Best Practices and Better Protocols

Guidance for a comprehensive community emissions inventory system from a high level review of international best practices

Prepared for

BC Ministry of Environment
Community Energy and Emissions Inventory Working Group

BRITISH COLUMBIA

Prepared by

Alex Boston

HB Holland Barrs Planning Group

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Prepared for Ted Sheldon, BC Ministry of Environment on behalf of the Community Energy and Emissions Inventory Working Group.

Prepared by Alex Boston, Holland Barrs Planning Group with a contribution from Nygil Googins, Simon Fraser University Energy and Materials Research Group.

Executive Summary

The BC Government's Community Energy and Emissions Inventory Initiative **(CEEI) intends to collect and centralize high-quality geocoded data to generate high-value community inventories for the province's 185 local governments.**

Community **inventories can be valuable tools** to help municipalities plan and implement effective GHG (greenhouse gas) and sustainable energy management strategies and strengthen broader sustainability planning at the local level. They can also help other local institutions and senior governments strengthen climate and energy policy development.

This **report offers strategic guidance for a comprehensive community emissions inventory** system based on a high level review of international best practices.

It is a dynamic time for local government energy and emissions inventories. There are several initiatives in Canada, the US and internationally to establish a more universal standard for local government community and corporate inventories. There is also significant movement in new data management systems for local inventories.

This high level review has facilitated CEEI Initiative opportunities to both inform and be informed by these developments. There is **considerable interest in the CEEI** from other jurisdictions **because of the initiative's potential to centrally streamline access to and management of data** that is otherwise onerous and inefficient for a myriad of local governments to independently acquire and process.

The report's observations, findings **and recommendations are organized in four areas:**

Protocols and Standards Recommendations

Protocols guide the collection, accounting and reporting of GHG data. As GHGs move incrementally towards regulation or quasi regulation, there is an increasing need for consistency.

- The **CEEI should stay abreast of several processes to strengthen the integrity and consistency of community inventory protocols**:
    - **Review** the draft International Council on Local Environmental Initiative's *(ICLEI's) International Emissions Protocols.*
    - **Keep informed of ICLEI Canada's and FCM's activity** on a potential National Supplement to the ICLEI International protocol and Federation of Canadian Municipality's (FCM's) *Standards and Guidance Document.*
    - **Maintain communication with California Climate Action Registry (CCAR)** on its local government protocol process.

- **Link relevant findings into the activity of BC Government officials involved in** corporate inventories **and carbon neutral local government**.

Data Management Systems Recommendations

Given the CEEI's unique objectives, an off the shelf data management solution is unlikely.

- Preliminarily, there are at least several software developers the CEEI should explore:
    - The **Clinton Climate/ICLEI/MicroSoft/Centre for Neighborhood Technology initiative** may meet CEEI's needs or could with adaptation.
    - With further development, **Hyla's software may meet CEEI's needs.**
    - While his widely used municipal software has not been updated, **Ralph Torrie has high literacy in GHG and energy, and software development**.
- Many leading local agencies are looking forward to the implementation of CEEI's precedent setting initiative. **BC could take advantage of its leadership from a communications perspective.**

Community Inventory Parameters Recommendations

The range of parameters used across inventories varies, and influences their respective utility.

- The **CEEI should initially provide data to municipalities that is readily accessible** and most effectively facilitates development of strong local climate and sustainability plans. This can be supplemented iteratively with richer data.

Reporting Formats and Capacity Building Recommendations

Regardless of the quality and quantity of data collected and analyzed, an inventory's utility is strongly shaped by the reporting format.

- **Develop a reporting format to present data in a compelling, coherent, user-friendly manner.**
- **Consider delivering capacity building programs** to enable local governments to maximize the utility of inventories for climate action planning.
- Consider **provincial level reports and online reporting tools on local government activity** to strengthen awareness, recognize leadership, and build support.

1 Introduction

A community greenhouse gas emission and energy inventory can be a valuable tool to help local governments plan, implement and monitor climate change mitigation strategies and sustainable energy systems. Over and above these primary objectives, inventories can facilitate a number of other local priorities:

- Air quality management;
- Integrated land-use and transportation planning;
- Infrastructure optimization and planning; and
- Community economic development planning.

Community inventories can additionally help a variety of institutions such as large commercial and industrial energy users more effectively and sustainably manage their energy systems. Moreover, a good community inventory system can help senior governments better harness local government capacity towards climate change mitigation.

Given this range of functions, and the ambitious goals of the BC government's Community Energy and Emissions Inventory Initiative to prepare community wide inventories for every BC municipality, it is appropriate to examine community inventory best practices in other jurisdictions with the intention of building a system that provides valuable, high quality data and guidance.

1.1 Community Energy and Emissions Inventory Initiative Objectives

The Community Energy and Emissions Inventory Initiative is an undertaking of the BC Ministry of Environment involving multiple ministries and key stakeholders. Its primary goal is:[1]

- "**To establish a** cost-effective provincially-sponsored, rigorous yet flexible, **data collection, analysis and reporting system to provide BC local governments with inventory baselines, ongoing monitoring and periodic reports** to help inform community decision making.

- These community energy and greenhouse gas reports must meet agreed-to standards, be reproducible across communities and time, and be available to BC local governments and other agencies in a user-friendly, transparent format."

[1] BC Provincial Government. August, 25, 2007. *CEEI Project Charter* Version 0.6

The project's objectives are:[2]

- "To **provide all 185 BC local governments with a community-wide inventory** on which to consider future energy consumption and greenhouse gas emission reduction targets and related community-wide reduction actions.

- To support many of the present (48) and future BC local government participants in the Federation of Canadian Municipalities (FCM) Partners for Climate Protection (PCP) Five-Milestone Program. An approved community energy and emissions inventory will achieve Milestone One.

- To provide the Provincial Government, and other agreed-to users, with information on local government contributions towards reducing energy consumption and greenhouse gas emissions, both as individual jurisdictions and in province-wide summaries.

- To contribute to the 'measurement, sector target and emissions reduction' function recently established with the newly formed Climate Action Secretariat."

This initiative will greatly expedite protracted local government efforts to procure and process data, and has the potential to accelerate local GHG management.

