Data Requirements for Community Energy and Emissions Inventories in British Columbia

July 2008

Prepared for the BC Provincial
Community Energy and Emissions Inventory
Working Group

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HYLA
ENVIRONMENTAL SERVICES LTD.

About Hyla Environmental Services Ltd.

Hyla Environmental Services Ltd. (HES) specializes in developing energy and emissions plans for local government and departments within senior levels of government (regional, provincial, and federal). With over 13 years of dedicated experience to emissions management, HES' work extends to corporate and community sustainability plans, including integrated community sustainability plans. HES has developed proprietary software, Energy and Emissions Reporting and Monitoring System™ (EEMRS™), which is used to calculate emissions, develop emissions forecasts, and integrate account-level management to produce accurate, cost effective emissions management strategies and monitoring programs. HES is a leader in this field having completed over 75 corporate energy and emissions inventories and 16 emissions management strategies.

HES Ltd. is a founding reporter of The Climate Registry.

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2008 REPORT

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Executive Summary

The Community Energy and Emissions Inventory Working Group (CEEIWG) is a cross government working group, including external support agencies, that is developing a community energy and greenhouse gas (GHG) emissions reporting system to provide inventories to local government across British Columbia.

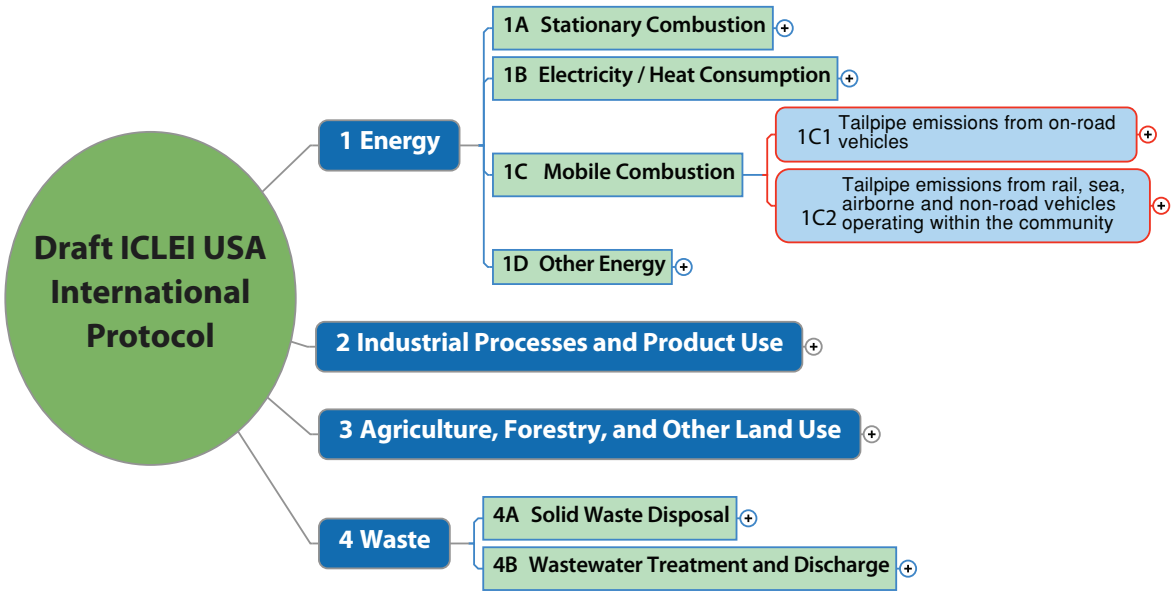
A number of projects have been commissioned by the CEEIWG that provide information relevant to community inventories. The themes of these papers include data acquisition, best practices, inventory summaries, user needs, and lessons learned. These papers and projects attempt to:

1. clarify the components of community inventories including the data that makes up each component;
2. provide a brief overview of historic practices that local governments in British Columbia have undertaken when developing community energy and emissions inventories;
3. survey local government's experience and information needs for successful action with community energy and emissions plans;
4. present some of the lessons learned from a number of pilot communities that undertook community energy and emissions plans using inventories commissioned by the CEEIWG; and,
5. to the extent that the existing datasets allowed, produce community energy and emissions inventories for all local government in BC.

The standard inventory framework for local governments in Canada is the Federation of Canadian Municipalities (FCM) Partners for Climate Protection (PCP) framework, herein referred to as the 'FCM PCP'. The FCM PCP and related guidance document (FCM 2008)[1] is used by 166 members of the PCP across Canada. In BC, there are 55 PCP participants.

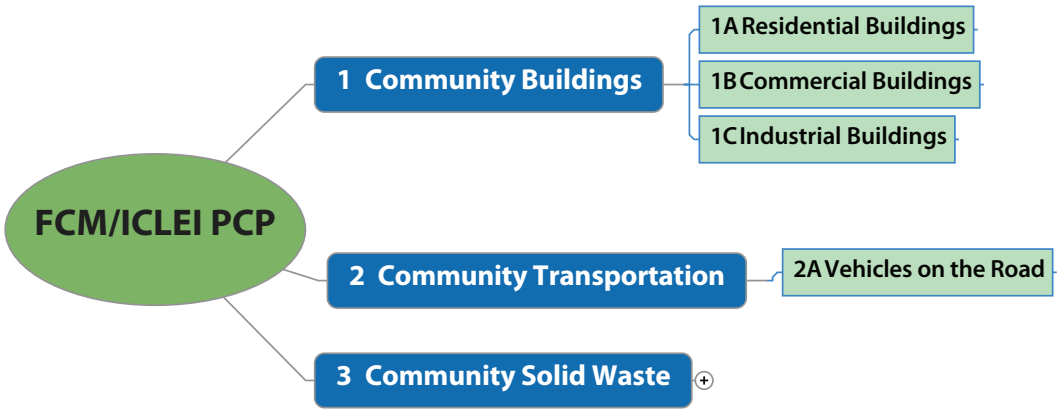
In 2007, ICLEI introduced the Draft International Local Government GHG Emissions Analysis Protocol (ICLEI 2008), herein referred to as the 'draft ICLEI International Protocol'. The draft document introduces an inventory framework (figure i) that is closely aligned with the National Greenhouse Gas Inventory (IPCC 2006) but is a bold departure from the existing FCM PCP framework (figure ii) that the majority of Canadian local governments have been following for over 15 years.

Figure i. ICLEI's Draft International Inventory Framework



1 In support of the PCP framework, HES was commissioned by the FCM to develop a standards and guidance document for the FCM PCP program. Funding for the document was provided by the Provincial Ministry of Environment.

Figure ii. Existing FCM/ICLEI Partners for Climate Protection Inventory Framework



The differences between the draft ICLEI International Protocol and the existing FCM PCP inventory framework are outlined in figure iii and include:

1. the addition of agriculture, forestry, and other land use change which have not been included in past local government inventories;
2. additional requirements for mobile combustion (e.g., rail, marine, and air travel) which are not typically policy relevant for local government; and,
3. mandatory requirements in the waste sector (e.g., emissions from wastewater treatment and discharge) which were previously discretionary.

Figure iii. Sector Equivalencies

ICLEI DRAFT INTERNATIONAL PROTOCOL		FCM PCP	
SECTOR	**EQUIVALENCIES**		**SECTOR**
Energy	Stationary Combustion	Residential	**Buildings**
	Electricity and Steam		
	Stationary Combustion	Commercial	
	Electricity and Steam		
	Stationary Combustion	Industrial	
	Electricity and Steam		
	Licensed Vehicles On The Road	Licensed Vehicles On The Road	**Transportation**
	Rail	N/A	
	Marine		
	Air		
	Off-Road		
Waste	Solid Waste	Solid Waste	**Waste**
	Wastewater		
Agriculture and Land Use Change	Livestock	N/A	**N/A**
	Manure		
	Biogenic Flux		
	Reforestation		
	Sequestration		

In support of developing a community energy and GHG emissions reporting system that will provide inventories to all local government across British Columbia, the CEEIWG commissioned Hyla Environmental Services Ltd. (HES) to explore the emerging inventory framework and protocols, and the data requirements for a CEEIWG system. This report details each Macro Sector in the draft ICLEI International Protocol (e.g., Energy, Industrial Processes and Product Use, Agriculture, Forestry, and Other Land Use, and Waste) and presents recommendations for inclusion and/or exclusion in CEEIWG inventories along with the data required to populate a CEEIWG system.

The scope of this project did not include acquiring datasets for sectors or subcategories that have not been typically included in FCM PCP community inventories. HES was asked to explore the availability of these datasets and whether or not the datasets would meet the needs of a CEEIWG system that would presumably include all categorizations in the draft ICLEI inventory framework.

The draft ICLEI International Protocol includes sectors that local government in BC have not been required to include in past inventories. Because the ICLEI International protocol is still draft relatively new (Fall 2007) and is expected to replace the older FCM PCP inventory framework, the CEEIWG requested an evaluation of the data requirements for these sectors and the availability of data, if any. Regardless of whether or not a sector was data deficient, further CEEIWG deliberations would provide decisions on which sectors to include and which to exclude.

Inclusions/Exclusions

HES has provided recommendations on which sectors to include and exclude based on our discussions with the CEEIWG, our evaluation of available data, and the practicality of reporting emissions at the local government level (e.g., regional districts and municipalities) which also meets the emerging ICLEI protocol.

Regardless of the perceived significance of any emissions source contained within the existing (FCM PCP) or forthcoming (draft ICLEI International) protocols, the CEEIWG should explore all emissions sources so that emissions inventories are as complete as the data allows. Emissions sources that are deemed insignificant may be excluded as *de minimus* once an evaluation is completed on the efficacy of including such sources.

It is recommended that:

1. **Stationary Combustion** emissions are included in their entirety in 2007 CEEIWG reports with the exception of natural gas consumed at electricity generating stations on the grid (consider including as an information item);
2. **Electricity** emissions are included in their entirety in 2007 CEEIWG reports. Although **Heat Consumption** data is insignificant, these datasets are difficult to obtain and may represent a disproportionate amount of effort to include. The CEEIWG will attempt to determine the location of these sources as CEEI content is developed;
3. **On-Road Mobile Transportation** emissions are included in 2007 CEEIWG reports;
4. **Air, Marine, Railway, and Off-Road Transportation** emissions be temporarily excluded from 2007 CEEIWG reports until such time that a study on the practicality of developing emissions estimates for these modes of transportation is undertaken;
5. **Industrial Processes and Product End Use** emissions are not included in CEEIWG inventories;
6. **Livestock and Manure Spread** emissions, and **Net Biogenic Carbon Flux** from **Land Use Change** in **Forested Areas** are included in 2008 CEEIWG reports for census divisions (e.g., regional districts). **Net Biogenic Carbon Flux** from **Land Use Change** in **Croplands, Grassland, Wetlands, Settlements,** and other land uses are not included in local government inventories;
7. **Solid Waste Disposal** emissions are included in their entirety in 2007 CEEIWG inventory reports; and,
8. **Wastewater Treatment and Discharge** emissions are not included in 2007 CEEIWG inventory reports, but are included in their entirety in 2008 CEEIWG inventory reports if not determined to be *de minimus*.

Data Collection, Historical Data, and Data Security

Datasets from BC Hydro, Terasen Inc., Pacific Northern Gas, and Fortis BC are available to the CEEIWG in May or June for the previous years energy consumption. The Recycling Council of BC Municipal Solid Waste Tracking Report and/or any forthcoming Ministry of Environment Community Waste Reduction Section consultants reports on landfill gas production will be used as appropriate. Data for deforestation will be drawn from the Canadian Forest Services access to the National Inventory Reports (NIRs).

ICBC vehicle registration data is available quarterly if the CEEIWG wishes to evaluate seasonal differences in the number of vehicles on the road in a resident-based transportation model. This timing is general guidance from the data providers. The Province may wish to explore agreements that specify the timing of requests so that the CEEIWG can produce community inventories for local governments across BC in a timely manner.

Some datasets are only available from local governments (e.g., composting and wastewater). Once final decisions have been made regarding what sectors to include/exclude, the CEEIWG may wish to outsource data collection for solid waste in coordination with the provincial ministry responsible for the sector in question.

The 2003 data year may represent the first year for which emissions inventories are available for all local governments in BC that utilize real consumption data. This limitation is due to the unavailability of natural gas data from Terasen Inc. prior to 2003.

The CEEIWG must be cautious with summarized energy consumption data in CEEIWG reports to ensure that confidentiality of data is preserved, as defined by the data providers of electricity and natural gas. Vehicle registration data that is assigned to postal codes is also highly confidential if not aggregated in CEEI reports.

Energy

The ***Energy*** macro sector is subdivided into three subsectors: Stationary Combustion (buildings); Electricity/Heat Consumption (buildings); and Mobile Combustion (transportation).

The following is recommended for the Stationary Combustion subcategory:

1. PNG's ability to disaggregate data to census division requires further exploration;
2. The CEEIWG must be cautious with summarized energy consumption data in CEEIWG reports to ensure that confidentiality of data is preserved, as defined by the data providers;
3. The CEEIWG should explore methods of removing natural gas consumption of residential multi-unit customers from the commercial sector and should consider combining the commercial and industrial sectors;
4. The CEEIWG should contact the Propane Gas Association of Canada and the Canadian Association of Petroleum Producers for a list of consultants that may be able to disaggregate total propane and fuel oil sales in BC into regions and provide further advice on disaggregation into local government geopolitical boundaries (note: HES has made such contact and has been advised that several consultants could provide this service to the CEEIWG);
5. The CEEIWG should survey local government in remote areas not serviced by electricity and natural gas to acquire their diesel fuel consumption data for electrical generators, if any. A determination can be made whether or not these emissions are deminimus at that time. Diesel generators owned and operated by BC Hydro are already included in electricity consumption data and their emissions embedded into BC Hydro's emissions factor for electricity;
6. The CEEIWG should begin to track renewable energy supply to begin to tabulate displaced conventional energy sources.

The following is recommended in the Electricity and Heat Consumption subsector:

1. Aggregation of data for buildings classifications (e.g., residential, commercial, and industrial) should follow that aggregation employed for stationary combustion, if any;
2. The CEEIWG should ensure that the province or the data providers include emissions factors for electricity with the annual datasets provided;
3. The CEEIWG should survey local government and the private sector for independent power producers that are off the grid and request data as appropriate; and,
4. The CEEIWG should request data from Metro Vancouver and other entities that own similar facilities, on the power and steam output of the Waste-to-Energy facility and determine how to account for their emissions and energy outputs in regional district and municipal government inventories. Further exploration into how this data is incorporated into BC Hydro's consumption estimates is also required.

The following is recommended for the Mobile Combustion subsector:

1. Prior to including on-road mobile transportation emission in 2007 CEEIWG reports, the results of estimates from various on-road transportation emission models should be tested including the range of inputs available to each model. The results of this methodological study will provide a set of detailed recommendations that would advise the CEEIWG on how best to proceed with emissions from on-road mobile combustion. One component of this study could include obtaining the vehicle identification numbers from ICBC so that fuel efficiency data can be more accurately assigned to individual vehicles;
2. As per recommendations within the user needs survey (page 5), a wider spectrum of information specific to local governments should be provided regarding community transportation (note: this type of information is only available to the CEEIWG through a resident-based approach to community transportation;
3. The CEEIWG should pursue a partnership with ICBC to obtain odometer readings from all vehicles registered on

the road. The partnership would ideally make it mandatory for vehicle owners to state their odometer reading when insuring or re-insuring their vehicle. Alternatively, a requirement to record the odometer readings of vehicles whose ownership is changing should be explored.

