vehicles (Class 8a and 8b). Alternative vehicles including trailers, forklifts, snow mobiles, airplanes, marine vehicles, and rail are omitted from CEEI reports. Motorhomes, motorcycles, buses (school and city), and taxis are included, but classified as "subsectors".

Each vehicle's annual fuel consumption is determined by multiplying **vehicle fuel economy** (litres of fuel⁶ / 100 km) by **vehicles kilometres travelled** (VKT). This results in volume of fuel, e.g. litres of gasoline, for each vehicle in BC.

2.2.1 Vehicle Fuel Economy

To determine the fuel efficiencies of vehicles that are 'on the road' within a given jurisdiction, ICBC vehicle record information is matched to NRCAN vehicle fuel economy information. For more details on how fuel efficiencies are applied to certain vehicle subsectors, see [Section 6.3.1](#) of the CEEI Technical Methods and Guidance Document.

2.2.2 Vehicle Kilometres Travelled

The calculation process used to determine VKT reflects the greatest level of uncertainty within the transportation sector, particularly outside the Lower Mainland where data will now be withheld. The calculations for VKT vary according to vehicle use. Vehicles where VKT cannot be directly calculated from ICBC (taxis, buses, motorcycles, motorhomes, medium duty and heavy duty vehicles) are assigned annual mileage according to a default table of VKT values which have been calculated from supporting data sets. Traditional passenger vehicles, however, follow a more comprehensive calculation process.

⁶ At the current time, it is assumed that vehicles are fueled on either gasoline or diesel.⁶ Hydrogen and electric vehicles are assigned an emission factor of zero.

Data for passenger vehicle VKT is derived from the AirCare Program (from 2007 to 2012) which collects odometer readings for the majority of Metro Vancouver and Fraser Valley vehicles. These odometer readings serve as the basis from which all BC passenger vehicle subsectors are assigned VKT values in CEEI. The difference in kilometres travelled between subsequent AirCare inspections is divided by the time period that has elapsed, providing the kilometres travelled per year. This value is then tagged to the vehicle's subsector type (e.g. large car) and insurance category package (e.g. commuter).

All AirCare vehicles of the same "VKT tag" (subsector type and insurance category) in their respective Regional Districts are bundled together to create an average value for that VKT "tag". This average value is then assigned to all other (non-AirCare) vehicles of the same "tag".

2.2.3 Accuracy

The accuracy of the transportation sector is considered to be moderate. Passenger vehicle VKT estimates are statistically sound, with bias and uncertainties reduced as far as is practical. However, validation of results is not yet possible at the level of census subdivision (e.g., municipality). Commercial vehicle fuel efficiency and VKT are based on North American default values.

The average VKT data used for larger commercial trucks consuming diesel fuel are questionable and have been provided for use in CEEI reports by Pacific Analytics with a cautionary note. Fuel consumption rates for commercial trucks are also considered to be inaccurate since these rates are not assigned to vehicles by their manufacturers, and larger trucks have widely varying loads.

2.3 Municipal Solid Waste

Community solid waste (landfill) emissions are based on the total mass of solid waste deposited at landfills. Emissions are then attributed to contributing municipalities and unincorporated areas. For 2007-2012 CEEI reports, information was obtained from either regional district staff or other resource materials. For more information on data sources used in waste emissions calculations, see [Section 7.3](#) of the CEEI Technical Methods and Guidance Document.

The amount of emissions produced at each landfill is highly variable for a number of reasons. In order to achieve the highest level of accuracy possible, the jurisdictional profile of each landfill must be taken into account using a number of data sources, estimates and calculations. Note that GHG emissions from a disposal facility are attributed to the municipality or regional district where the Municipal Solid Waste (MSW) is produced and not necessarily to the region where the disposal facility is located.

CEEI reports do not include GHG emissions from:

- MSW that is not deposited at a regionally operated landfill (for example, a forestry landfill);
- biogenic MSW sent to compost centres; and
- demolition, land clearing and construction waste.

Since landfill GHG emissions are compounded according to how long the landfill has been active, CEEI reports use "Waste in Place" methodology that integrates the historical MSW that has entered the

landfill to date. This approach attributes the highest GHG volumes to the most recent inputs, since attributed emissions decline according to time the waste has been on-site.

Some landfills throughout the province are missing historical jurisdictional information. As a result, two estimation methods were used where data was missing from MSW tonnage sent to landfills between 1977 and 2012. For information on these estimation calculations, see [Section 7.3.2.2](#) of the CEEI Technical Methods and Guidance Document.

The GHG intensity of emissions created at landfills is greatly affected by the area's level of precipitation, waste composition, temperature, pH and buffer capacity, availability of nutrients, waste density and particle size, and landfill characteristics (e.g., depth of landfill, leachate runoff). Since site-specific information on these characteristics is not available for the majority of landfills, estimates of methane generation rates for each landfill are made by assessing the level of annual precipitation, and then classifying each landfill's waste as either "Relatively Inert," "Moderately Decomposable," or "Decomposable".

2.3.1 Accuracy

GHG emission estimates from solid waste disposal as reported in the CEEI are highly uncertain. There are several reasons for this uncertainty, including variability in landfill emissions intensity, lack of available information on landfill tonnage, and a lack of documentation of the operational characteristics of landfills including opening dates, historical tonnage rates, and potential deposits from other jurisdictions. Therefore data from the waste sector should be used with caution.