1.2 Project Objective and Scope

This report is prepared for the Community Energy and Emissions Initiative to meet the following objective:

- Undertake a **high level international review of community inventory best practices** to **provide strategic guidance for developing a provincially centralized data collection and management system that could generate community inventories** for local governments in BC.[3]

This report has **four substantive sections**:

- **Protocols and Standards**

- **Data Management Systems**

- **Community Inventory Parameters**

- **Reporting Formats and Capacity Building**

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[2] Ibid.

[3] Although there was useful data collected through interviews with key players in other countries, there were barriers in obtaining inventories outside of North America. Detailed community wide inventories are not standard practice in most of Europe. Several European sources provided good quantitative summaries of emission reduction measures but had not prepared detailed community wide inventories. Inventories in Australia and New Zealand are widespread but confidential.

This report is not intended to comprehensively or definitively answer all the CEEI's inventory protocol, practice and data management questions. It is a high-level review that will substantively inform CEEI's strategic planning and research exercise. Notably, the exercise has already connected the CEEI to significant international developments on protocols and data management, many of which are particularly germane to BC's involvement in the Western Climate Initiative.

The report complements Sheltair Group's survey of *Energy and GHG Inventory Practices by Local Governments in BC,*[4] and builds on the Ministry of Labour and Citizens' Services report, *Greenhouse Gases: How are Emissions Determined and Measured?*[5]

1.3 Guiding Principles

Research has been guided by identifying best practices that meet a number of inventory principles:

- **Credible:** inventories are accurate and complete as far as can be judged, and that uncertainties are reduced as far as practicable.
- **Transparent:** inventories leave a clear audit trail and communicate their methodologies, data sources and assumptions.
- **Consistent:** inventories permit effective comparison both internally within an institution over time, and with other institutions in other sectors and jurisdictions.
- **Relevant:** inventories effectively serve decision makers (in local and provincial governments as well as other key players) in GHG reduction planning and monitoring.
- **Practical**: inventories are not an excessive time and resource burden and managers recognize they will be iteratively refined.

These principles subsume those articulated by a variety of bodies establishing inventory protocols.[6] The CEEI has *project* principles, which are subtly different from *inventory* principles. The CEEI may feel it appropriate to have principles specific to the inventory -- if they are not already enshrined in a protocol that is adopted. The principles should also be consistent with other GHG inventory practices in the province, notably municipal corporate inventories.

[4] MacDonald, Ron. November, 2007. *Energy and GHG Inventory Practices by Local Governments in BC* prepared for the Ministry of Environment CEEI Initiative. Sheltair Group.
[5] Ministry of Labour and Citizens' Services. June, 2007. *Greenhouse Gases: How are emissions measured?* developed for Ministry of Environment by Office of the Chief Information Officer.
[6] FCM Standards and Guidance, ISO 14064, WBCSD-WRI GHG Protocol Initiative.

1.4 Research Methodology

Most **data has been collected through interviews with key experts** – see appendix 1. This was supplemented by a literature review. A **selection of community inventories has also been analyzed** to enable the CEEI to compare and contrast the parameters to those traditionally measured in BC.

The interview sample was composed of select professionals working with municipal organizations, non-profits, provincial/state governments, local governments, and consulting firms across the US, Canada, and a few international sources.

1.5 Inventory Limitations

The popular inventory adage "if you don't measure it, you can't manage it" is deceptive.

A good inventory is not a sufficient condition for effective mitigation activity. There are many examples of jurisdictions with a history of good inventories and skyrocketing emissions, e.g. Ann Arbor (MI), Calgary (AB), Cambridge (MA). **Moreover, an inventory is not even a necessary condition for significant emission reductions.** There are great examples of significant municipal emission reductions without inventories, e.g. London (UK) and Bogota (Columbia).[7] The most advanced and pervasive municipal emission reductions are across continental Europe where inventories are non-existent or much less sophisticated than in North America.[8]

Good inventories, nevertheless, can help well-informed institutions manage their energy and emissions in a much more sophisticated manner. Portland (OR) and Seattle (WA) actively consulted their inventories to formulate strategic climate measures that have driven emissions back to 1990 levels and below, respectively.

If local governments are expected to contribute proportionately to the BC Government's 33% reduction target by 2020, they will require strong planning, implementation, monitoring and evaluation. **Well-designed community inventories can be valuable tools to inform strategic local government action.**

This report makes recommendations that will help build an effective system to manage data and prepare high value community inventories that tangibly assist local governments in developing strategic local climate action plans.

[7] Greater London Authority's congestion charge and public transit expansion reduced transportation related GHGs 16 percent: http://www.c40cities.org/bestpractices/transport/london_congestion.jsp . Bogota's Transmillenio bus rapid transit development drove Bogota's 40 percent GHG reduction: http://www.nycclimatesummit.com/casestudies/transportation/trans_bus_bogota.html

[8] Interviews and email communication with Maryke Van Staden, ICLEI Europe; Adrian Hewitt, Merton Borough Council UK; Lara Curran, Woking Borough Council; Diane Liverman, Oxford Environmental Change Institute.

2 Protocols and Standards

Protocols guide the collection, accounting and reporting of GHG inventory data. Good protocols are based on the principles identified in the *Introduction.*

Of the principles discussed in 1.1, the one driving developments protocols and standard is *consistency*. A growing number of local governments, provincial and state governments, and third parties across North America, Australia and New Zealand are wanting a more universal protocol.

Consistency is progressively more important as GHGs move incrementally towards regulation or quasi regulation. For instance, in the BC context, if local government's are going to buy offsets in their own communities to achieve carbon neutrality, or sell offsets to the private sector to finance further mitigation measures, community wide, corporate (i.e. local government operational) and private sector **GHG inventories and emission reduction calculations must be fungible, i.e. consistent.**

If local governments are intending to register their corporate or community inventory with a third party like the Climate Registry, consistency will be required. Various registries already have local government corporate protocols and there are a number of local governments that have already registered with these entities.

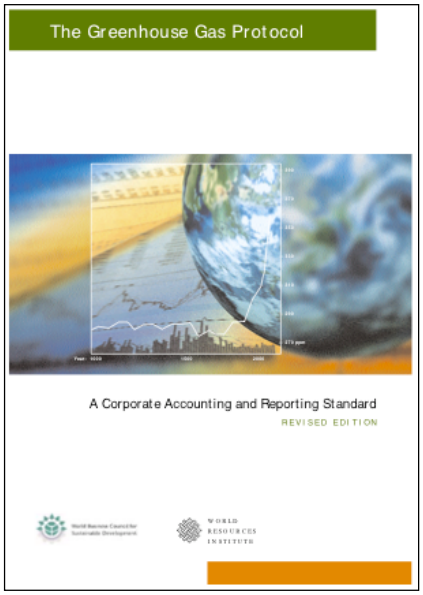
This section outlines the state of play on protocols for community wide GHGs.