Industrial Processes and Product Use

The ***Industrial Processes and Product Use*** macro sector is not further subcategorized and includes greenhouse gas emissions from chemical industrial processes. Due to lack of policy relevance for local government and double counting in provincial and federal reporting processes, it is recommended that this sector is excluded from CEEIWG reports.

Agriculture, Forestry, and Other Land Use

The ***Agriculture, Forestry, and Other Land Use*** macro sector includes direct emissions from livestock and spread of manure, and the change in total carbon stored in various states (e.g., cropland and grassland). Emissions from livestock and manure and forestry land use change are recommended for inclusion in 2008 CEEIWG reports, whereas emissions from other land use (cropland, grassland, wetlands, and settlements) are not recommended for inclusion in CEEIWG reports at this time because these subsectors are data deficient.

Waste

The ***Waste*** macro sector is subdivided into two subsectors: Solid Waste and Wastewater Treatment and Discharge.

The following is recommended for the solid waste disposal subsector:

1. The CEEIWG should obtain data on the amount and origin of municipal solid waste that is incinerated at the Waste-to-Energy facility. This data should be included in 2007 inventory reports; and,
2. Since the Recycling Council of BC's Municipal Solid Waste Tracking Report does not always include data for municipalities (e.g., it includes aggregated data for regional districts and spot treatment for municipalities) the CEEIWG should consider using different methods to calculate emissions based on the availability of quality data for mass of waste tipped and/or landfill gas production estimates from internal reports obtained from landfill managers.

The Wastewater Treatment and Discharge subsector includes direct emissions from wastewater treatment plants in the form of methane.

The following is recommended for the wastewater treatment and discharge subsector:

1. The CEEIWG should explore surveying local government for wastewater treatment facilities and applicable data.

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1. Introduction and Background

The Ministry of Environment's Environmental Quality Branch is a co-leader within the BC government in developing and implementing measures to address global climate change and coordinates the Community Energy and Emissions Inventory Working Group (CEEIWG). The CEEIWG is a cross government working group (inset) that is developing a community energy and greenhouse gas (GHG) emissions reporting system that will provide inventories to local government across BC.

Although not intrinsically linked, the CEEIWG initiative is timely since the Province has recently introduced the Climate Action Charter[1]. With 123 local governments signed on, Climate Action Charter (inset) signatories will work with the Union of BC Municipalities and the provincial government on Joint Provincial-UBCM Green Communities Committee and Green Communities Working Groups. Since part of the voluntary commitment that local governments make to the Climate Action Charter is to measure and report their community greenhouse gas emissions, the CEEIWG inventory reports are intended to assist local government in this regard.

The CEEIWG has contracted Hyla Environmental Services Ltd. (HES), a consulting firm with considerable experience developing energy and greenhouse gas emissions inventories for local government. HES has been asked to share expertise and pilot a system of data retrieval and inventory summaries that results in community energy and greenhouse gas emissions inventories for all local government (188) in BC. Methodological approaches to emissions inventory development, including data manipulation and systems-related issues that are specific to HES' software, were not part of this contract. Specifically, HES has been asked to:

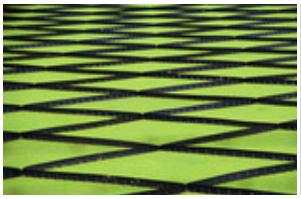
1. Review the background of the CEEIWG and the documents produced to date;
2. Review existing and emerging GHG inventory frameworks to be considered by the CEEIWG for use in the development of CEEIWG inventories;
3. Identify the datasets provided by the data providers and utilized by HES to produce the CEEIWG preliminary inventories and identify the datasets that the CEEIWG would need to acquire to meet the requirements of emerging inventory frameworks, if adopted by the Province;
4. Identify any outstanding issues associated with data acquisition; and,
5. Recommend the scope of CEEIWG inventories including their relevance to local government.

2. Background and Review of Existing CEEIWG Documents

2.1 Background

HES' early efforts with the Province began in 2005 with an introductory paper[2] to outline the type of data that would be required to produce the community inventory reports. HES also prepared a paper that outlined procedures for acquiring data on behalf of the province[3].

Also in 2006, HES was asked to acquire the datasets on behalf of the Province that were previously identified and prepare six preliminary inventory reports for local government participating in the Ministry of Energy, Mines and Petroleum Resources' Community Action on Energy and Emissions (CAEE) Program. In 2007, HES was asked by the Province to assemble datasets that would enable HES to produce preliminary community energy and emissions reports for 2005 for 50 or more local governments in the Province.



Community Energy and Emissions Inventory Initiative

The CEEI Working Group is supported by the BC Ministry of Environment, five other Provincial Ministries, and several supporting organizations and related data providers.

Community Action on Energy and Emissions

The CAEE is supported by the Ministry of Energy, Mines, and Petroleum Resources, Ministry of Environment, and the Ministry of Community Development.

Climate Action Charter

Local government that sign the Climate Action Charter make a voluntary commitment to become carbon neutral, measure and report on their community's greenhouse gas emissions profile, and work to create compact, more energy efficient communities.

1 http://www.cserv.gov.bc.ca/ministry/whatsnew/climate_action_charter.htm

2 Acquiring Energy Consumption and Activity Data for Local Government Inventories in British Columbia. Community Energy Association. Richmond, BC . 9 pp.

3 Energy Consumption and Activity Data Acquisition System for Local Governments in British Columbia. Draft. Ministry of Environment. Victoria, BC. 7 pp.

CEEIWG:

The CEEIWG will employ a system to:

1. serve as a central repository from which local governments can identify their annual community energy consumption and greenhouse gas emissions;
2. uniformly calculate and deliver community baseline energy consumption and GHG emission information to serve the needs of the provincial and local governments; and,
3. provide a centralized point of enquiry for all who require annual inventory reports thus reducing demand for reports directly from individual data providers.

2.2 Review of Existing CEEIWG Documents

The relevant documentation to research includes:

1. Two brief papers prepared by HES Ltd.: (1) Acquiring Energy Consumption and Activity Data for Local Government Inventories in British Columbia; and (2) Energy Consumption and Activity Data for Local Government Inventories in British Columbia Phase II: Procedures for Acquiring Data from BC Hydro, Terasen Inc., and the Insurance Corporation of British Columbia. Both papers are referred to herein as the **Data Acquisition** papers;
2. Best Practices and Better Protocols: Guidance for a comprehensive community emissions inventory system form a high level review of international best practices (Holland Barrs Planning Group). This paper is referred to herein as the **Best Practices** paper;
3. Energy and Greenhouse Gas Inventories by Local Governments in BC: Implications for the CEEIWG Initiative (Sheltair). This paper is referred to herein as the **Inventory Summaries** paper;
4. Community Energy and Greenhouse Gas Inventory User Needs Research (Elevate Consulting). This paper is referred to herein as the **User Needs Research** paper;
5. Community inventories developed over 2007 for the pilot initiative described in 2.1 and the inventories developed for all local government (188) in 2008. These inventories are referred to herein as the **HES Preliminary Inventories**.

2.2.1 Data Acquisition Reports (HES Ltd.)

The first of these brief reports was commissioned to explore the assertion that acquiring data may be the most significant obstacle to the development of community energy and emissions inventories in a timely manner.

The purpose of the initial paper was to identify the issues and recommend a strategy to overcome any limiting factors. A general description of the tools and resources required to implement the strategy was provided as follows:

1. Develop a checklist of data requirements for energy-based inventories;
2. Develop a list of data providers for all data sources required to develop energy-based inventories;
3. Develop a template data request form for data providers of data sources, if required;
4. Request a cost structure for all data sources from data providers, if any;
5. Resolve confidentiality issues with data sources.

The information provided in table 1 was included within the initial data acquisition report and represents a checklist of data requirements for each sector.

Table 1. Difficulties encountered while acquiring data for community inventories

Sector	Electricity	Propane / CNG	Natural Gas	Fuel Oil	Wood	Diesel Fuel	Gasoline	Mass / Direct Emissions	Activity Data
Residential	H, Y, N	H, Y, N	H, Y, N	L-H, Y, N	L-H, Y, L	L-H, Y, N	-	-	-
Commercial	H, Y, N	H, Y, N	H, Y, N	L, Y, N	-	L, Y, N	-	-	-
Industrial	H, Y, N	H, Y, N	H, Y, N	L, Y, N	-	L, Y, N	-	-	-
Transportation	-	L,Y,L	L,Y,L	-	-	H, Y, H	H, Y, H	-	H, Y, L
Solid Waste	-	-	-	-	-	-	-	L-H, Y, N	-

KEY: the order of the abbreviations in the key are as follows:

Significance	L: low; H: high
Issues	Y: yes; N: no
Costs	L: low; H: high; N: none

Data providers, historical data, timing for requests, and data sharing agreements

External agencies that provide data for the most significant sectors are listed in table 2 along with the earliest year for which data is available. Other datasets (e.g., fuel oil, propane, etc.) are not available from vendors as the data is considered confidential business information by the distributors. While this represents a deficiency in developing complete community inventories, the CEEIWG has the option of exploring methods of disaggregating existing province-wide datasets for fuel oil and propane to local government boundaries.

The availability of historical data from BC Hydro and the Insurance Corporation of British Columbia (ICBC) is absolute as per table 2. Datasets for 2001 and 2002 may be available from Terasen Inc. for some communities in BC, although 2003 is the first year for which a complete data set exists for all BC local governments and therefore, the 2003 data year represents the first year for which emissions inventories that include natural gas consumption are available for all local governments in BC.

Table 2. Availability of historical datasets.

Data Provider	Data	Availability of Historical Data
BC Hydro	electricity	1994 - present
Terasen Inc.	natural gas	2003 - present
ICBC	activity data (number of vehicles)	2000 - present

The second Data Acquisition report focussed on the procedures for acquiring energy consumption and activity data from the primary data providers– BC Hydro, Terasen Inc., and ICBC. When the scope of the Preliminary Inventories was expanded to other parts of British Columbia, Fortis BC and Pacific Northern Gas were added to the list of data providers.

The time of the year when requests are made can affect the ability of the data providers to respond to the request in a timely manner. BC Hydro and Terasen Inc. have identified several periods during which large data requests should be avoided, or otherwise times of the year when delays may be encountered if a request is made. Table 2 presents reasonable timelines for the receipt of data and periods during the year during which large data requests should be avoided. It should be noted that these timelines will vary from year to year and the CEEIWG should consult with the data providers in early December-late January of each year to coordinate the timing of data acquisition. No preference for timing was provided by Fortis BC and Pacific Northern Gas, although this aspect of the data request would need to be explored as the Province discusses data sharing agreements, if any.

Table 3. Response to 'Time to Receive Data'.

Data Provider	Time to Receive Community Data	Periods to Avoid/Consider Requesting Data
BC Hydro	3 weeks	Avoid March to April. Consider May - June as optimal time
Terasen Inc.	3 weeks	Avoid April to May, November, and December
ICBC	3 weeks	N/A

Data sharing agreements were only required for the data received by ICBC[4] since this data reveals the postal codes associated with the make, model, and model year of all vehicles registered in the Province. BC Hydro and Terasen did not specify a need to enter into a similar agreement. The Province may wish to explore agreements that specify the timing of requests so that the CEEIWG can produce community inventories for local governments across BC in a timely manner.

HES' discussions with the data providers resulted in the following recommendations:

1. Data providers have expressed a preference that requests were made by the same individual as much as possible (avoid any repeated edification that may otherwise be necessary); and,
2. BC Hydro and Terasen Inc. encourage one request per year for province-wide community datasets, therefore, community datasets for the entire province should be made once per year starting with initial contact in January to establish a firm timeline for receipt of the most current dataset.

HES developed and carried out the procedures in the second Data Acquisition report to secure the data necessary to develop the Preliminary Inventories, which included 6 inventories in 2007 for the pilot projects described in section 2.2 (bullet 5) and an inventory for each local government in British Columbia in 2008 (note: some inventories were incomplete due to data deficien-

4 Memorandum of Understanding between Ministry of Environment and the Insurance Corporation of BC

cies as described in sections five through eight). We did not encounter any difficulties obtaining any of the data sets acquired from BC Hydro, Terasen Inc., and ICBC and the data providers responded to the request in a timely manner.

Fortis BC and Pacific Northern Gas are not able to summarize data by regional district as their service delivery boundaries (e.g., the boundaries to which data is coded) do not correspond with census divisions (e.g., regional districts). We did not receive community datasets for the year 2005 from Fortis BC (see page 19)– we received a dataset for the year 2007.

2.2.2 Best Practices (Holland Barrs Planning Group)

This report offered guidance for a comprehensive community emissions inventory system based on a high level review of international best practices. The report recognized that community inventories require that local government negotiate access and then manage data, making the compilation of an inventory a very inefficient process.

Protocols and standards identified included:

1. World Business Council on Sustainable Development/World Resources Institute's GHG Protocol Initiative which is the current world standard used by The European Trading System, the California Climate Action Registry (CCAR) and the Chicago Climate exchange;
2. ICLEI Cities for Climate Protection Campaign Protocol/Guidelines for Reporting (Draft 1999) has been the primary tool for consultants and the FCM. ICLEI's standards are evolving with the California Climate Action Registry and WRI in efforts to have a more consistent North American Protocol.
3. The Federation of Canadian Municipalities' ***Developing Greenhouse Gas Emissions and Energy Consumption Inventories: A Standards and Guidance Document for Canadian Municipalities***, which is the current standard for local government in Canada. This document referenced a spreadsheet tool that the FCM Partners for Climate Protection provides to local government across Canada to develop community inventories.

Although not comprehensive, the report identified existing and future software solutions as follows:

1. Torrie Smith Municipal Greenhouse Gas Strategy Software used by the Federation of Canadian Municipalities' Partners for Climate Protection Program;
2. HES' Energy and Emissions Reporting and Monitoring System™, which is used by HES to produce inventories for local government clients, including the preliminary inventories identified in section 2.2.5.
3. Clinton Climate Initiative's forthcoming tool (Fall 2008) that will process inventories for the Clinton Climate Initiative's C40 cities.

A number of recommendations were presented as follows:

1. stay informed of all the organizations and evolving protocol documents potentially developing a BC supplement;
2. develop a centralized system capable of managing large volumes of high quality, geocoded data from multiple sources is desirable;
3. develop a reporting format to present data in a compelling, coherent, user-friendly manner;
4. consider delivering capacity building programs to enable local governments to maximize the utility of inventories for climate action planning;
5. consider provincial level reports and online reporting tools on local government activity to strengthen awareness, recognize leadership, and build support; and,
6. consider an interim data management system that is a stepping-stone to a more sophisticated system.