2.4 Land Use Change from Deforestation

In the land use and deforestation sector, CEEI emissions data are estimated by the Canadian Forest Service (CFS) and Environment Canada in the National Inventory Report: Greenhouse Gas Sources and Sinks in Canada, 1990-2013 (NIR).⁷ Estimates of GHGs resulting from deforestation are made by accounting for forest variability such as general age and the type and density of forest prior to logging, based on a number of sample plots that are reflective of terrestrial variation.

Deforestation data is now available at the municipal level. Since deforestation is often in the control of municipalities, it is now included within the scope of the CEEI, with the intention to help prompt reductions in the sector.

2.4.1 Accuracy

Data collected and utilized in the deforestation sector is considered to be moderately accurate due to the fact that the sampling area (recorded at provincial and national levels) is larger than ideal to determine regional district-level findings.

In addition, Information for the 2007 - 2012 CEEI was derived from 2008 and 2012 satellite imagery and aerial photographs. Previous information reported in the 2007 – 2010 CEEIs was derived from 2000 and 2008 satellite imagery and aerial photographs. Due to the temporal time scales in which air photos were taken, the accuracy level of this data is deemed to be moderate. For additional information on methods

⁷ See: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/7383.php

employed to determine deforestation mapping, refer to Canada's National Deforestation Monitoring System: System Description⁸.

2.5 Memo Items

2.5.1 Agriculture: Enteric Fermentation

Agricultural emissions in the 2007-2012 CEEI reports are based on the National Inventory Report (NIR), which identifies emissions caused by enteric fermentation, manure management, and agricultural soils. However, due to the lack of granular data available at the local level, emissions from manure management and agricultural soils are not included in CEEI agricultural emissions totals. This indicates that findings from this sector must be applied with caution, since over half of the emissions for the sector are not accounted for. For this reason, agricultural sector data is included as a "memo item" within CEEI reports, and is not added to the total emissions for each municipal government area.

For more information on how emissions are created in both agricultural soils and manure management associated with agricultural processing, see [Section 9](#) of the CEEI Technical Methods and Guidance Document.

Enteric fermentation emissions estimates are based on the number of livestock for each regional district, taken from the 2011 Census of Agriculture. For each regional district, the number of animals is multiplied by the estimated methane emissions from each animal (taken from the NIR) to give total methane emissions. Methane emissions are then multiplied by methane's global warming potential (25) to determine carbon dioxide equivalent (CO₂e) emissions. For more information on data sources used to calculate enteric emissions, see [Section 9.3](#) of the CEEI Technical Methods and Guidance Document.

2.5.2 Accuracy

The livestock count mentioned above is considered to be highly accurate as it is based on census data. However, the NIR assumes the same methane emissions per animal across the country, which disregards regional variations in farming practices. Therefore, the level of accuracy within this sector is deemed to be moderately accurate.

2.6 Supporting indicators

The 2012 CEEI Reports include a number of supporting indicators in recognition of the important influence that community characteristics have on community-wide emission reductions⁹. These indicators include:¹⁰

- ◆ **Housing Type:** Private dwellings by structural type;
- ◆ **Mode of Commute to Work:** Employed labour force by mode of commute;
- ◆ **Residential Density:** Population and dwelling units per "net" land area;
- ◆ **Parks and Protected Greenspace:** Land area that is parks and protected greenspace;

⁸ <http://cfs.nrcan.gc.ca/pubwarehouse/pdfs/36042.pdf>

⁹ Supporting indicators are not included in the CEEI emissions calculations for each local government.

¹⁰ Commute Distance, "employed labour force by commuting distance", will no longer be reported, as the data are no longer available through the Census or the National Household Survey.

- ◆ **Proximity to Transit (*new in 2012):** Persons, dwelling units and employment within walking distance of a “quality” transit stop/line;
- ◆ **Proximity to Services (*new in 2012):** Walk Score® <http://www.walkscore.com/CA-BC/>
- ◆ **Floor Space (*new in 2012):** Average floor area by building category and era.

For more information on planned improvements and new indicators included in the 2012 CEEI report as “place holders” (without data available), please see [Section 10.2](#) of the CEEI Technical Methods and Guidance Document. For more information on the methods used to determine supporting indicators in CEEI reports, see [Section 10.3](#) of the CEEI Technical Methods and Guidance Document.

2.7 Further Information

Community Energy and Emissions Inventory (CEEI) information and reports for each BC local government can be found at the Ministry of Environment website:
<http://www2.gov.bc.ca/gov/topic.page?id=9CD252EC63C84868AC2325F70E21683C>

BC local governments looking for additional information on approaches and best practices for undertaking corporate operations and/or community-wide energy conservation and greenhouse gas emissions reduction initiatives are encouraged to visit: www.toolkit.bc.ca.

Both rural and metropolitan BC local governments are incorporating climate change adaptation planning as well as greenhouse gas emission reduction initiatives into their community planning. For more information on climate change adaptation please see “[Preparing for Climate Change: An Implementation Guide for Local Governments in BC](#)”.

BC local governments looking for additional information including community case studies, and best practices for climate change adaptation planning are also encouraged to visit: www.retooling.ca.

Contact

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