Observations and Findings

2.1 General Protocols

2.1.1 The GHG Protocol Initiative

The **world standard for GHG accounting protocols is the World Business Council on Sustainable Development / World Resources Institute GHG Protocol Initiative.**[9] It is the product of a large collaborative effort in which national and sub-national governments have collaborated with academics, non-profits, large companies and trade associations from every major industrial sector. The European Trading System, the California Climate Action Registry (CCAR) and the Chicago Climate Exchange all use the GHG Protocol Initiative as the basis for their accepted methodologies.



The world GHG inventory standard

The **BC Government is using GHG Protocol**

[9] http://www.ghgprotocol.org

Initiative methodologies like the *Project Accounting Protocol and Guidelines* to account for project related GHG emission reductions.

There are sector specific addenda to the GHG Protocol Initiative in industries with significant emissions, e.g. cement, forestry, petroleum. They provide greater specificity and tools to assist institutions in those sectors.

There is **no local government corporate or community-wide addendum**. This can be attributed in part to the presence of an ICLEI established protocol that most local governments preparing inventories follow closely or loosely. Moreover, in contrast to national governments and many private sector players, there has also been no legal or regulatory pressure to reduce local government corporate and community-wide emissions so inventories have not, to date, required the same rigour.

2.1.2 ISO 14064 GHG Reporting Series

Through the GHG Protocol, the WBCSD and WRI developed the ISO 14064 series of standards for GHG reporting. **14064-1 provides guidance at the *organizational level* for quantification and reporting of emissions and removals**. 14064-2 provides guidance at the *project level* for quantification and reporting of emissions and removals. 14064-3 provides guidance and specification for the *validation and verification* of GHG assertions. 14065 provides *specification for verification bodies* in the accreditation process.

These **standards impose requirements not normally expected of local governments and, thus, few local governments have applied them and then only to corporate activity.** The development of this standard, nevertheless, informs the work of the California Climate Action Registry and other players involved in developing local government protocols and in this way influences them.

2.2 Local Government Protocols

While not profoundly different, **community inventory protocols throughout BC and Canada, and across the US and beyond vary due to the range of players involved in their preparation and the absence of a single, definitive protocol**. The result is varying inventory consistency and in some cases accuracy.

2.2.1 ICLEI's "Current" Protocol

ICLEI is the leading and largest agency internationally assisting local governments in climate protection. ICLEI has been developing inventories for more than a decade. For much of this period**, ICLEI national organizations have depended on the *ICLEI Cities for Climate Protection Campaign Protocol/Guidelines for Reporting* published in 1999**.[10] Many local governments and consultants use this guidance including the FCM.

[10] http://www.sustainablecommunities.fcm.ca/files/Capacity_Building_-_Energy/Resources_and_Tools/CCP-protocol.pdf

This **straightforward protocol has helped a wide range of local government sizes and permutations meet their basic needs**. While providing sufficient guidance for a high level inventory, **some local governments wanting to extend the scope and increase the precision of their inventories have desired more sophisticated methodologies**.

This has **compelled many large local government climate leaders,** e.g. like Boulder and Seattle, for example, **to develop their own protocols based more closely on the GHG Protocol Initiative.** In Canada, a number of local governments and consulting firms with a deep interest in energy management have also developed more elaborate GHG and energy protocols.

2.2.2 ICLEI's Emerging International Standard

ICLEI US, on behalf of **ICLEI** International, is currently **working with a number of key players such as GHG Protocol specialists WRI and the California Climate Action Registry to develop a more robust, comprehensive and universal emissions protocol.**

A **draft** ***International Emissions Analysis Protocol*** **covering both corporate and community emissions was** released in early November 2007, and is being circulated for expert review until early December 2007 with the hope of releasing a **public version in early 2008.**

Some initial subjective observations of the draft are:

- Provides much **more strategic guidance on scope of emissions and guidance for corporate and community activity, their treatment, and calculation methodologies** over the 1999 ICLEI protocol.

- Much **more consistent with the GHG protocol** over the 1999 ICLEI protocol.

- Makes only passing reference to the ICLEI five milestone process, increasing the protocol's audience to local governments that aren't active or closely following the PCP/CCP programs.

- **Increasingly useful for local governments interested in a more comprehensive, precise inventory.**

- There **may still be a role for a simplified protocol for local governments without significant resources**, or interested in investing significant resources in accuracy improvements.

- While there are many good arguments for an exclusive GHG focus, the practical application of inventories at the local level is increased when parameters and analysis resonate with existing municipal priorities. **The protocol could strengthen its guidance and discuss the implications of including richer energy data** (e.g. disaggregating building or transportation emissions to help target mitigation efforts), financial expenditures on energy (to strengthen fiscal performance or promote

economic development), and including **criteria air contaminants** (to strengthen support from health protection sectors). Where climate plans have deep traction, there tends to be richer GHG linkages to some of these priorities.

Through this high-level international inventory review, **the CEEI has been formally asked to join the advisory group.** ICLEI, CCAR and WRI are all interested in the CEEI because its unique circumstance is yet another important consideration for the development of an effective protocol. Moreover, assuming the CEEI will successfully meet its ambitious objective of collecting the data and generating 185 local government community inventories, it would be a powerful precedent for other jurisdictions.

In Canada, ICLEI Canada and the FCM are also reviewing this draft protocol. Their perspectives may be informative for the CEEI.

A couple of other documents are expected to support this protocol. ***National Supplements* would outline unique domestic considerations including relevant emission factors**. The US and Australia are developing such supplements. ICLEI Canada may develop a Canadian supplement.