2.2.3 User Needs Research (Elevate Consultants)

The goals of the user needs research report was to determine the needs of local government in British Columbia as well as the level of understanding and anticipated use of community inventories across the province. To achieve this goal, a web-based survey was sent to Chief Administration Officers for all local governments in the province. The survey response rate of local government was 32% (e.g., 59 local governments).

The results are summarized as follows:

1. few local governments (13%) had completed an inventory and fewer still had completed a GHG plan;
2. knowledge/awareness of these inventories was low with 62% claiming no knowledge;
3. the strengths of an inventory were noted to be in providing confidence to planning, target setting and performance measures, creating a knowledge base that fosters public awareness and support, and gaining an understanding of the level of action being achieved by each local government in the province;
4. limitations were identified as the current availability of reliable data which is easily understood, and easy to obtain and access to inventory expertise;
5. respondents did not see inventories as necessary for action or the lack of an inventory as being restrictive in implementing reduction measures;

6. a baseline inventory was considered a necessary tool for planning, target setting and measurement of performance;
7. public accountability was highlighted as important to local government;
8. local government council, staff and public would require the use of a baseline inventory to create defensible awareness to the public, develop plans, set targets and measure their performance. The interviews however, showed that where there was this knowledge, it covered both the intent and basic composition of this type of inventory. A common theme during the interview stage was a desire for education and on-going knowledge support on the development, maintenance and potential uses of an inventory. There was a strongly expressed desire to avoid re-inventing the wheel and to learn from other local governments;
9. respondents saw informing the public as the primary purpose of such inventories with other factors such as identifying conservation activities, tracking, developing by-laws, and planning as other highly ranked potential uses; and,
10. the value given to the completion of inventories was more diverse in communities with informed respondents as opposed to those just getting started. When staff responded to the survey in lieu of the CAO, the value of such projects was seen to include aspects such as political, competitive as well as regulation and policy monitoring.

Respondents indicated a need to subcategorize data as follows:

1. breakdown of vehicles by their fuel economy rating;
2. personal versus commercial vehicle breakdown;
3. commercial building breakdowns (e.g. school, office, hotel, etc.);
4. breakdown of commercial vehicles (e.g. light truck, heavy truck, bus, etc.);
5. residential building breakdowns (e.g. single family, multi-family, etc); and,
6. breakdown of personal vehicles (e.g. car, motorcycle, RV, etc).

Recommendations on the relevance and accuracy of data types to local government was summarized as follows:

1. the priority for data of a particular source is based to a large extent, on the perceived amount of influence that a local government may have with the source and relevance to a community;
2. survey respondents stated that activities within their jurisdiction which they had no control over such as international airports, marine ports and to some extent agriculture, were not considered important in terms of receiving data; and,
3. while respondents referenced a preferred accuracy level of +/-1% they understood the difficulty in obtaining this. The majority of the respondents stated the more accurate the better. Furthermore a clear message from the respondents was for the province to standardize the inventory system and process requirements which in turn will provide a level of accuracy across the board and confidence in the actions taken.

Respondents identified other themes as follows:

1. standardization of inventories;
2. energy use data by sector – industrial, commercial, residential, municipal, institutional;
3. emissions data on wood burning appliances;
4. information on environmental impacts and the linkage to increasing or decreasing energy use and greenhouse gas emissions;
5. knowledge of alternate, accessible, affordable energy sources;
6. analysis of diesel powered communities; and,
7. data for wood waste from secondary manufacturing industries.

2.2.5 Preliminary Inventories (HES Ltd.)

As a follow-up to the data acquisition papers that HES prepared for the Ministry of Environment before the creation of the CEEIWG, HES developed inventories for six communities in British Columbia that were undertaking a community energy and emissions action plan. An example inventory is presented in Appendix A. The inventory structure followed the FCM PCP inventory framework and therefore, HES' experience with the Preliminary Inventories are specific only to the sectors in the preliminary inventories.

HES also prepared community energy and emissions inventories for 188 local governments in BC, although some inventories were incomplete due to data deficiencies in areas of the Province as follows:

1. data was not available for small communities that rely on diesel fuel generators to produce electricity;
2. data is inaccurate and/or not available in remote communities where postal codes are assigned to a central location in a neighbouring municipality (note: although not considered a local government under the Local Government Act[5], this scenario was particularly acute when attempting to prepare inventories for First Nations– HES was asked to provide two such inventories);

5 http://www.qp.gov.bc.ca/statreg/stat/l/96323_00.htm

3. with the exception of piped propane to Whistler and Revelstoke, consumption data is unavailable for propane and fuel oil used for space heating;
4. Fortis BC could not provide electricity data summarized by local government boundary (municipal and regional district) and could not provide data for 2005;
5. Pacific Northern Gas could not provide natural gas data summarized by regional district boundary; and,
6. data on volume/mass of solid waste was not available in some areas of the province where the solid waste landfill is not managed or where the mass of solid waste tipped is not tracked.

3 GHG Inventory Framework and Guidelines

The CEEIWG has adopted the spirit and intent of the five overarching accounting principals in the World Resources Institute / World Business Council for Sustainable Development (WRI/WBCSD) GHG Protocol *Corporate Accounting and Reporting Standard* (2005 WRI/WBCSD) as follows:

1. Relevance: Ensure that the GHG inventory appropriately reflects GHG emissions and serves the decision-making needs of users—both internal and external;
2. Completeness: Account for and report all GHG emission sources and activities within the defined inventory boundary;
3. Consistency: Use consistent methodologies to allow for meaningful comparisons of emissions over time. Clearly document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series;
4. Transparency: Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make the necessary detail of the accounting and calculation methodologies and data sources used; and,
5. Accuracy: Ensure that the quantification of GHG emissions is neither systematically overstating or understating your true emissions, and that uncertainties are reduced as much as practicable. Achieve sufficient accuracy enabling users of your data to be able to make decisions with reasonable assurance of the integrity of the reported information.

These principles are intended to ensure a fair, faithful, and truthful representation of GHG emissions and are based on accounting principles to be used as guidance when deciding how to count emissions and the methodologies to be employed. The principles have been designed with corporate GHG accounting in mind and are not intended to define how community emissions inventories should be developed– decisions that are often intrinsic to data availability, data quality, and systems-related limitations.

3.1 Existing Inventory Framework and Guidelines

In Canada, there is only one inventory framework that applies to local government community energy and emissions inventories. The *de facto* standard is the FCM Partners for Climate Protection (PCP) framework and related guidance document (FCM 2008)[6], which replaced ICLIE's Cities for Climate Protection (CCP) Guideline (ICLEI 1999). Regardless, the PCP framework is based on ICLEI's CCP– an initiative with over 600 members worldwide. In Canada, there are 166 members of the PCP, with 55 members in British Columbia. PCP members in Canada are recognized internationally as CCP members, but not necessarily as ICLEI members.

An alternate framework provided by the International Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories has been available to municipalities, although this framework applies to national reporting standards, and has not yet been applied to local government inventories in Canada. Notwithstanding the existing framework within the IPCC Guidance documents, it is the methodologies within the IPCC documents that are generally common to all inventory practices around the world.

3.1.1 FCM's Partners for Climate Protection and ICLEI Cities for Climate Protection Campaign

The FCM PCP framework has been used by PCP members in Canada for at least 18 years and has its roots in the first inventories conducted by Vancouver, Regina, and Toronto in the early 1990s. By 1996, this framework was presented as the cornerstone to the FCM 20% Club and ICLEI CCP programs (note: in 1998, the FCM and ICLEI programs merged to form the FCM PCP program).

Figure 3a presents an overview of the FCM PCP framework, which assigns categories by utilization as either buildings, transportation, or community solid waste. Various energy types (e.g., electricity for buildings and gasoline for passenger vehicles) are included within each sector.

6 In support of the FCM PCP framework, HES was commissioned by the FCM to develop this standards and guidance document for the FCM PCP program

Figure 3a. Overview of FCM PCP Framework

Community Buildings are subdivided into residential, commercial, and industrial subsectors and transportation only includes on-road transportation, although some PCP members included off-road vehicles if it was thought to be relevant to their program. Community Solid Waste includes all municipal solid waste generated within a local government's boundary and disposed of to landfill. Organizing energy sources by sector allows the reader of a PCP inventory to immediately recognize the component parts of the emissions reported.

3.1.2 IPCC

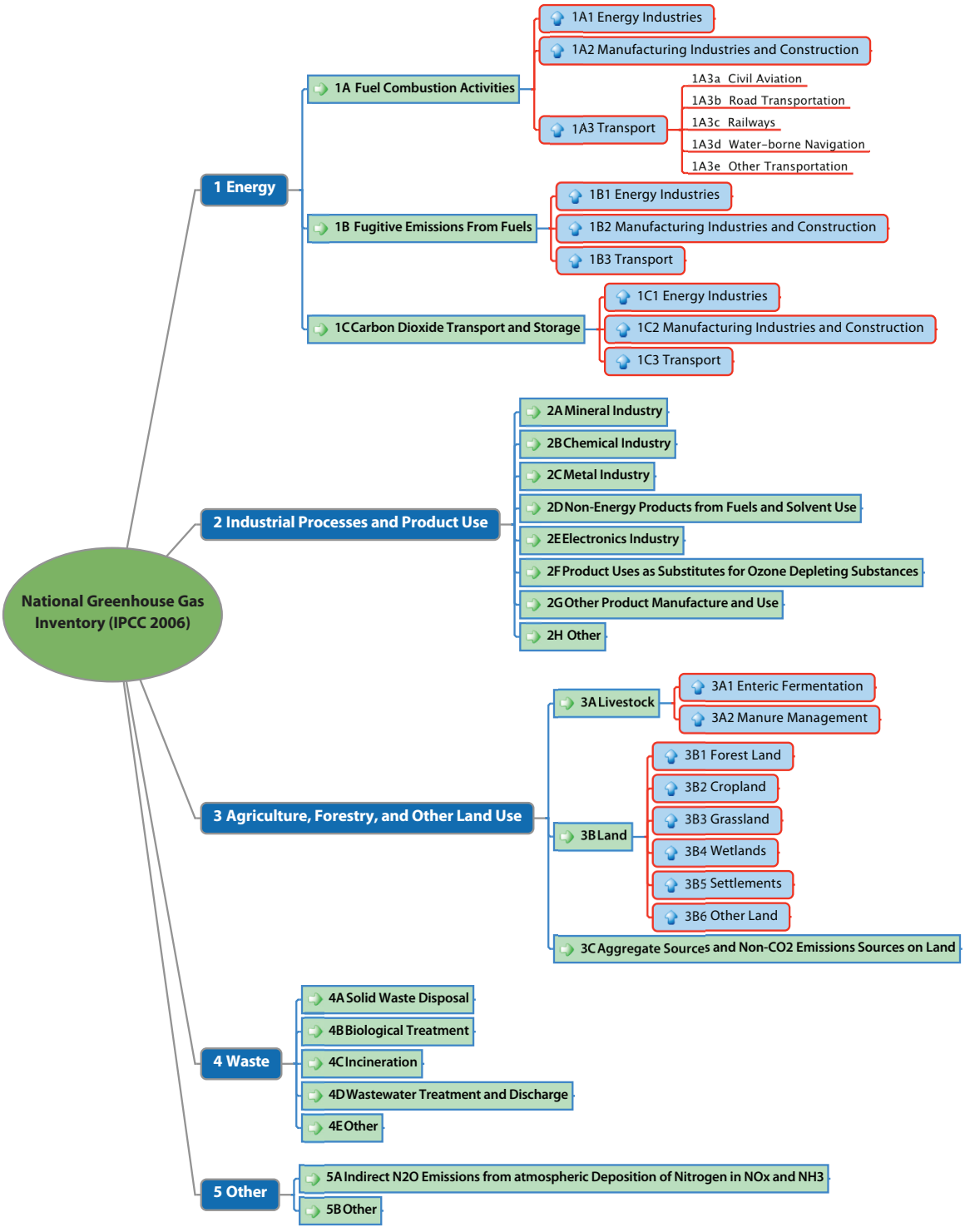
In terms of hierarchy, methods and guidance for inventories conducted worldwide have their roots in the 1996 International Panel on Climate Change Guidelines (IPCC 1996). The 1996 IPCC guidance document was revised in 2006 (IPCC 2006). Although the IPCC documents can be either too general or too detailed in scope relative to the needs of local government, the basis for greenhouse gas calculations are found within these documents.

The 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines) provide methodologies for estimating national inventories of anthropogenic emissions by sources and removals by sinks of greenhouse gases. An overview of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories is available[7].

Figure 3b presents the main categories of emissions sources and sinks for IPCC inventories and all subcategories. The categories identify emissions by source, rather than sector, as in the PCP framework.

7 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/0_Overview/V0_1_Overview.pdf

Figure 3b. IPCC Inventory Framework



Categorizing emissions by source is advantageous when it is important to see the total emissions from energy types with the highest organizational level. Although depending upon how the final energy and emissions data is summarized, it may be cumbersome to view at a glance the total energy and/or emissions for a specific sector (e.g., buildings).

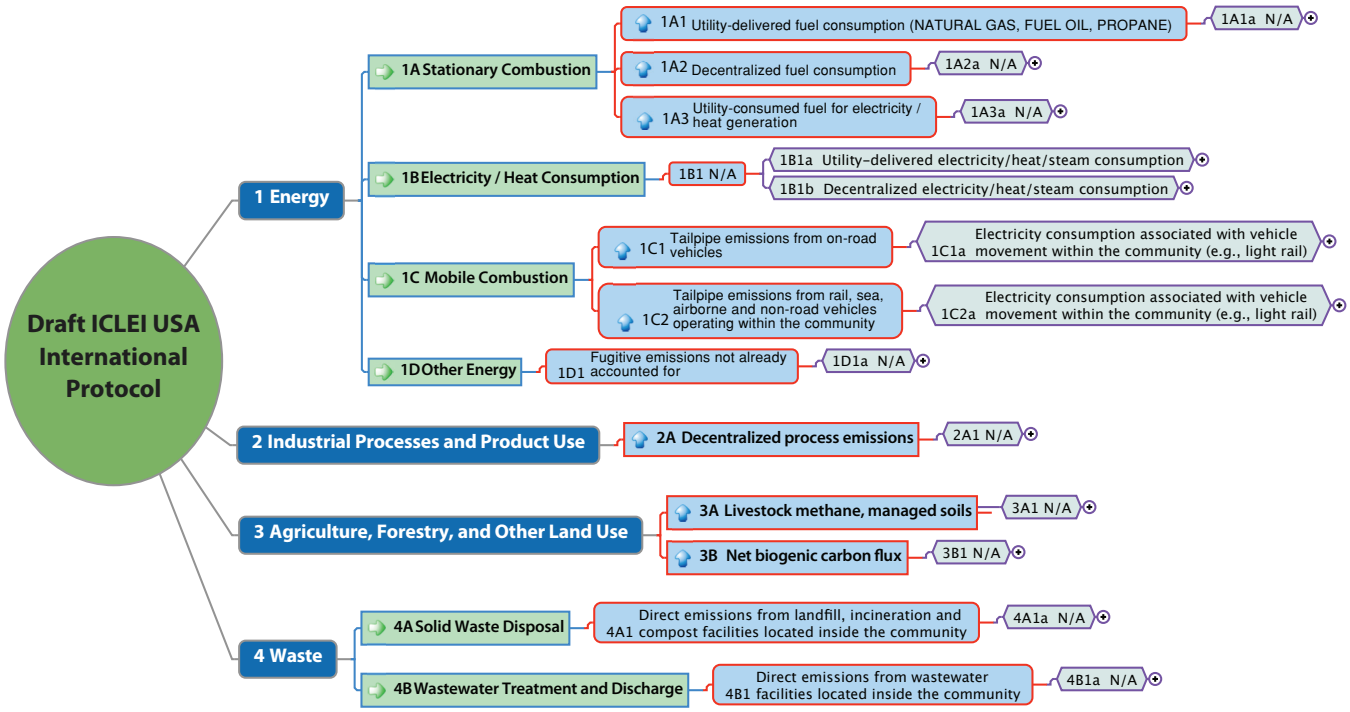
3.2 Emerging Inventory Framework and Guidelines

In section 3.1.1, the existing ICLEI CCP guidance document was introduced. Drafted in 1999, the document is outdated and in need of review. ICLEI has recently released a new guidance document that is significantly different than their previous CCP guidance document. The Draft International Local Government GHG Emissions Analysis Protocol (ICLEI 2008) was introduced in early winter 2007 and made available for public comment in Winter 2008.