A draft *International Emissions Measures Protocol* will also be shortly released by ICLEI for review. In contrast to the *International Emissions Analysis Protocol,* **it will provide guidance on project related emission reduction calculations.** These companion documents are similar to the GHG Protocol's complimentary *Corporate Accounting and Reporting Standards* and *Project Accounting Protocol and Guidelines.*[11]

2.2.3 CCAR Scoping Paper on Local Government GHG Inventories

The California Air Resources Board commissioned **CCAR** to produce a **scoping paper,** *GHG Inventories for Local Government Operations and Activities*. Released in November 2007, this paper includes discussion on community inventories and is the first stage in the CCAR process for developing an inventory that could be third party verified and registered with CCAR or the Climate Registry. A stakeholder-driven process of subject experts to define key policy and technical issues will be established. **A draft protocol will be developed** through this process, and through iterative improvements a final protocol will likely be developed.

CCAR and other regional climate registries have **registered local government corporate activity and expect further improvements to corporate activity protocols** and standards to be seamless. They are **not certain whether the accuracy or consistency of community inventories will be sufficient for registration**, or at least the same standard guaranteed of registered private sector inventories. The process will examine these issues.

As mentioned, **CCAR is simultaneously involved in the ICLEI process** and **hopes the two sets of guidance will be harmonized**. At the same time, CCAR has high standards for registration involving third party verification and specific expectations of data quality that

[11] http://www.ghgprotocol.org/standards

may need to supplement the ICLEI protocol. ICLEI is also interested in providing guidance to a wide spectrum of local governments around the world, most of which are unlikely interested in preparing inventories with the rigour required for registration in this current era of GHG "regulation." The CCAR process will examine these issues and intends to **come to a resolution within a year.**

2.2.4 FCM Standards and Guidance

The Federation of Canadian Municipalities has produced a draft paper *Developing Greenhouse Gas Emissions and Energy Consumption Inventories: A Standards and Guidance Document for Canadian Municipalities*. This document has been in development for several years and **is expected to be released in early 2008.**

The document was originally developed to compliment the FCM/ICLEI Partners for Climate Protection program in Canada and their spreadsheet system for preparing inventories.[12] It could, nevertheless, be applied to local governments not engaged in PCP or using alternative data management systems.

One of the factors delaying its release was the desire to provide a Canadian user's guide to the ICLEI inventory software that was being developed. The Harmonized Emissions Analysis Tool (HEAT) project, however, has been eclipsed by the Clinton Climate Initiative/ICLEI/Microsoft online inventory project discussed in section 3.2.3.

The unreleased document provided richer guidance than the ICLEI 1999 protocol and not as much as the current draft ICLEI *International Emissions Analysis Protocol.* Its consistency with the latter on finer details is currently uncertain. FCM, however, expects they will be consistent and the document will essentially become Canada's National Supplement to the new ICLEI Protocol. When the online inventory project, mentioned above, is released in late 2008, FCM expects the document will have to be further updated to provide practical guidance for Canadian local governments.

Strategic Recommendations

- The **CEEI should stay abreast of several processes to strengthen the integrity and consistency of community inventory protocols,** standards and guidance, specifically:

    - Review and solicit updates on the draft *ICLEI International Emissions Analysis Protocol* **and the ICLEI** *International Emissions Measures Protocol.*

    - **Share technical reviews with ICLEI Canada and FCM**. **Stay abreast of the of their efforts to develop a National Supplement** to the ICLEI protocol and the **release of FCM's** *Developing Greenhouse Gas Emissions and Energy Consumption Inventories: A Standards and Guidance Document for Canadian Municipalities* in

[12] In Canada FCM and ICLEI support the *Partners for Climate Protection* program. In the rest of the world, ICLEI's campaign runs under the banner: *Cities for Climate Protection.*

early 2008. Given its expertise, the **CEEI could play a valuable role in contributing to this national supplement or may feel the need to develop its own BC supplement.**

- **Maintain communication with CCAR on protocol development** of community and corporate activity, including technical reviews of their draft protocol. **Guidance pertaining to corporate activity will likely be of greatest relevance to the BC Government carbon neutral local government initiative. Community guidance may be unnecessarily onerous** at the early stages of the CEEI proces – **if the primary interest is providing strategic guidance for developing effective community action plans, and monitoring progress**.

- As most of this activity simultaneously covers corporate activity, **some of these developments should similarly be considered by BC Government officials involved in carbon neutral local government** and corporate inventories.

3 Data Management Systems

This section discusses the relevance of the unique CEEI initiative vis-à-vis data management, and the state of play of key data management systems for local government inventories.

Observations and Findings

3.1 CEEI's Unique Centralized and Networked Inventory System

Leading agencies (e.g. California Energy Commission), **local governments** (e.g. Seattle), **and non-profits** engaged in climate protection (e.g. CCAR, WRI) **laud the BC government's ambitious CEEI initiative**.

There does not appear to be any other effort by a senior government to collect data centrally and generate community inventories for all local governments in their jurisdiction in one fell swoop. Inventories should not be that onerous to conduct but with every local government having to negotiate access to and then manage data, it is a very inefficient process. CEEI expedites this whole process. **Many institutions will be observing CEEI implementation so they can encourage other states/provinces to follow BC's example or some variation of it.**

There are **some tangentially related developments**. For example the (San Francisco) Bay Area Air Quality Management District, encompassing 110 local governments, has centralized some top down data and is now building LG capacity to prepare their own inventories. Similarly, the Nova Scotia Department of Energy is building LG capacity across the province to develop inventories.

Overseas, there is some more advanced activity, e.g. **New Zealand's National Centre for Climate Energy Solutions has prepared inventories for all Local Territorial Authorities**.[13] LTAs are similar to BC municipalitie, although their geographical boundaries are generally much larger. Using a combination of national top down and local bottom up data, the middle out approach **does not appear, however, to provide the accuracy or detail sufficient for many local governments. ICLEI New Zealand continues to provide extensive inventory services to local governments.**

3.2 CEEI's Unique Data Management Requirements

The **CEEI's unique objectives,** i.e. centralizing large volumes of high quality geocoded data from multiple sources that would be sorted by municipality and overlapping regional district to prepare almost 200 individual inventories, **demands a unique software management solution.**

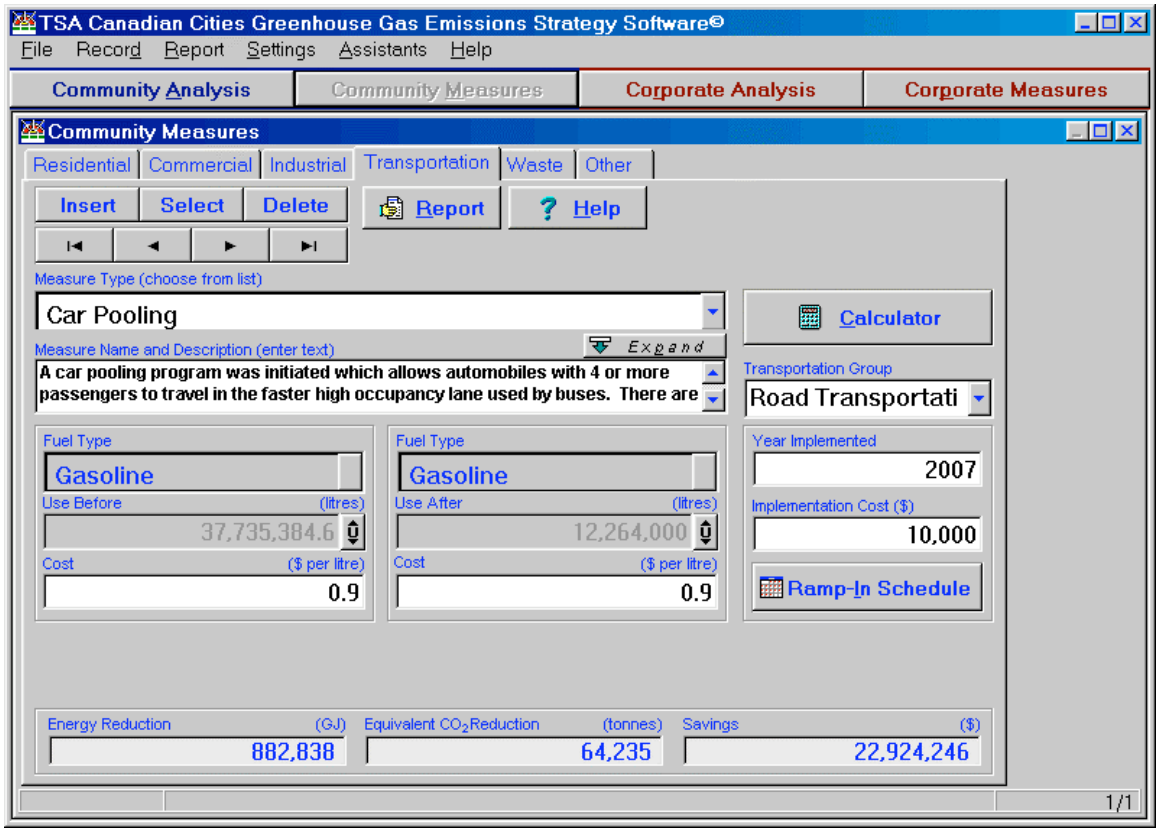
[13] http://www.niwascience.co.nz/ncces/projects/ghge

Given the CEEI's unique objectives, **no off the shelf data management solution seems to exist**. In fact, o**ver and above a range of rudimentary to sophisticated adaptations of common spreadsheet applications like Excel, or software that has been developed expressly for one municipality, there are not many software applications expressly designed to meet the wide diversity of local government** corporate and community inventory needs.

Central considerations of several such software applications are discussed here. They are relevant because of their widespread use, emerging sophistication and/or knowledge of the BC context.

3.2.1 Torrie Smith's Municipal Greenhouse Gas Strategy Software

Ralph Torrie produced the software used most widely to conduct corporate and community municipal inventories.[14] Known in the US as ICLEI's *Clean Air and Climate Protection Software*, and under different names in other jurisdictions, it automates energy conversions, embeds emission coefficients, and offers deeper analysis and monitoring for GHG and energy management. It quantifies financial savings, air pollutant reductions and other mitigation co-benefits. The preparation procedure involves ICLEI staff, consultants or municipal staff procuring the data, uploading and analyzing it, and generating reports.



Torrie Smith's GHG Inventory Software has been used by local governments around the world

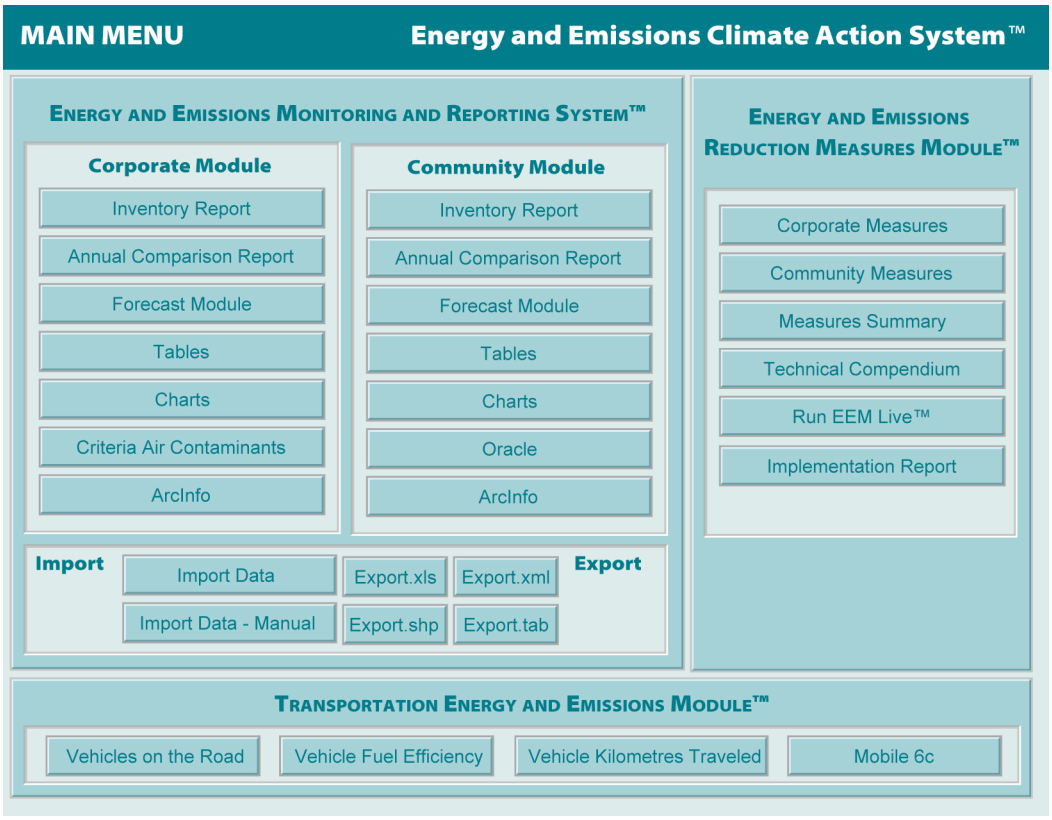
[14] http://www.torriesmith.com/cities-software.cfm

While Torrie's expertise in GHG and energy policy, inventories and modeling is still sought and used by many public and private sector clients, he has not updated his municipal inventory tool in years and now works for an international consulting firm.