ICLEI's new document is a protocol which proposes rules to govern the type of information that is included in community emissions inventories and includes methods that define spatial scope (e.g., geopolitical boundaries). It is a bold departure from their existing guidance document. For example, the inventory framework follows a similar framework to that of the 2006 IPCC guidance document– the inventory is organized by source (e.g., energy, process emissions, land use change, etc.) and not by sector (e.g., buildings, transportation, etc.), although this is the simplest and most superficial difference.

Figure 3c presents an overview of the main categories of emissions proposed in the ICLEI protocol and all subcategories. The categories and subcategories follow the IPCC framework.

Figure 3c. ICLEI GHG Emissions Analysis Protocol Framework



3.3 Evaluation

The FCM PCP inventory framework has seen success over the years since the framework is easy to understand and focusses on energy and emissions that local government intuitively recognize as belonging to their community inventory.

ICLEI has introduced a new protocol for community greenhouse gas inventories that organizes inventories by source rather than sector and includes most of the same inventory framework as IPCC national inventories. On the surface, ICLEI's draft protocol is aligned with the IPCC guidance documents, a document that describes the development of inventories at the national level. Although the ICLEI document is being developed for community inventories, the parallels ICLEI makes to national boundaries and local government boundaries in its prescription of protocols may prove impractical to apply to local government geographies.

A number of other differences in ICLEI's new protocol sharply contrast previous ICLEI guidance, and at the very least, seem a comparatively bold departure from historical community inventories. For example, the draft ICLEI International Protocol adds rail, sea, and air travel to community transportation. Although the addition of those components are not brash, it is the prescription that the emissions from all modes of community transportation be calculated to include only those emissions generated within the local government's geopolitical boundary that may not be practical to estimate. This is one of many departures

that the draft ICLEI International Protocol takes from the existing FCM PCP inventory framework that could be considered an impractical accounting exercise.

The naming convention in the draft ICLEI International Protocol follow the naming convention of the IPCC framework. The CEEIWG should use a combination of names for each sector that are more closely aligned with the existing FCM PCP framework since local governments in BC already identify with the names in the FCM PCP framework and the names in the draft ICLEI International Protocol are not easily identifiable.

Regardless of the challenges with the details of the draft ICLEI International Protocol, the CEEIWG will likely adopt the draft ICLEI inventory framework due to the Province's alignment with The Climate Registry and the latter's alignment with ICLEI. Although, it is recommended that the Province follow the FCM PCP framework for the 2007 inventory reports.

The CEEIWG should develop a slightly modified version of the voluntary protocol that suits the specific needs of local government and the availability of province-wide datasets. Data for sectors not currently included in the FCM PCP framework should be explored immediately and incorporated into CEEIWG reports for the 2008 inventory year. Any system developed by the CEEIWG must be flexible enough to accommodate continuous improvement to existing sectors and sectors that will be added in the future.

Table 3 provides a simple comparison of the sectors covered by each of the inventory frameworks presented in section 3.1 and 3.2, although the table follows the FCM PCP inventory framework and organizes information by sector.

Table 3. Comparison of Sectors/Subsectors Included in IPCC, ICLEI, and FCM PCP Inventories.

SECTOR	SUBSECTOR		IPCC	Draft ICLEI GHG Protocol	FCM PCP
Buildings	Residential		√	√	√
	Commercial		√	√	√
	Industrial	energy emissions	√	√	√
		process emissions	√	√	rarely
Transportation	Licensed Vehicles On The Road		√	√	√
	Rail	Federal and/ or Provincial Jurisdiction	√	√	
	Marine		√	√	
	Air		√	√	
	Off-Road		√	√	rarely
Waste	Solid Waste		√	√	√
	Wastewater		√	√	rarely
Agriculture	Livestock		√	√	
	Manure Fertilizers		√	√	
Land Use Change	Biogenic Flux		√	√	
	Reforestation		√	√	
	Sequestration		√	√	

3.4 Policy Relevance to Local Government

On balance, the FCM/ICLEI inventory framework seems incomplete in comparison to the other two frameworks, although the long term, historical use of the FCM PCP sectors is an indication that they may represent the energy and emissions sectors in a community that are most relevant to local government.

In the past, the FCM has stated that over half of Canada's emissions are under the direct control of local government. Although the FCM cannot track the source of this statement and how the percentage was estimated, we assume the statement originated from the FCM's Municipalities Tables that were conducted across the country in the late 1990s. Regardless of the statement's origin and validity, it could be assumed that even as a very coarse guess, local government may indeed control over half of the emissions within their geopolitical boundaries and the percentage could increase to the extent that senior government is able to empower them.

HES' experience with local government community energy and emissions plans supports the claim that over half of the emissions in a local government boundary are under local government's direct control with caveats– the first and foremost caveat

is there is generally far less influence, if any, for built environments and far more control in growing communities.

Further, Elevate Consultant's User Needs Research revealed that "the priority for data of a particular source is based to a large extent, on the perceived amount of influence that a local government may have with the source and relevance to a community".

In HES' opinion, one of the fallacies in decision making processes regarding what to include/exclude in inventories is the tendency to first consider the available tools and policies available to local government that enable them to positively affect emissions as it may be assumed to be unnecessary to include emissions for sectors/sources where no policy levers exist. We believe this to be a fallacy since most of the existing policies available to local government to affect change in community emissions are provincial and federal legislation. Not counting emissions where there are no current policy tools is counter intuitive to affecting change over time. By counting all emissions sources across British Columbia, and tabulating those emissions to local government boundaries, a map of emissions results can be established that identifies the magnitude of emissions sources within local government boundaries. The results may trigger local government to become pro-actively involved in lobbying senior government for the policies and tools they require to affect positive change in their emissions inventories.

The FCM PCP framework has focussed on sectors that are intuitively policy relevance but has ignored other sectors, regardless of magnitude, because they are not perceived to be policy relevant. The draft ICLEI International Protocol strives to count all emissions, regardless of policy relevance or magnitude. HES recommends that the CEEIWG have a view to count all emissions sources until as prescribed in the draft ICLEI International Protocol, as much as available data allows, and until such time that all datasets are fully explored.

4 Data Sources and Realigning Inventory Frameworks

British Columbia is an excellent example of a jurisdiction that is able to produce community energy and emissions inventories for all local government in a relatively simple manner. In BC, there are only two electricity utilities, two natural gas distribution companies, and one province-wide vehicle insurance company (note: energy utilities exist in the province, but are usually owned and operated by the local government. Nelson and New Westminster are examples of local government that operate their own electrical utility).

In the spring of 2008, HES carried out the data acquisition procedures outlined in section 2.2.1 and prepared community energy and emissions inventories for all local government in BC for the data year 2005. HES has developed proprietary software, Energy and Emissions Reporting and Monitoring System™ (EEMRS™), which is used to summarize energy consumption and activity data and calculate greenhouse gas emissions for local government clients. The software provides a number of different functions including emissions forecasts and emissions management strategies. HES also developed the Transportation Energy and Emissions Module™ (TEEM™) to develop fuel estimates for vehicle classes within the community transportation sector. Although flexibility exists, EEMRS™ was designed to summarize data according to the FCM PCP inventory framework (section 3.1.1, figure 1).

In section 4.1, the types of energy consumption and activity data, and the sources of data are identified. Section 4.2, presents a realigned inventory framework and section 4.3 and beyond, explores the datasets in detail.

4.1 Datasets utilized by HES to produce the CEEIWG preliminary inventories

Table 4 lists the types of energy utilization (or activity data that is used to estimate GHG emissions) in each sector included in a typical FCM PCP inventory and the data providers.

Table 4. Data Sources and Data Providers

Sector	Energy type / activity data	Data Source	Data
Residential, Commercial, and Industrial Buildings	Electricity	BC Hydro, FortisBC	√
	Natural Gas	Terasen Inc., PNG	√
	Fuel Oil	Various distributors	X
	Propane	Various distributors	X
Transportation	Number of vehicles per vehicle class (to be specified)	Insurance Corporation of British Columbia	Vehicle registrations
Solid Waste*	Total volume or mass with diversion	Local Government Records	Per capital volume

* actual tipping data is available for local government inventories within regional districts with managed landfills. Actual tipping data was used where appropriate.

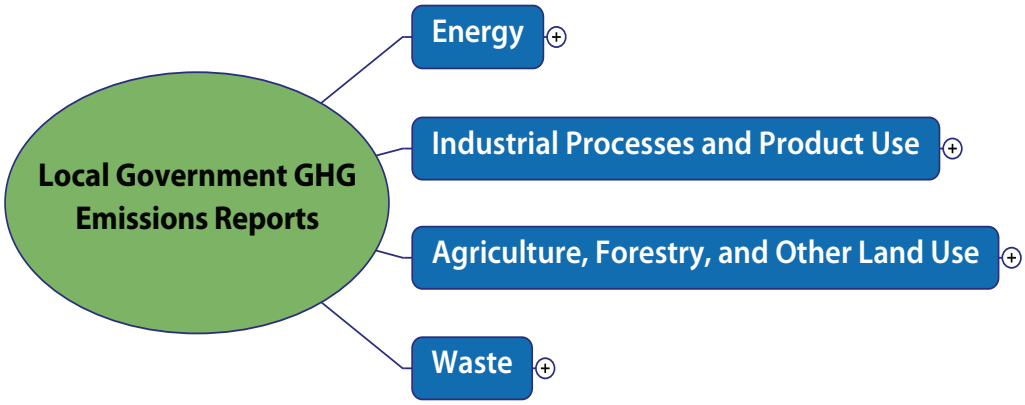
4.2 Realigning the Inventory Framework

Although no decisions have been made at this time, the provincial government is moving towards adopting the draft ICLEI International Protocol inventory framework (pers. comm. Ted Sheldon, Ministry of Environment) as this is the anticipated inventory framework that The Climate Registry will follow to produce their own guidance document for members. Accordingly, this paper presents energy and emissions in the draft ICLEI International Protocol inventory framework in the remaining sections of the report (figure 4), although the equivalent FCM PCP inventory framework is noted where appropriate.

In general, the realignment is as follows:

1. Buildings and transportation sectors of the FCM PCP framework are now included in the Energy Macro Sector;
2. Industrial processes emissions, sometimes included in the buildings sector of the FCM PCP framework, are now included in the Industrial Processes and Product Use Macro Sector;
3. Agriculture, Forestry, and Other Land Use is a new sector that was not included in the FCM PCP framework;, and,
4. Categories for waste remain unchanged, although new subcategories have been added (see section 8).

Figure 4. Realigned Inventory Framework



4.3 Organizational and Operational Boundaries

For local government, the organizational boundary of a community GHG inventory is generally defined as the local government's geopolitical boundary (e.g., the legal geographic boundary). Various issues arise when attempting to restrict the inventory to the confines of this boundary. These issues are particularly acute for community transportation (presented in section 5.3).

Direct and indirect emissions are categorized into three 'scopes' for reporting purposes. For an inventory to be robust, all direct emissions (scope 1) and emissions from purchased electricity (scope 2) must be included. Emissions from other indirect sources are optional (scope 3). These categorizations improve transparency in a community inventory and allow for recognition of those sources that could be double-counted in other inventories (e.g. scope 2 and 3). The definitions for scope are:

1. **Scope 1 Emissions:** All direct emissions sources located within the geopolitical boundary of the local government (e.g., combusted fuel);
2. **Scope 2 Emissions:** Indirect emissions that result as a consequence of activity within the jurisdiction's geopolitical boundary limited to electricity, district heating, steam and cooling consumption; and,
3. **Scope 3 Emissions:** All other indirect and embodied emissions that occur as a result of activity within the geopolitical boundary (e.g., upstream emissions from the transport of fuel oil).

Scope 1 emissions make up all direct emissions in a GHG inventory, whereas scope 2 emissions make up indirect emissions associated with electricity production and supply, usually originating outside the organizational boundary. In general, scope 3 emissions are upstream and downstream emissions associated with scope 1 and scope 2 emissions reported in the inventory. An example of an upstream emission is the energy associated with supplying energy to a building (e.g., the emissions associated with the transport/distribution of energy). An example of a downstream emission is the energy associated with servicing the building or the emissions associated with occupants moving to and from the building.

5 Energy

There are three main categorizations in the Energy Macro Sector: Stationary Combustion; Electricity/Heat Consumption; and Mobile Combustion (figure 5a). An 'other' section is included for fugitive emissions not already accounted for elsewhere.

Energy and emissions from buildings and transportation in the FCM PCP inventory framework are found within the Energy Macro Sector in the draft ICLEI International Protocol inventory framework.

5.1 Stationary Combustion

Natural gas, fuel oil, and propane use in the residential, commercial, and industrial buildings sectors within the FCM PCP inventory framework are included within the ***Stationary Combustion*** Macro Subsectors in the draft ICLEI International Protocol inventory framework (figure 5a). These sources are scope 1 emissions and are defined as utility-delivered fuel consumption (e.g., natural gas), decentralized fuel consumption (e.g., propane), and utility consumed fuel for electricity and heat generation (e.g., natural gas fired electricity generation). There are no scope 2 emissions in this subsector. Electricity for buildings is included in Electricity / Heat Consumption (section 5.2). Figure 5b presents the relationship between the buildings and transportation sectors in the FCM/ICLEI inventory framework and the realigned framework.