Although it is dated, many local governments in Canada and around the world have been satisfied with the inventories generated by this software. At the same time **most large local governments involved in ICLEI's CCP/PCP program have developed their own software/spreadsheet systems or contracted others to carry out this task because their unique and complex data does not seem to work with a one size fits all software package**.

3.2.2 Hyla Environmental Services' Inventory Software

Hyla Environmental Services' **Russ Haycock is actively preparing inventories for a range of public sector clients mostly in BC with a particular emphasis on local government** corporate and community activity.



Hyla's software is being regularly updated to meet municipal energy and emission inventory needs

Through the CAEE, Hyla has prepared a dozen community inventories for BC municipalities consisting of a PDF'd summary sheet of emissions by sector. These basic reports are not a reflection of the functionality of Hyla's software. Generally, Hyla **develops technical compendia with rich energy data, emission forecasts according to scenarios**

with variable assumptions and commensurate cost projections. The software has standard links to other important energy and emissions software, e.g. Mobile 6c, and customized links for some clients to other energy software tools.

Haycock and his software have some **unique considerations for the CEEI**. Through the CAEE process and his other municipal clients, Haycock has experience **working with large aggregated data sets that are then separating according to multiple jurisdictions**.[15] He has **trusted relationships with BC data providers** – an essential consideration for gaining access to good quality data with significant privacy concerns. The **software is also moving online to facilitate uploading data and downloading reports** while at the same time protecting confidentiality.

Squamish

DRAFT Community Energy & Greenhouse Gas Emissions Inventory: 2005

2005

COMMUNITY BUILDINGS	Consumption by Type					Subtotal & Indicators			
	Type	Consumption	Energy	Indicators	CO_2e	Energy	Energy/Unit	CO_2e	CO_2e/Unit
RESIDENTIAL BUILDINGS	Electricity	85,815,914 kWh	308,937 GJ	6,023	2,832 t	**438,294 GJ**	14,248	**9,450 t**	0.5
	Natural Gas	129,357 GJ	129,357 GJ	1,778	6,618 t		73		3.7
COMMERCIAL BUILDINGS	Electricity	43,455,492 kWh	156,440 GJ	941	1,434 t	**309,778 GJ**	46,180	**9,279 t**	1.5
	Natural Gas	153,338 GJ	153,338 GJ	410	7,845 t		374		19.1
INDUSTRIAL BUILDINGS	Electricity	154,221,141 kWh	555,196 GJ	156	5,089 t	**555,196 GJ**	988,597	**5,089 t**	32.6
SUBTOTAL	Electricity	283,492,547 kWh	1,020,573 GJ		9,355 t	**1,303,268 GJ**		**23,818 t**	
	Natural Gas	282,695 GJ	282,695 GJ		14,463 t				

COMMUNITY TRANSPORTATION	Consumption by Type					Subtotal & Indicators			
	Type	Consumption	Energy	Indicators	CO_2e	Energy	Energy/Unit	CO_2e	CO_2e/Unit
PASSENGER VEHICLES	Gasoline	10,399,668 litres	360,452 GJ	7,165	26,029 t	**360,452 GJ**	1,451	**26,029 t**	3.6
LIGHT DUTY GASOLINE TRUCKS	Gasoline	4,443,076 litres	153,997 GJ	1,824	11,121 t	**153,997 GJ**	2,436	**11,121 t**	6.1
MEDIUM DUTY GASOLINE TRUCKS	Gasoline	584,439 litres	20,257 GJ	227	1,463 t	**20,257 GJ**	2,575	**1,463 t**	6.4
MOTORCYCLES	Gasoline	45,535 litres	1,578 GJ	344	114 t	**1,578 GJ**	132	**114 t**	0.3
MEDIUM DUTY DIESEL TRUCKS	Diesel Fuel	4,645,386 litres	179,684 GJ	295	12,921 t	**179,684 GJ**	15,747	**12,921 t**	43.8
LIGHT DUTY DIESEL TRUCKS	Diesel Fuel	279,435 litres	10,809 GJ	94	777 t	**10,809 GJ**	2,973	**777 t**	8.3
PASSENGER VEHICLES	Diesel Fuel	147,041 litres	5,688 GJ	136	409 t	**5,688 GJ**	1,081	**409 t**	3.0
SUBTOTAL	Gasoline	15,472,718 litres	536,284 GJ		38,727 t	**732,464 GJ**		**52,834 t**	
	Diesel Fuel	5,071,861 litres	196,180 GJ		14,107 t				

COMMUNITY SOLID WASTE	Consumption by Type			Subtotal & Indicators			
	Type	Mass	CO_2e	Energy	Energy/Unit	CO_2e	CO_2e/Unit
COMMUNITY SOLID WASTE	Solid Waste	8,712.20 t	4,095 t			**4,095 t**	
SUBTOTAL	Solid Waste	8,712.20 t	4,095 t			**4,095 t**	

GRAND TOTAL		Consumption	Energy	CO_2e		
	Electricity	283,492,547 kWh	1,020,573 GJ	9,355 t	**2,035,732 GJ**	**80,747 t**
	Natural Gas	282,695 GJ	282,695 GJ	14,463 t		
	Gasoline	15,472,718 litres	536,284 GJ	38,727 t		
	Diesel Fuel	5,071,861 litres	196,180 GJ	14,107 t		
			Mass	**CO_2e**		
	Solid Waste		8,712 t	4,095 t		

Example of Hyla's community inventory summaries produced under BC's CAEE

[15] Community Action on Energy and Emissions is a BC Government program to help local governments strengthen local energy sustainability and reduce GHG emissions. See: http://www.bcclimateexchange.ca/index.php?p=caee

Consistent with some other institutions in the field, there are sensitive transparency issues related to Hyla's inventories.[16] Due to the time and resource investment in developing intricate methodologies to calculate and analyze energy and emissions data, this information is not fully disclosed. The absence of disclosure raises concerns with some parties around data utility and integrity. As with registered private sector inventories, confidence in its integrity could be similarly achieved through third party verification.

3.2.3 An International Online Data Management Collaboration

The Clinton Climate Initiative announced in May, 2007 a commitment to "develop a suite of technology tools that will enable cities to accurately monitor, compare and reduce their greenhouse gas emissions."[17] The Centre for Neighborhood Technology is carrying out project Management on behalf of the Clinton Climate Initiative. **ICLEI** and **Microsoft** are at the table.

The project partners are cognizant of the limitations of previous software applications and intend for this new online software tool to hurdle all major challenges in a phased manner. It will be, for example, expandable into less common local government sectors, e.g. marine or aviation, as well as **have networking functionality, e.g. enable multiple local government inventories analyzed together**. They eventually expect it to incorporate criteria air contaminants and provide some detailed energy data and functionality to link to more sophisticated energy management tools.

The project members are interested in the CEEI initiative, **because the unique and precedent setting objectives would be an intriguing and valuable challenge.**

The partnership could well entertain using BC as a pilot for political jurisdiction inventory networking. Because BC has only one electric utility and several natural gas companies for billing purposes, and one public automobile insurance agent, procuring consistent data is significantly easier than in most jurisdictions. Because the Government of BC is fully engaged and can facilitate cooperation with the most important data sources also makes BC highly appealing.

The best estimate for an operating version 1.0 is fall, 2008. The top priority upon launch is processing inventories for the Clinton Climate Initiative's C40 cities.[18] These would be generated at no cost, and essentially involve each local government uploading data that would be "automatically" processed, providing the basis for a report.

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[16] A number institutions have invested heavily in developing skills, knowledge and tools providing inventory services and are wary of liberally sharing this knowledge. For instance, despite the plethora of municipal inventories in Australia and New Zealand, ICLEI Oceania was not comfortable sharing any of their protocols, let alone a sample inventory. This concern is understandable given an unfortunate history of failing to acknowledge intellectual property developed in this field.

[17] http://www.clintonfoundation.org/051707-nr-cf-cci-pr-clinton-foundation-microsoft-to-develop-online-tools-enabling-worlds-largest-40-cities-to-monitor-carbon-emissions.htm

[18] All project members are involved in the international collaboration on a new global protocol. This project, in fact, was one of the drivers for strengthening the protocol.

Depending on the preparedness of the C40 cities, at the earliest BC could likely step into line is fall, 2008. The cost implications to other users are unknown. **ICLEI Canada expects modifications could well be necessary for application in different jurisdictions.**

There are **some challenges** associated with this potential software solution. **Timelines could be incompatible** with CEEI. **BC is not first inline** to use the software and its unique needs would be secondary to the C40 cities. The **system's novelty could translate into bug infestations**. The **system's design may not be compatible with CEEI's need to upload large aggregated data sets that require separation** by municipality. Depending on the level of detail CEEI expects, **confidence may have to be built with date providers to meet data privacy and security expectations**. **All of these challenges, however, may be easily overcome**.

Strategic Recommendations

- **While other options will likely emerge, there are preliminarily several software developers the CEEI Initiative should consider:**

    - The **Clinton Climate/ICLEI/MicroSoft/Centre for Neighborhood Technology initiative may meet CEEI's needs or could with some adaptation**. The BC Government should formally communicate its interest in exploring this opportunity. There a number of challenges that would need to be considered, including possible timeline incompatibility, design suitability, data security, and first generation software bugs.

    - **With further development, Hyla's software could meet CEEI's needs.** Haycock's familiarity with BC data providers and municipalities, history of software refinement to meet municipal energy and emission requirements has many benefits.

    - **While his municipal software has not been updated and refined, Ralph Torrie continues to be active in energy and GHG inventory and modeling activity and has strong software development literacy**. He may be interested in playing a role building or strategically advising the development of a software system.

- The optimal software solution may not dovetail with CEEI's timelines. **At the very least, it might be prudent to consider an inter-rim rudimentary data management system** that is a stepping-stone to a more sophisticated system.

- **Given corporate emissions are subsets of community emissions, the CEEI may want to consider how *data collection* and *management* can facilitate the development of corporate inventories.** The data may simply be stored for access by local governments, or eventually, the same data management system might be used for inventory preparation. The system could generate a range of report qualities from crude to sophisticated – depending on the investment. Both Hyla's and Clinton Climate's would appear to offer this functionality.

- The province of BC will be in a position to showcase the CEEI at inter-provincial and state-provincial gatherings as a critically valuable tool to support local GHG management activity. A number of institutions are anxiously awaiting CEEI implementation. **BC could take advantage of its leadership from a communications perspective.**

4 Community Inventory Parameters

The range of parameters used across inventories varies, and influences their respective utility. **As discussed in the introduction, being *practical* is a guiding principle.**

Some parameters or "secondary indicators" beyond GHGs by sector of activity and fuel source, have no additional cost and add significant value. In other situations, there are resource and time costs associated with gathering and including secondary indicators.

Refining inventories is an iterative, long-term process. Starting with readily available data that can be refined over time is the standard practice for local governments with a long history of GHG and energy management and an interest in inventories.

A number of **inventories from across Canada and the US have been analyzed** as a departure point to discuss these parameters and compare them to those surveyed in *Energy and GHG Inventory Practices by Local Governments in BC*.[19] Given the volume of community inventories across North America, those selected are based on a subjective, but informed sample of municipalities with mature climate action plans, and a range of municipal populations and socio-economic conditions. See the *Bibliography* for web references.

As previously discussed, European local government examples were not included because they overwhelmingly do not take as much stock in systematically accounting for emissions.[20] Examples from Australia and New Zealand were not included because ICLEI Oceania, who conducts the overwhelming majority of community inventories, considers the level of detail this report sought as proprietary.