Figure 5a. Energy Macro Sector

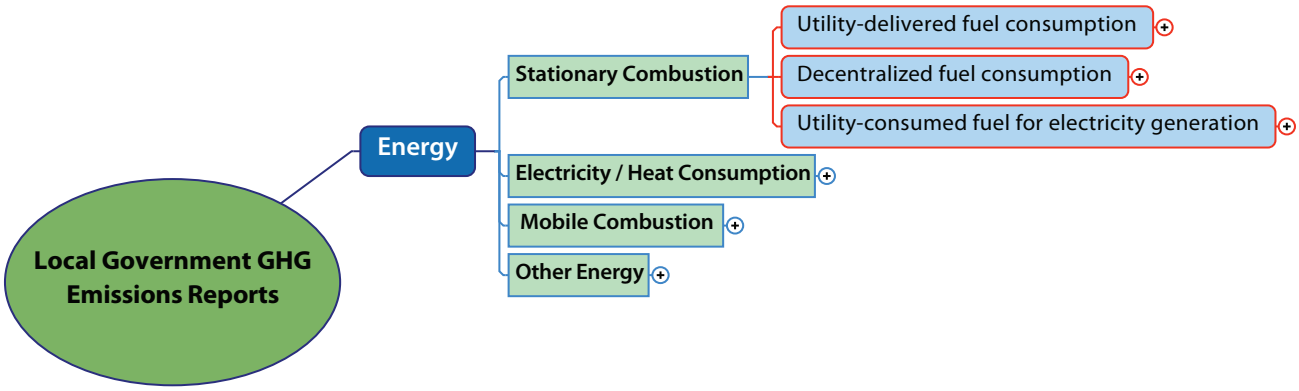
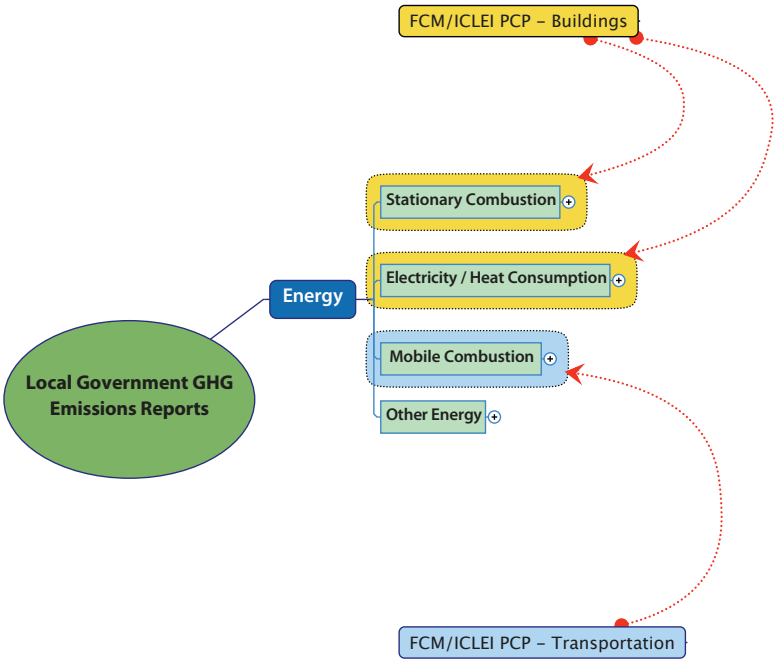


Figure 5b. Buildings and Transportation Sector Relationship to Realigned Framework



5.1.1 Exclusions / Inclusions

Not all emissions sources in the draft ICLEI International Protocol are appropriate for inclusion in BC community emissions inventories. That said, the act of 'exclusion', or an emissions source that is recommended for exclusion in inventory reports should not be interpreted as a breach of a protocol, rather an emissions source that is counted elsewhere or otherwise not presently counted due to other reasons (e.g., data deficiency).

In the energy macro sector, natural gas consumed at electricity generating stations that supply electricity to the grid should not be assigned to the local government for which the generating station is located (e.g., Burrard Generating Station in the City of Port Moody, Prince Rupert Generating Station, and the Fort Nelson Generating Station). The GHG emissions from such sources are counted in a blended emissions factor that is applied to all electricity consumed by the local governments it services and counted as an indirect, or scope 2 emissions in the Electricity / Heat Consumption macro subsector (see section 5.2).

Small, localized diesel fuel fired generators that provide electricity to remote communities are to be counted as a scope 1 emissions in applicable local government community inventories.

Table 5a provides a recommendation of the subsectors to include/exclude in the Stationary Combustion Macro Subsector.

Table 5a. Inclusions/Exclusions for Stationary Combustion

Macro Sector		Scope 1 Emissions	Example	Recommendation for Inclusion / Exclusion
Energy	Stationary Combustion	Utility-delivered fuel consumption	Natural gas and propane to heat buildings	INCLUDE
			Piped propane to heat buildings	INCLUDE
		Decentralized fuel consumption	Fuel oil to heat buildings	INCLUDE
			Propane for space heaters	INCLUDE
		Utility-consumed fuel for electricity and/or heat generation	**Natural gas consumed at electricity generating stations on the grid**	EXCLUDE
			Diesel fuel consumed at small, local electricity generating stations off the grid	INCLUDE

5.1.2 Consumption Data and Sources

Energy consumption data is available for the majority of total energy making up the Stationary Combustion macro subsector of local government inventories. In BC, these fuel types are natural gas, fuel oil, and, propane. Scope 1 emissions in this subsector include utility delivered fuel consumption, decentralized fuel consumption, and utility consumed fuel for electricity and/or heat generation. Table 5b describes each energy type and the data provider for each source, if any.

Table 5b. Data Sources and Data Providers for Stationary Combustion

Macro Sector		Scope 1 Emissions	Energy Type	Data Source	Data
Energy	Stationary Combustion	Utility-delivered fuel consumption	Natural Gas	Terasen Inc.	√
				Pacific Northern Gas	√
			Propane: Piped Delivery	Terasen Inc.	√
		Decentralized fuel consumption	Fuel Oil	Various	X
			Propane: Commercial Transport	Various	X
		Utility-consumed fuel for electricity and/or heat generation	Natural Gas	Terasen Inc.	√
			Diesel Fuel	Various	X

5.1.3 Available Datasets

For utility-delivered natural gas, Terasen Inc. provides gas transmission services to the majority of the southern half of the province, whereas Pacific Northern Gas (PNG) services the northern half of the province. For utility-delivered propane, Terasen Inc. provides pipeline transmission to two communities in BC– Whistler and Revelstoke.

The data extracts for Terasen Inc. and Pacific Northern Gas are similarly configured as shown in table 5c. For FCM PCP inventories, energy within three buildings sectors– residential, commercial, and industrial– are shown in inventory summaries. The data is shown in table 5c as provided and consists of breakdowns of consumption and customers for residential, commercial, and industrial sectors. To derive greenhouse gas emissions, consumption data is applied to a simple calculation (consumption data x emissions coefficient/global warming potentials for CO_2, CH_4, and N_2O = CO_2e).

Table 5c–Terasen Inc. Natural Gas Data Extract

Community	*COM CONS (GJ)*	*COMM CUST*	*RES CONS (GJ)*	*RES CUST*	*IND CONS (GJ)*	*IND CUST*
Community Name 1	*2,383,907*	*27,396*	*2,383,907*	*27,396*	*52,568*	*12*

Datasets are available in June of the year for the previous years data for both Terasen Inc. and PNG and should be requested in late April or early May.

5.1.4 Data Quality for Available Datasets

The ability to validate the data that is provided by data providers in this sector is not available and therefore, the quality of the datasets are taken at face value as received by the data providers. Although true to the accounting system of the data providers, information provided regarding the number of connections as it relates to individual units (e.g., one apartment or one townhome) may not be accurately represented in datasets (see 5.1.7 Other Issues).

5.1.5 Confidentiality Issues for Available Datasets

There are significant confidentiality issues for the datasets required for the Energy sector. These issues are acute for industrial customers in communities where a small number of customers in a jurisdiction make it easy to estimate the consumption of one or two high volume customers.

5.1.6 Unavailable Datasets

Datasets for regional districts were not available from PNG and currently, their service area boundaries do not align with regional district boundaries.

Fuel oil and propane are the only decentralized fuel types in BC and are provided via commercial transport to various buildings and commercial distributors. At present, this data is not available at the level of local government geopolitical boundary due to the competitive nature of the industry providing these fuels. Disaggregations of province-wide datasets should be explored through contact with the Propane Gas Association of Canada[8] and the Canadian Association of Petroleum Producers[9].

To date, there has been no effort to acquire data for diesel fuel powered electricity generators in remote communities not serviced by electricity or natural gas, although this data should be included were applicable.

5.1.7 Other Issues

For natural gas, the aggregated data summaries for consumption and related number of customers does not necessarily reflect the actual number of customers in the residential, commercial, and industrial sectors. Further, there may be discrepancies in the systems and/or accuracy of systems used to assign a customer to the commercial and industrial sectors; either the Standard Industrial Classification (SIC) or the North American Industrial Classification System (NAICS) is used, neither of which may reconcile with the actual customer designation local government may assign. Further, in terms of accuracy of how these classifications were assigned, it is not the case that mistakes were made while classifying customers, rather the systems have changed over time and classification updates of long time customers are not likely updated. Alternatively, classifications may be based on rate class information that is associated with the relative volume of natural gas distributed to a customer.

A further problem exists with data for the commercial and residential sectors. Many multi-unit residential customers are listed in the commercial dataset and not in the residential dataset for multi-unit residential customers where a single metre serves one building containing many separate residential units. The result is a data deficient residential buildings dataset and an overstated commercial buildings dataset for natural gas consumption. Numerous connections in a single building that are listed as a single customer does not allow for accurate calculations of unit-based indicators in this subsector.

8 http://www.propanegas.ca/

9 http://www.capp.ca/

5.1.8 Recommendations

The following recommendations are provided regarding stationary combustion consumption data and data sources:

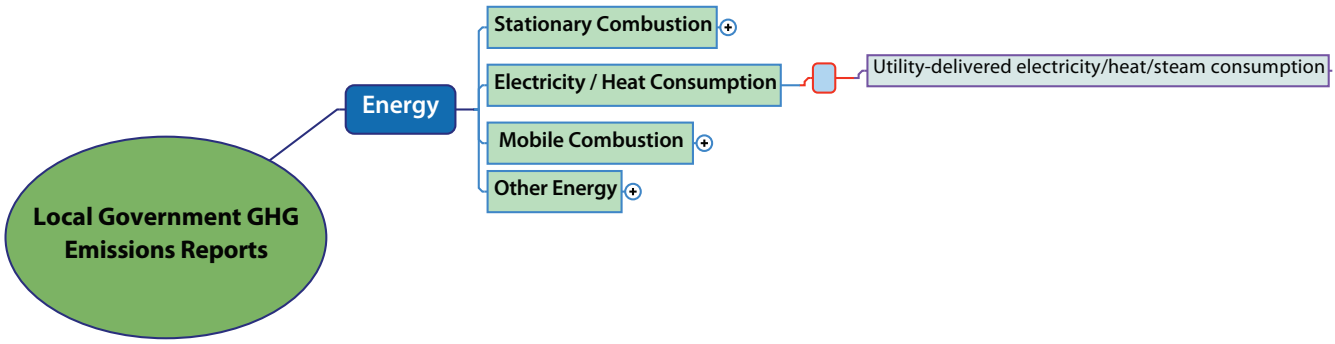
1. It is recommended that the stationary combustion subsector be included in its entirety with the exception of Natural gas consumed at electricity generating stations on the grid;
2. PNG's ability to disaggregate data to census division requires further exploration;
3. The CEEIWG must be cautious with summarized energy consumption data in CEEIWG reports to ensure that confidentiality of data is preserved, as defined by the data providers;
4. The CEEIWG should explore methods of removing natural gas consumption of residential multi-unit customers from the commercial sector and should consider combining the commercial and industrial sectors;
5. The CEEIWG should contact the Propane Gas Association of Canada and the Canadian Association of Petroleum Producers for a list of consultants that may be able to disaggregate total propane and fuel oil sales in BC into regions and provide further advice on disaggregation into local government geopolitical boundaries (note: HES has made such contact and has been advised that several consultants could provide this service to the CEEIWG);
6. The CEEIWG should survey local government in remote areas not serviced by electricity and natural gas to acquire their diesel fuel consumption data for electrical generators, if any; and,
7. The CEEIWG should begin to track renewable energy supply to begin to tabulate displaced conventional energy sources.

5.2 Electricity and Heat Consumption

Electricity consumption in the residential, commercial, and industrial buildings sectors within the FCM PCP inventory framework is included within the ***Electricity and Heat Consumption*** macro subsectors in the draft ICLEI International Protocol inventory framework (figure 5a).

Whereas natural gas, propane and fuel oil are categorized as utility-delivered fuel consumption and are scope 1 emissions, utility-delivered electricity, regardless of how it is generated (e.g., hydroelectric, natural gas fired electricity generation) is categorized as an indirect, scope 2 emission. There are no scope 1 emissions in this subsector. The main energy type in this category is electricity (figure 5b). Some larger municipalities have steam consumption, but this data will be difficult to obtain and/or disaggregate and will be insignificant possibly not justifying a separate listing.

Figure 5b. Electricity / Heat Consumption Macro Subsector.



5.2.1 Exclusions / Inclusions

It is recommended that the Electricity and Heat Consumption subsector is included in its entirety.

Table 5d. Inclusions/Exclusions for Electricity and Heat Consumption

Macro Sector		Scope 2 Emissions	Example	Recommendation for Inclusion / Exclusion
Energy	Electricity and Heat Consumption	Utility-delivered electricity/ heat/steam consumption	Electricity supplied by utilities to buildings, etc.	INCLUDE
			Steam supplied by utilities to buildings, etc.	INCLUDE*

* The Waste-to-Energy facility in Burnaby, owned by Metro Vancouver and run by a private company, produces electricity for the grid and steam to buildings in the near vicinity.

5.2.2 Consumption Data and Sources

Electricity consumption data is available for the Electricity and Heat Consumption macro subsector from two data providers–BC Hydro and Fortis BC. Table 5e describes the energy type and the data provider for each source.

Table 5e. Data Sources and Data Providers for Electricity and Heat Consumption

Macro Sector		Scope 2 Emissions	Energy Type	Data Source	Data
Energy	Electricity and Heat Consumption	Utility-delivered electricity/ heat/steam consumption	Electricity	BC Hydro	√
				Fortis BC	√

5.2.3 Available Datasets

BC Hydro services the majority of the province with electricity and Fortis BC serves southern interior local government. Both data providers provide similar datasets to that shown in table 5f. The data is not significantly different in structure than the natural gas and piped propane data shown in table 5c. Residential, commercial, and industrial summaries are available from each data provider. To derive greenhouse gas emissions, consumption data is applied to a simple calculation (consumption data x emissions factor = CO_2e (note: factors for CH_4 and N_2O and global warming potentials are built into the emissions factor provided by the Province or the electrical utility)).

Table 5f. BC Hydro Electricity Data Extract

Mun_ Name	CON COM (kWh)	CON IND (kWh)	CON RES (kWh)	CON TOTAL (kWh)	CUST COM	CUST IND	CUST RES	CUST TOTAL
1	65,923,170	N/A	94,962,913	160,886,083	1,096	101	7,987	9,184
2	14,486,397	2,008,540	16,878,307	33,373,244	261	31	1,062	1,354
3	1,112,682	158,677	3,757,998	5,029,357	23	2	181	206
4	16,250,093	22,835,283	60,266,923	99,352,299	437	134	3,989	4,560

The data is available in May of each year for previous years data for both BC Hydro and Fortis BC datasets.

5.2.4 Data Quality for Available Datasets

The ability to validate electricity data from data providers is not available and therefore, the quality of the datasets are taken at face value as received by the data providers. Similar to datasets for natural gas and propane, the number of customers (e.g., connections) for multi-unit residential buildings may not accurately represent the actual number of connections (see Other Issues). Also, single customer account listings for common areas in multi-unit residential buildings may further confound calculations of indicators (note: at the time of writing, BC Hydro indicated that they are working on resolving this issue (per. comm. Denis Nelson)).

5.2.5 Confidentiality Issues for Available Datasets

There are significant confidentiality issues for electricity datasets within this sector. As with natural gas and piped propane data, these issues are acute for industrial customers in communities where a small number of customers makes it easy to estimate the consumption of one or two high volume customers. BC Hydro has not provided industrial consumption values for communities where a single industrial customer accounts for more than half of the total consumption in the subsector. Fortis BC has not specified any issues with confidentiality, although the same level of treatment afforded the BC Hydro datasets should be applied to the Fortis BC datasets unless otherwise advised by Fortis BC. BC Hydro has suggested how to resolve these confidentiality issues in a letter to the Province.

5.2.6 Unavailable Datasets

Fortis BC was unable to provide datasets for the years 2005 and 2006.

5.2.7 Other Issues

Fortis BC's dataset for local government within their service area do not align with the geopolitical boundary of the local government. For example, a dataset for the City of Oliver will also include consumption data for connections outside the geopolitical boundary. At present, Fortis BC indicates that it does not have the ability to provide a data set that distinguishes between a customer inside or outside of a local government geopolitical boundary.

BC Hydro did not provide an emissions factor for its datasets and instead requested that the CEEIWG calculate the emissions factors from data provided on their website (http://www.bchydro.com/info/reports/reports52594.htm). Fortis BC has not provided an emissions factor for its data (note: upcoming regulations under Bill 44 may specify an electricity emissions factor for the Province by 2008).

The City of Nelson, a municipality in the southeast part of the province, owns and operates its own electrical utility to provide a portion of its community electricity consumption. This data was provided to HES for the data year 2005, although the City has not calculated an emissions factor for the emissions associated with their electricity.

5.2.8 Recommendations

The following recommendations are provided regarding electricity and heat consumption data and data sources:

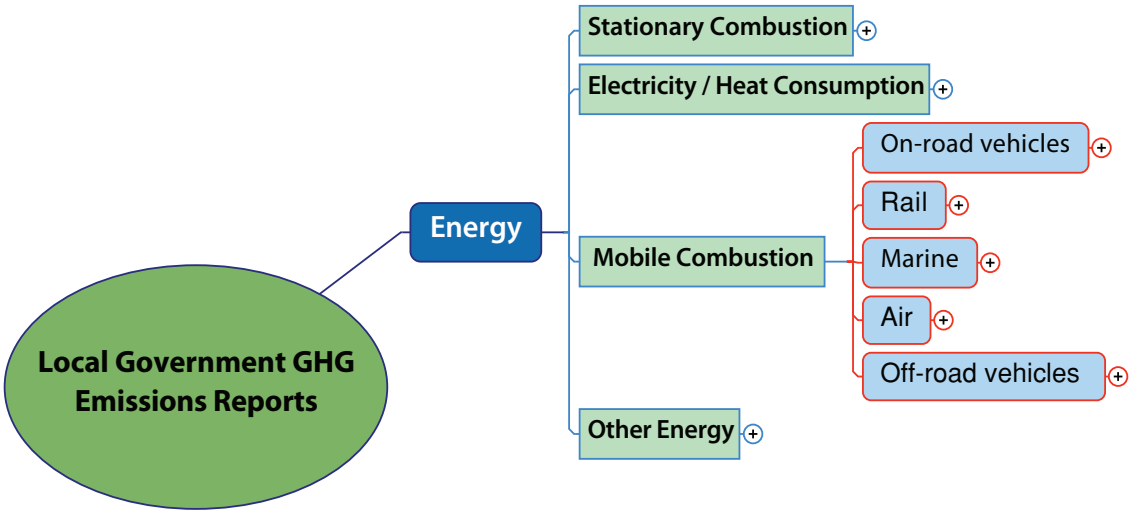
1. It is recommended that the Electricity and Heat Consumption subsector is included in its entirety;
2. The CEEIWG must be cautious with summarized energy consumption data in CEEIWG reports to ensure that confidentiality of data is preserved, as defined by the data providers. Further, the CEEIWG should follow BC Hydro's recommendations on how to deal with confidentiality issues of industrial electricity customers (Appendix B);
3. The CEEIWG should clarify single customer account listings for common areas in multi-unit residential buildings. Aggregation of data for buildings classifications (e.g., residential, commercial, and industrial) should follow that aggregation employed for stationary combustion, if any;
4. The CEEIWG should ensure that the data providers or the Province include emissions factors for electricity with the annual datasets provided;
5. The CEEIWG should survey local government and the private sector for independent power producers that are off the grid and request data as appropriate; and,
6. The CEEIWG should request data from Metro Vancouver and other entities that own similar facilities, on the power and steam output of the Waste-to-Energy Facility and determine how to account for their emissions and energy outputs in local government inventories.

5.3 Mobile Combustion

The community transportation sector within the FCM PCP inventory framework is included within the Mobile Combustion macro subsector in the draft ICLEI International Protocol inventory framework. Mobile combustion includes on-road, rail, marine, air, and off-road modes of travel (figure 5d).

Mobile combustion is the most complex subsector in the energy category in terms of the estimation of emissions and allocating those emissions estimates to local government geopolitical boundaries.

Figure 5d. Mobile Combustion Macro Subsector.



5.3.1 Exclusions / Inclusions

In a typical FCM PCP inventory, on-road vehicles were included because on-road transportation is policy relevant to local government. Some discretion could be applied to the inclusion of off-road vehicles, but generally, off-road vehicles were not included in FCM PCP inventories since data is not typically available.

Rail, marine, and air travel has generally not been policy relevant to local government in the past since these modes of transport are regulated by senior levels of government, and therefore, have typically been excluded from local government inventories.

Including emissions from rail, marine and air travel will result in an inventory that is 'complete', although the quality of the data once assigned to local government geopolitical boundaries may not be as accurate as desired. Consequently, several recommendations for treatment of emissions relative to geographic boundary are provided in section 5.3.3.

With the exception of on-road transportation, it is recommended that all modes of travel within the mobile combustion macro subsector be temporarily excluded in 2007 CEEIWG inventory reports until further study is conducted to explore datasets and methodologies to assign emissions from these modes of transportation to local government geopolitical boundaries.

Emissions from fuel used at airports located within geopolitical boundaries and emissions from fuel used by railway transport could be included immediately, but it is suggested that emissions from air, marine, and railway modes of transport be treated as a suite of emissions to be explored as a group and rolled into local government inventories together for 2008 reporting.

Table 5g. Inclusions/Exclusions for Mobile Combustion

Macro Sector		Scope 1 Emissions	Example	Recommendation for Inclusion / Exclusion
Energy	Mobile Combustion	On-road vehicles	Emissions from vehicles on the road	INCLUDE
		Air	Emissions from air travel of residents	TEMPORARILY EXCLUDE
			Emissions from fuel used at airports located within geopolitical boundaries	TEMPORARILY EXCLUDE
		Marine	Fuel used by sea-going modes of transport	TEMPORARILY EXCLUDE
		Rail	Fuel used by railway transport	TEMPORARILY EXCLUDE
		Off-road vehicles	Fuel used by off-road vehicles	TEMPORARILY EXCLUDE

5.3.2 Activity Data and Sources

Table 5h. Data Sources and Data Providers for Mobile Combustion

Macro Sector		Scope 1 Emissions	Activity Data	Data Source	Data
Energy	Mobile Combustion	On-road vehicles	Number of registered vehicles on the road	ICBC	√
			Fuel efficiency of vehicles	NRCan	√
			Vehicle kilometres traveled	Stats Canada	√
			Fuel sales data	Kent Marketing	√
		Air	Emissions from air travel of residents	N/A	X
			Emissions from fuel used at airports located within geopolitical boundaries	Local Airports	√
		Marine	Fuel used by sea-going modes of transport	Local Ports	?
		Rail	Fuel used by railway transport	Railway Association of Canada	√
		Off-road vehicles	Fuel used by off-road vehicles	N/A	X

5.3.3 Data Quality for Available Datasets

HES has developed a model that estimates fuel consumption for on-road vehicles using a single dataset of all vehicles registered on the road in BC. To complete the fuel consumption estimates, fuel efficiencies for individual vehicles are matched to individual vehicle registration data, and vehicle kilometers traveled (VKT) estimates from Statistics Canada for specific classes of vehicles are combined in a simple calculation (fuel efficiency x vehicle kilometres travelled x emissions coefficient/global warming potentials for CO_2, CH_4, and N_2O = CO_2e). Fuel estimates for various classes of vehicles are then aggregated into local government geopolitical boundaries and the GHG emissions are calculated.

There is a wide range of issues with this type of transportation model, but the affect of these issues on the final emissions calculations has not been tested.

It is well established that the fuel efficiency ratings reported by vehicle manufacturers are inaccurate. Reported discrepancies between 15 to 20 percent lower than the actual fuel efficiency achieved on the road under normal driving conditions are common. Regardless, new guidelines and future legislation regulating how automobile manufacturers test and report fuel efficiency ratings have been established and this data will be more accurate in the future.

Vehicle kilometres traveled data is the most difficult data to obtain and represents the most significant error in fuel consumption estimates. The perceived magnitude of the error in VKT data can cast doubt on the accuracy of vehicle-VKT models, although these types of models provide rich data to local governments that can illustrate useful trends over time.

HES has also calculated emissions from fuel sales data purchased from fuel marketing companies. This data is collected from fueling stations in most communities, but unfortunately, the dataset does not include diesel fuel from commercial cardlocks and fuel that is transported to commercial and industrial establishments that operate large fleets. Further, data is not collected from some fueling stations that are not easily accessible and/or that are not known to sell a relatively large volume of fuel. These issues are intrinsic to the dataset available for purchase but do not address extrinsic issues related to using the available data to calculate community transportation emissions for local government. Some of the more significant extrinsic issues associated with the use of fuel sales data to calculate community transportation emissions include the acute problem associated with non-residents purchasing fuel within a local government boundary, but actually consuming the majority of that fuel outside of the local government boundary. This issue is amplified at fuel service stations alongside highways that pass through a local government boundary. At such stations, the total volume of fuel sold is significantly higher than other fueling stations not on a highway within the local government boundary. In an absence of a credible customer survey, the origin of the drivers are unknown, although it could be assumed that many are passing through the community and are not residents of the community.

The use of transportation models such as EEME2 or TransCAD that make use of vehicle counts within a local government geopolitical boundary is another option for estimating fuel consumption, although, these methods are relatively expensive compared to the previous two models discussed and it is highly unlikely that the Province would be able to provide local governments with the mobile combustion component of community inventories on an annual basis if this method were to be used.

Since actual fuel consumption is unknown within any geopolitical boundary, any of the methods of estimating fuel cannot be validated and therefore decisions regarding the use of the methods briefly described above must be made based on a balance between the errors assigned to the data utilized and the resulting accuracy, and the overall usefulness of the results to local government. Costs associated with a vehicle-VKT model or a fuel sales model are not prohibitive; although, until further study is conducted on the accuracy of each model and the applicability of the results of each model to local government inventories, costs remain secondary to any decision on the use of a specific model.

Since we are not in receipt of datasets associated with air, marine, and railway transport, comments on the datasets required to estimate these modes of transportation cannot be provided. Railway transport data is available through the Raliway Association of Canada[10] and air travel can be calculated using activity data collected from Airport Authorities. A preliminary investigation into these modes of transport confirms that these datasets are available, although we have not reviewed any such datasets to evaluate the ability to disaggregate data to census division/subdivision level or their applicability to the CEEIWG.

5.3.4 Confidentiality Issues for Available Datasets

There are confidentiality issues with the vehicle registration data received by the Insurance Corporation of BC (ICBC). Since this data is provided by postal code, specific vehicle makes and models can be easily located, potentially predisposing vehicles to theft. For this reason alone, the details within the ICBC data that is provided to the CEEIWG is considered highly confidential and cannot be shared in the form received by the CEEI. The fields within the dataset provided to the CEEI and used by HES' TEEM™ for 2005 CEEI reports included: body style; fuel type; gross vehicle weight; make; model; model year; and, registered owner postal code.

10 http://www.railcan.ca/ download Raliway Trends 2007

5.3.5 Unavailable Datasets

At present, we are not aware of any datasets that would provide/advise fuel consumption estimates for off-road vehicles. We are not aware of any datasets that could be used to calculate emissions from air travel of residents within a geopolitical boundary.

5.3.6 Other Issues

By far, the most prevalent issue surrounding fuel consumption estimates in the mobile combustion subsector is allocating emissions to geopolitical boundaries. We suggest that data quality issues can be overcome, although estimating emissions within geopolitical boundaries may not be achievable.

5.3.7 Recommendations

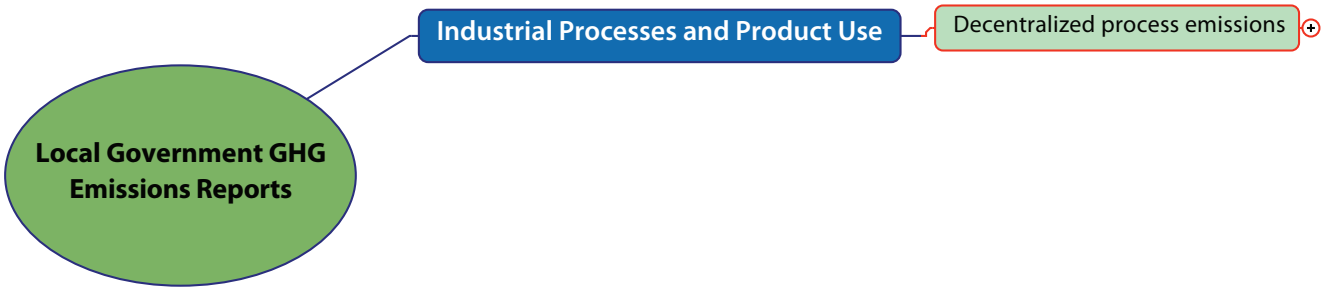
The following recommendations are provided regarding mobile combustion activity data and data sources:

1. It is recommended that on-road mobile transportation emissions be included in 2007 CEEIWG reports;
2. It is recommended that air, marine, railway, and off-road transportation be temporarily excluded from 2007 CEEIWG reports until such time that a study on the practicality of developing emissions estimates for these modes of transportation is undertaken. This recommendation is directed specifically at the methods that are available to allocate air travel and off-road vehicles to residents within a geopolitical boundary;
3. Prior to including on-road mobile transportation emission in 2007 CEEIWG reports, the results of estimates from various on-road transportation emission models should be tested including the range of inputs available to each model. The results of this methodological study will provide a set of detailed recommendations that would advise the CEEIWG on how best to proceed with emissions from on-road mobile combustion. One component of this study could include obtaining the vehicle identification numbers from ICBC so that fuel efficiency data can be more accurately assigned to individual vehicles;
4. The CEEIWG must keep confidential all raw data provided by ICBC; and,
5. The CEEIWG should pursue a partnership with ICBC to obtain odometer readings from all vehicles registered on the road. The partnership would ideally make it mandatory for vehicle owners to state their odometer reading when insuring or re-insuring their vehicle. Alternatively, a requirement to record the odometer readings of vehicles whose ownership is changing should be explored.

6 Industrial Processes and Product Use

Industrial Processes and Product Use is a macro sector in the draft ICLEI International Protocol inventory framework (figure 6) and a sector that was discretionary in the FCM PCP inventory framework. These emissions include direct emissions from chemical industrial processes (e.g., stack emissions not necessarily due to fuel consumption), but do not include energy consumption in industrial buildings (note: energy consumption in industrial buildings was recommended for inclusion in section 5).

Figure 6. Industrial Processes Macro Sector.



6.1 Exclusions / Inclusions

It is recommended that industrial process and product end use data be excluded from CEEIWG inventories since this type of data is already reported in National Inventory Report process and may be policy irrelevant to most local government. Focus groups with local government would provide guidance to the CEEIWG on whether or not to include this sector in local government inventories.

Table 6. Inclusions/Exclusions for Industrial Processes

Macro Sector	Scope 1 Emissions	Example	Recommendation for Inclusion / Exclusion
Industrial Processes and Product Use	Decentralized process emissions	CO_2e from industrial chemical processes	EXCLUDE

6.2 Activity Data and Sources

If a decision is made to include emissions in this sector, data from the National Inventory Report process could be included in CEEIWG reports, although this data is limited to large industry. Data for smaller industry may not be available or may be limited to the permitted air emission levels found in a Ministry of Environment or Metro Vancouver air emissions permit.

6.3 Confidentiality Issues for Available Datasets

If a decision is made to include emissions from industrial processes and product end use, the CEEIWG must explore confidentiality issues, if any, subsequent to an understanding of the type of data that would be made available to them.

6.4 Recommendations

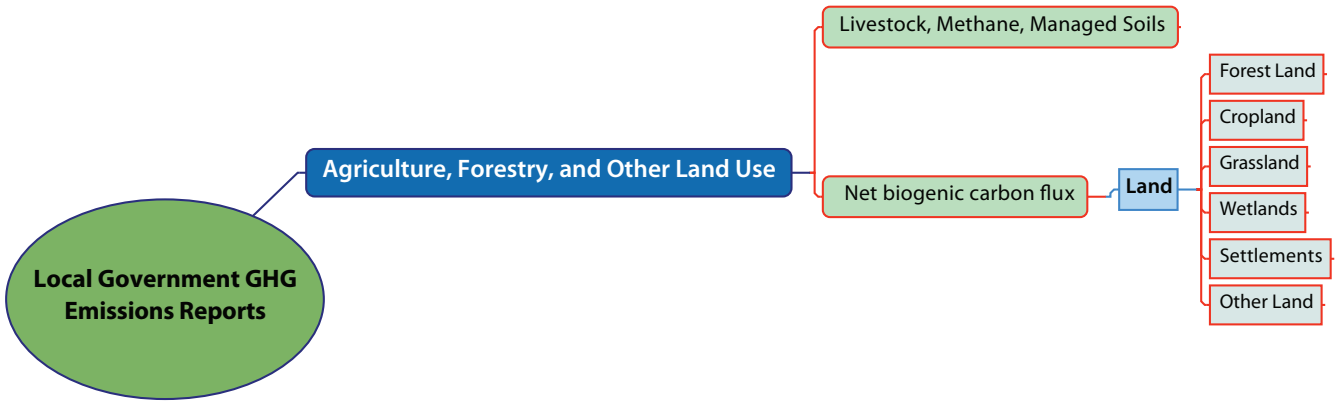
The following recommendations are provided regarding industrial processes and product use data and data sources:

1. It is recommended that emissions from industrial processes and product end use not be included in CEEIWG inventories; and,
2. Notwithstanding recommendation 1 above, it is recommended that the CEEIWG undertake focus groups, first internally within the CEEIWG, and then with local governments, if further discussion is warranted, to determine whether or not to include emissions from industrial processes and product use.

7 Agriculture, Forestry, and Other Land Use

Agriculture, Forestry, and Other Land Use is a macro sector in the draft ICLEI International Protocol inventory framework (figure 7), although agriculture, forestry, and other land use emissions are excluded from the FCM PCP inventory framework. These emissions include direct emissions from livestock, managed soils, and land use change of forest land, croplands, wetlands, etc.

Figure 7. Agriculture, Forestry, and Other Land Use Macro Sector.



7.1 Exclusions / Inclusions

Data for livestock counts and spread of manure is available and therefore CEEIWG reports could incorporate emissions from agriculture in local government reports after further exploration of the dissaggregation of data and assignment to local government boundaries. Data for net biogenic carbon flux for deforestation is available from the Canadian Forest Service.

Since aforestation, cropland, grassland, wetland, and settlement data is currently not available and/or may be insignificant or policy irrelevant to local government, it is recommended that emissions due to net biogenic carbon flux from land use change in forests (aforestation), croplands, grassland, wetlands, settlements, and other land uses not be included in local government inventories.

Local government has expressed interest in data for aforestation in their communities, but their expression of interest may only be relevant to their corporate operations inventories as an offsetting measure and not their community inventories.

Table 7a. Inclusions/Exclusions for Agriculture, Forestry, and Other Land Use

Macro Sector	Scope 1 Emissions	Example	Recommendation for Inclusion / Exclusion
Agriculture, Forestry, and Other Land Use	Livestock, Methane, and Managed Soils	Number and type of livestock	INCLUDE
		Spread of manure	INCLUDE
	Net biogenic carbon flux	Changes in forested area	INCLUDE
		Changes in cropland	EXCLUDE
		Changes in grassland	EXCLUDE
		Changes in wetlands	EXCLUDE
		Changes in settlements	EXCLUDE
		Changes in other land	EXCLUDE

7.2 Available Datasets

Data for livestock counts and manure spread is available from Statistics Canada's Census of Agriculture[11]. Because the data does not align with census subdivisions (e.g., municipalities), it is recommended that livestock and manure spread be reported at the census division level only. Data for net biogenic carbon flux for forested areas is available from the Canadian Forest Service at the census division level.

Table 7b. Data Sources and Data Providers for Agriculture, Forestry, and Other Land Use

Macro Sector	Scope 1 Emissions	Example	Data Source	Data
Agriculture, Forestry, and Other Land Use	Livestock, Methane, and Managed Soils	Number and type of livestock	Statistics Canada	√
		Spread of manure	Statistics Canada	√
	Net biogenic carbon flux	Changes in forested area	Environment Canada, Canadian Forest Service	X
		Changes in cropland	N/A	X
		Changes in grassland	N/A	X
		Changes in wetlands	N/A	X
		Changes in settlements	N/A	X
		Changes in other land	N/A	X

Table 7c provides an example of the dataset available from the Canadian Forest Service. The data is currently assigned to terrestrial ecozone and will be provided to the CEEIWG at the census division level.

11 http://www.statcan.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3438&lang=en&db=IMDB&dbg=f&adm=8&dis=2

Table 7c–Deforestation Data Extract

Area Name	Classification	Event	Data (kt)	2005
(left blank)	Deforestation	Deforestation	Sum of CO_2	133
			Sum of CO	4
			Sum of CH_4	0
			Sum of N_2O	0
			Sum of Total CO_2e	146
Sum of Total CO_2e				279

7.4 Data Quality for Available Datasets

The Canadian Forest Service and the Provincial Ministry of Environment must provide further information on the quality of existing datasets. Provincial Ministry of Environment staff have indicated that it will be difficult to aggregate data to regional district geopolitical boundaries and in many cases, very difficult to assign data to municipal geopolitical boundaries.

7.5 Confidentiality Issues for Available Datasets

There are no confidentiality issues for any datasets that are currently available from Statistics Canada.

Land use change for forested areas may be confidential and Provincial staff would need to advise on the type of data that would be made available to the CEEIWG.

7.6 Unavailable Datasets

Datasets are not available for land use change for cropland, grassland, wetlands, and settlements. Provincial staff associated with the CEEIWG should keep apprised of the availability of data for these land use categories.

7.7 Other Issues

There may be a significant lag time to receive the forest land use datasets. The data outputs are derived from satellite and/or aerial photo coverages and may not be available in time to meet CEEIWG inventory rollouts. At present, 2006 deforestation estimates at the census division level are available for the 2007 CEEI reports.

7.8 Recommendations

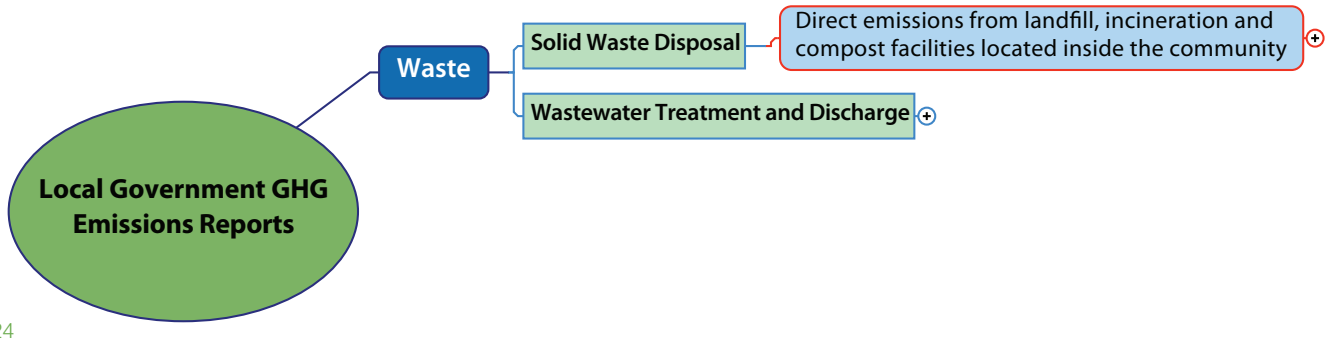
The following recommendations are provided regarding agriculture, forestry and land use data and data sources:

1. Since data is available, it is recommended that CEEIWG inventory reports for census divisions include emissions from livestock and manure spread, and deforestation land use change; and,
2. It is recommended that the CEEIWG determine whether or not to pursue developing emissions from net biogenic carbon flux, regardless of the availability of datasets (e.g., croplands, grasslands, and wetlands).

8 Waste

Waste emissions within the FCM PCP inventory framework are included within the ***Waste*** macro sector in the draft ICLEI International Protocol inventory framework. There are two subsectors in the Waste macro sector; Solid Waste Disposal and Wastewater Treatment and Discharge (figure 8a).

Figure 8a. Waste Macro Sector.



8.1 Solid Waste Disposal

Solid waste emissions within the FCM PCP inventory framework are included within the ***Solid Waste Disposal*** macro subsector of the draft ICLEI International Protocol inventory framework and include direct emissions from landfills, incineration and compost facilities.

8.1.1 Exclusions / Inclusions

It is recommended that the solid waste disposal subsector be included in its entirety.

Table 8a. Inclusions/Exclusions for Solid Waste Disposal

Macro Sector		Scope 1 Emissions	Example Data and/or Method to Employ	Recommendation for Inclusion / Exclusion
Waste	Solid Waste Disposal	Direct emissions from landfills	Actual tipping data from within a local government boundary deposited at a managed landfills	INCLUDE
			Per capita disposal rates converted to estimates of mass tipped at unmanaged landfills	
			Landfill gas production estimates using first order kinetics (Scholl-Canyon Model)	
		Direct emissions from incineration	Mass of municipal solid waste incinerated	INCLUDE
		Direct emissions from composting facilities	Mass of materials deposited at composting facilities	INCLUDE*

*Surveys need to be developed to acquire this data for possible inclusion in future inventory reports.

8.1.2 Activity Data and Sources

Table 8b. Data Sources and Data Providers for Solid Waste Disposal

Macro Sector		Scope 1 Emissions	Activity Data	Data Source	Data
Waste	Solid Waste Disposal	Direct emissions from landfills	Actual tipping data from within a local government boundary at managed landfills	Landfill managers (Regional Districts)	√
			Per capita disposal rates converted to estimates of mass tipped at un-managed landfills	Landfill managers (Regional Districts)	√
		Direct emissions from incineration	Mass of municipal solid waste incinerated	Metro Vancouver and others	√
		Direct emissions from compost facilities	Mass of materials deposited at compost facilities	various	X

8.1.3 Available Datasets

HES' Preliminary Reports used data within the Recycling Council of British Columbia's (RCBC) BC Municipal Solid Waste Tracking Report[12]. At the time the HES Preliminary Reports were produced, this was the only common dataset for the entire province. Disposal rates and population statistics are provided for regional districts for 1990, 2001, 2002, 2003, 2004, and 2005 (figure 8b).

Recently, a report commissioned by MOE[13] provides landfill gas production estimates using a dataset that allows an alternate methodology to be employed (Scholl-Canyon methodology).

An annual dataset, such as that provided in the RCBC report, allows for the default IPCC (1997) estimation method for landfill gas production (e.g., HES used this method for the CEEIWG 2005 preliminary reports since this was the only dataset that covered the majority of the province). Referred to as the waste commitment method, this method estimates the landfill gas produced from the waste tipped in an given inventory year over it's lifetime, but assigns all the emissions to the year in which

12 BC Municipal Solid Waste Tracking Report 2003-2005. Recycling Council of British Columbia. 2006. 74 pp.

13 Inventory of Greenhouse Gas Generation from Landfils in British Columbia. Golder and Associates. 2008. 15pp plus appendices

it was deposited.

A more accepted approach for estimation of landfill gas production is to use a first order kinetics method, often referred to as the Scholl-Canyon Method. This methodology estimates the total landfill gas produced by the landfill in the inventory year. The model requires inputs that are specific to the landfill and an historical dataset of the mass of waste tipped at the landfill.

Figure 8b. Example data from Recycling Council of BC.

Regional District Per Capita Disposal Rate Summary, 1990, 2001-2005

REGIONAL DISTRICT	1990*			2001			2002			2003			2004			2005		
	pop	disp rate	rank	pop	disp rate	rank	pop	disp rate	rank	pop	disp rate	rank	pop	disp rate	rank	pop	disp rate	rank
Regional Districts with populations less than or equal to 60,000 in 2003-2005																		
Alberni-Clayoquot	30,257	0.550	2	31,186	0.544	9	31,753	0.544	10	31,877	0.745	12	32,321	0.861	11	32,692	0.839	11
Bulkley-Nechako	37,136	0.700	4	42,890	0.42	5	43,513	0.399	4	42,643	0.509	7	43,815	0.489	5	43,933	0.470	3
Central Coast	3,500	0.400	1	3,973	0.378	3	4,013	0.378	3	3,902	0.384	3	3,866	0.388	2	3,905	0.256	2
Central Kootenay	49,587	0.701	7	59,540	0.288	2	59,245	0.372	2	60,209	0.340	2	59,874	0.409	3	60,237	0.494	7
Columbia Shuswap	40,510	0.710	7	50,305	0.429	6	50,826	0.429	5	51,306	0.589	9	52,367	0.561	9	53,245	0.603	10
East Kootenay	48,773	0.700	5	58,903	0.763	13	60,234	0.763	13	60,146	0.682	11	60,958	0.891	13	61,862	0.873	12
Kitimat-Stikine	39,431	0.700	6	42,894	0.505	8	42,914	0.505	7	42,669	0.479	6	43,043	0.475	4	42,919	0.476	5

8.1.4 Data Quality for Available Datasets

Data for two of the 27 regional districts in BC– Comox-Strathcona and Okanagan-Similkameen– were estimated in the RCBC report (e.g., Comox-Strathcona Regional District did not provide data and Okanagan-Similkameen Regional District provided partial data). The authors of the RCBC report found a discrepancy in the data provided for Skeena-Queen Charlotte relative to previous year's data, and therefore, the accuracy of the data for Skeena-Queen Charlotte Regional District for 2003-2005 is in question.

8.1.5 Confidentiality Issues for Available Datasets

There are no issues with confidentiality of datasets provided.

8.1.6 Unavailable Datasets

The majority of municipal solid waste is taken to transfer stations and then hauled to landfills. At the transfer station, solid waste originating from within a local government's boundary is mixed before it is hauled to a landfill, and therefore, the origin of the waste once deposited at the landfill cannot necessarily be assigned to its original source. (provide RDN and Metro Van example)

8.1.7 Other Issues

Although there are many methods to estimate methane emissions from solid waste, estimation methods are not as accurate as real monitoring data and modeling of landfill gas production.

To estimate landfill gas (LFG) emissions at specific landfills, localized conditions at landfills are taken into account. The resulting estimates of LFG emissions vary significantly in different regions of the province and these results cannot be assigned to local government as the origin of the waste subsequent to deposit at the transfer station is not tracked.

8.1.8 Recommendations

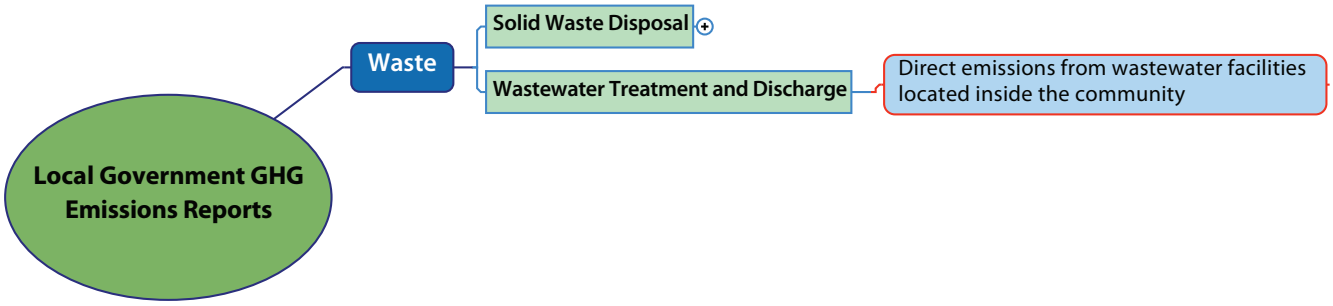
The following recommendations are provided regarding solid waste disposal data and data sources:

1. It is recommended that the solid waste disposal subsector is included in its entirety in the 2007 CEEIWG inventory reports;
2. The CEEIWG must obtain data on the amount and origin of municipal solid waste that is incinerated at the Waste-to-Energy facility. This data should be included in 2007 inventory reports;
3. Since the RCBC dataset does not include data for municipalities (e.g., it includes aggregated data for regional districts) the CEEIWG should consider using different methods to calculate emissions based on the availability of quality data from landfill managers at regional districts. The CEEIWG must establish a method of dissaggregating LFG data to municipalities that contribute solid waste to various landfills; and,
4. The CEEIWG should request composting facility data from local government and assess the significance of the emissions from composting relative to total emissions values in inventories to determine the value of including composting data in local government inventories. This data, if found to be significant, should be included in 2007 inventory reports.

8.2 Wastewater Treatment and Discharge

Wastewater treatment and discharge emissions are excluded from the FCM PCP inventory framework, but are included in the draft ICLEI International Protocol inventory framework (figure 8c). These emissions include direct emissions from wastewater treatment facilities.

Figure 8c. Wastewater Treatment and Discharge Macro Subsector.



8.2.1 Exclusions / Inclusions

The draft ICLEI International Protocol suggests that direct emissions from wastewater treatment and discharge be included in local government inventories, whereas in comparison, the FCM PCP inventory framework specified that these emissions were to be excluded. It is recommended that the wastewater treatment and discharge subsector is excluded from 2007 CEEIWG reports, and included in its entirety once data becomes available.

Table 8c. Inclusions/Exclusions for Wastewater Treatment and Discharge

Macro Sector		Scope 1 Emissions	Example	Recommendation for Inclusion / Exclusion
Waste	Wastewater Treatment and Discharge	Direct emissions from wastewater facilities	The emissions resulting from the anaerobic decomposition of wastewater sludge in wastewater treatment facilities	TEMPORARILY EXCLUDE

8.2.2 Activity Data and Sources

The CEEIWG must request facility data from local government and include emissions from wastewater treatment and discharge in 2007 inventory reports. Since wastewater treatment is generally a service provided by regional districts, a method of disaggregation of emissions to member municipalities must be developed.

8.2.3 Available Datasets

Emissions from wastewater treatment only arise from the anaerobic component of treatment and therefore, models to estimate these emissions must be used. Currently, there is no information on the availability of datasets, if any, although it is assumed that a factor will be used to estimate emissions in this subsector.

8.2.4 Data Quality for Available Datasets

Currently, there is no information on the quality of available datasets.

8.2.5 Confidentiality Issues for Available Datasets

There are no issues with confidentiality of datasets provided.

8.2.6 Recommendations

The following recommendations are provided regarding wastewater treatment and discharge data and data sources:

1. It is recommended that the wastewater treatment and discharge subsector be temporarily excluded from CEEIWG inventory reports; and,
2. The CEEIWG should survey local government for wastewater treatment facilities and applicable data.

References

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Appendix A - Detailed Summary of Community Energy and Emissions

Port Moody

Preliminary Community Energy & Greenhouse Gas Emissions Inventory: 2005

General

The BC Community Energy & Emissions Inventory (CEEI) initiative, led by the BC Ministry of Environment, is currently establishing a provincial database of community energy and greenhouse gas emissions information in order to provide annual inventories to all local governments in BC. While the Province and its partners establish the CEEI system, Hyla Environmental Services Ltd. is providing preliminary inventories.

The information contained in the preliminary inventories follow the requirements of the FCM Partners for Climate Protection Program for community inventories, which specifies reporting of energy and emissions for community buildings, community transportation, and community solid waste. Emerging protocols for voluntary reporting requirements for local government energy and greenhouse gas emissions inventories are becoming more rigorous and therefore, the information provided through future CEEI reports may include sectors not customarily reported by local government.

The preliminary inventories being provided to BC local government contains aggregated energy consumption data from electrical utilities and natural gas distribution utilities, estimates of fuel consumed by community vehicles, and estimates of greenhouse gas emissions from landfills. Consumption data for fuel oil and propane used for space heating is currently not available (note: propane distributed by pipeline by Terasen Inc. to Whistler and Revelstoke is included). These reports are provided to your community to support actions to reduce energy consumption and greenhouse gas emissions. Feedback on the clarity, usefulness and accuracy of the reports is appreciated.

Community Buildings: stationary combustion in residential, commercial, and industrial buildings

Electricity: BC Hydro Ltd. – consumption and number of accounts
Natural gas and propane distributed by pipeline: Terasen Inc. – consumption and number of accounts
Emission Factor for BC Hydro Electricity (2005): 0.0238 kg CO2e/kWh (http://www.bchydro.com/info/reports/reports52594.html)
Emission Coefficients for Diesel Fuel, Gasoline, Natural Gas, and Propane: 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Data Deficiencies: Data providers have restricted access to consumption data for large industrial customers where such data is considered confidential business information. For electricity consumption, data has been withheld if an industrial electricity account represents more than 50% of the total industrial electrical consumption within a local government boundary, and where this portion is greater than 3 GWh. For natural gas, data has been withheld if an industrial natural gas account represents more than 30% of the total industrial natural gas consumption within a local government boundary, and where this portion is greater than 50 TJ. If data in the industrial sector has been deleted, the number of customers appears as a line item within the industrial listing. If a line item does not appear, the data provider(s) do not have any industrial customers within the local government boundary, or the data provider does not recognize any industrial customers in their customer classification system for the particular local government inventory.

Community Transportation: mobile combustion for on-road transportation

Licensed Vehicles on the Road (complete listing of individual, licensed vehicles by make, model, and model year): Insurance Corporation of British Columbia
Vehicle Fuel Efficiency: Natural Resources Canada, Office of Energy Efficiency (http://oee.rncan.gc.ca/transportation/tools/)
Average Vehicle Kilometres Traveled: National Transportation Model, July 2007
Emission Coefficients for Gasoline and Diesel Fuel: 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Community Solid Waste

Solid Waste: BC Ministry of Environment and the Recycling Council of British Columbia - per capita disposal rates for municipal solid waste at regional landfill facilities. The mass of solid waste for local government was estimated using a 2005 disposal rate provided by landfill managers to the Recycling Council of British Columbia and 2005 population provided by BC Statistics. Municipalities are encouraged to inquire with their landfill manager whether or not more accurate data is available.
Emissions Factor for Solid Waste: 0.53 t CO2e/tonne

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Port Moody

Preliminary Community Energy & Greenhouse Gas Emissions Inventory: 2005

Community Buildings		Consumption by Type					Energy and Emissions Totals	
	Type	Connections	Consumption	Energy/Connection	Energy (GJ)	CO_2e (t)	Energy (GJ)	CO_2e (t)
Residential Buildings	Electricity	9,795	87,138,994 kWh	8,896 kWh/C	313,700	2,074	**937,204**	**33,966**
	Natural Gas	6,878	623,504 GJ	91 GJ/C	623,504	31,892		
Commercial Buildings	Electricity	824	52,807,775 kWh	64,087 kWh/C	190,108	1,257	**385,576**	**11,255**
	Natural Gas	388	195,468 GJ	504 GJ/C	195,468	9,998		
Industrial Buildings	Electricity	145	35,275,478 kWh	243,279 kWh/C	126,992	840	**515,338**	**20,703**
	Natural Gas	10	388,346 GJ	38,835 GJ/C	388,346	19,864		
Subotal	Electricity	10,764	175,222,247 kWh		630,800	4,170	**1,838,119**	**65,924**
	Natural Gas	7,276	1,207,319 GJ		1,207,319	61,754		

Community Transportation		Consumption by Type					Energy and Emissions Totals	
	Type	Vehicles	Consumption	Litres/Vehicle	Energy (GJ)	CO_2e (t)	Energy (GJ)	CO_2e (t)
Passenger Vehicles	Gasoline	13,561	22,644,641 litres	1,831 L/V	784,863	56,552	**792,027**	**57,062**
	Diesel Fuel	118	175,609 litres	1,670 L/V	6,793	488		
	Mbl Propane	8	14,649 litres	1,488 L/V	371	22		
Light Duty Vehicles	Gasoline	1,600	3,332,608 litres	1,964 L/V	115,508	8,323	**129,194**	**9,278**
	Diesel Fuel	127	292,129 litres	2,083 L/V	11,300	812		
	Mbl Propane	48	94,263 litres	2,300 L/V	2,386	143		
Motorhomes	Gasoline	121	630,410 litres	4,645 L/V	21,850	1,574	**23,368**	**1,672**
	Diesel Fuel	3	14,931 litres	5,210 L/V	578	41		
	Mbl Propane	8	37,161 litres	4,977 L/V	941	56		
Heavy Vehicle - Long Haul Carrier	Diesel Fuel	45	310,145 litres	6,892 L/V	11,996	862	**11,996**	**862**
Motorcycles	Gasoline	290	262,748 litres	906 L/V	9,107	656	**9,107**	**656**
Heavy Vehicle - Specialized	Gasoline	3	7,805 litres	2,561 L/V	271	19	**6,937**	**493**
	Diesel Fuel	38	160,630 litres	2,602 L/V	6,213	446		
	Mbl Propane	7	17,925 litres	4,227 L/V	454	27		

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Port Moody

Preliminary Community Energy & Greenhouse Gas Emissions Inventory: 2005

Medium Duty Vehicles	Gasoline	16	34,404 litres	1,825 L/V	1,192	86	**4,906**	**350**
	Diesel Fuel	39	90,041 litres	2,150 L/V	3,483	250		
	Mbl Propane	5	9,124 litres	2,309 L/V	231	14		
Heavy Vehicle - Commercial Truck	Gasoline	4	11,911 litres	1,825 L/V	413	30	**2,845**	**203**
	Diesel Fuel	16	60,486 litres	2,978 L/V	2,340	168		
	Mbl Propane	2	3,650 litres	3,780 L/V	92	6		
Heavy Emergency Vehicle	Diesel Fuel	6	35,452 litres	5,909 L/V	1,371	99	**1,371**	**99**
Heavy Vehicle - Commercial Pickup	Diesel Fuel	6	34,473 litres	5,746 L/V	1,333	96	**1,333**	**96**
Scooters	Gasoline	3	2,712 litres	904 L/V	94	7	**94**	**7**
Heavy Vehicle - Commercial Bus	Diesel Fuel	1	2,306 litres	2,306 L/V	89	6	**89**	**6**
Subotal	Gasoline	15,598	26,927,240 litres		933,298	67,247	**983,268**	**70,785**
	Diesel Fuel	399	1,176,203 litres		45,496	3,269		
	Mbl Propane	78	176,772 litres		4,474	269		

Community Solid Waste	Consumption by Type			Energy and Emissions Totals	
	Type	Mass (t)	CO_2e (t)	Energy (GJ)	CO_2e (t)
Community Solid Waste	Solid Waste	20,803	11,025		**11,025**
Subotal	Solid Waste	20,803	11,025		**11,025**

Grand Total		**Consumption**	**Energy**	**CO_2e**	Energy and Emissions Totals	
					Energy (GJ)	CO_2e (t)
	Electricity	175,222,247 kWh	630,800 GJ	4,170 t		
	Natural Gas	1,207,319 GJ	1,207,319 GJ	61,754 t		
	Gasoline	26,927,240 litres	933,298 GJ	67,247 t	**2,821,386**	**147,735**
	Diesel Fuel	1,176,203 litres	45,496 GJ	3,269 t		
	Mbl Propane	176,772 litres	4,474 GJ	269 t		
			Mass	**CO_2e**		
	Solid Waste		20,803 t	11,025 t		

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