Observations and Findings

4.1 General Considerations for Secondary Parameters

Identifying the secondary parameters to include should be guided by the principles discussed in the introduction. **Some important elaborations of these principles include:**

- **The needs of local government staff** setting up a GHG/energy program, e.g. large point sources and categories, #s and building typologies, #s and vehicle categories…
- **Useful long term tracking parameters** to monitor progress, e.g. GHG intensity of energy use, vehicle ownership/modal split trends…
- **Unique local emission drivers,** e.g. upper Fraser Valley agricultural emissions, industrial emissions in Kitimat, and marine emissions in the GVRD.

[19] Report prepared by the Sheltair Group for the CEEI, November, 2007.
[20] This should not suggest local government GHG management is not as advanced in Europe as North America. European local government action is far more advanced and pervasive.

- **The right data can inform and consolidate support behind a local climate program**. For example, municipalities with industries and/or populations in decline would find it useful to know their **gross community wide financial expenditures on energy**. This information lines up economic development players in the District – staff, Council and community – behind a climate plan.

  For example, when Sudbury conducted its inventory, it discovered the community as whole spent $400 million annually on energy, almost all of which left the community. With declining employment in forestry, mining and smelting, **its climate plan became a community economic development strategy** emphasizing job creation and industrial development through an energy conservation and efficiency and renewables agenda. Similar considerations are helping drive the District of Squamish's GHG and energy planning.

  While not as accurate as ambient air quality monitoring, **Criteria air contaminant data** can be derived from energy activity. **It can help drive support and program activity in dirty airsheds.** This would be one of the reasons some municipalities are so sophisticated in California and Ontario.

The following legend facilitates interpretation of the tables.

Community GHG Inventory Comparisons Legend

Administration Legend

ICLEI	International Council for Local Environmental Initiatives
CCP	Cities for Climate Protection (United States)
PCP	Partners for Climate Protection (Canada)
GHG Prot	World Resources Institute Protocols
IPCC Prot	International Panel on Climate Change - 1996 Inventory Protocols
Prot/Included	Included refers to an explicit explanation of the protocol methods
Target	The cities future GHG emission target, often set by protocol followed

Buildings Legend

NG	Natural Gas
Elec	Electricity
D-Gen	Diesel Generation
Wd.P	Wood Pellets
Prop	Propane
Refrdg	Refrigerant Leaks
Res	Residential
Com	Commercial
Ind	Industrial
Gov	Government
#	Categories
Ex: Res 4 #	- Four residential categories

Transportation Legend

LDG	Light Duty Gas
MDG	Medium Duty Gas
OR	Off Road
LDD	Light Duty Diesel
LDD	Light Duty Diesel
LDV	Light Duty Vehicle
HDV	Heavy Duty Vehicle

Greenhouse Gases (GHG)

CO2	Carbon Dioxide
CH4	Methane
HFC	Hydrofluorocarbon
SF6	Sulfur Hexafluoride
N20	Nitrous Oxide
CO2e	Carbon Dioxide Equivalents

Units

GJ	Gigajoule
kWh	Kilowatt Hour
BTU	British Thermal Units
Thrms (Therms)	100,000 BTUs of NG
gal	US Gallon
tons	US ton
$	Expenditures
C	Capita
H	Household

Solid Waste Legend

Land F	Landfill
Incin	Incineration

Community GHG Inventory Comparisons				
	Arcata CA	**Boulder CO**	**Calgary AB**	**Yellowknife NT**
Administration				
Inventory Year(s)	2002	1990 to 2005	1990 2000 1997 2003	2005
Basline Year	2000	1990	1990	2003
Forecast	2010	2012	-	2000
Targets	20% Below 2010, by 2020	Kyoto	-	-
Population	16,551	101,547	1,019,942	18,700
Data System	ICLEI	In House	ICLEI	CEDAT
Inventory Team	Staff / ICLEI	Consultants: Eco Energy	Staff	Consultants: Pembina
Protocol/Included	ICLEI - CCP/Y	GHG Prot/Y	ICLEI - PCP/N	CEDAT/Y
GHGs Measured	CO2e Conversion factor used	CO2 N20 CH4 HFC	CO2e Conversion factor used	CO2 N20 CH4
Sectors				
Buildings				
Source / Unit	Elec *Btu* Fuel Oil *Btu*	NG *CO2e* Elec *CO2e* Refrdg *CO2e* Diesel *CO2e*	Elec *CO2e* NG *CO2e*	Oil *GJ* Elec *kWh* NG *GJ* D-Gen *GJ* Wood *GJ* Wd.P *GJ* Prop *GJ*
Other Metrics	CO2e	None	None	CO2e GJ/y $ GHG/y
Disaggregation	None	Res 1 # Com 1 # Ind 1 #	None	Res 4 # Com 5 # Ind 1 # Gov 4 #
Transportation				
Source / Unit	Aggreg- *Btu* ate	Gas *CO2e* Dies *CO2e* Av. Fuel *CO2e*	Aggreg- *CO2e* ate	Gas *GJ* Dies *GJ*
Other Metrics	CO2e	None	None	CO2e $
Disaggregation	None	None	None	LDG OR MDG LDD
Solid Waste				
Source / Unit	Land F *CO2e*	Land F *CO2e*	Land F *CO2e*	None
Other Metrics	-	-	-	-
Additional				
Other Sectors	Community - Forest Industry	Industry Agriculture Industrial - Processes Offsets	Industry Urban Forest	None

Community GHG Inventory Comparisons				
	Seattle WA	**Somerville MA**	**Duluth MN**	**Berkeley CA**
Administration				
Inventory Year(s)	2002	2001	2001	2007
Basline Year	2000	1997	1999	2005
Forecast	2010	2010	2020	2020
Targets	Kyoto	-	20% below 1999, by 2020	-
Population	516,259	77,400	86,918	102,743
Data System	In House	ICLEI	ICLEI	ICLEI
Inventory Team	Staff/ Consultants	Staff/ ICLEI	Staff / ICLEI	Staff/ICLEI
Protocol\Included	GHG Prot/N IPCC Prot/N	ICLEI/Y	ICLEI - CCP/Y	ICLEI - PCP/Y
GHGs Measured	CO2 HFC CH4 SF6	CO2 CH4	CO2 CH4	CO2e Conversion factor used
Sectors				
Buildings				
Source / Unit	Oil *CO2e* NG *CO2e* Elec *CO2e*	Oil *BTU* NG *BTU* Elec *kWh*	Oil *gal* NG *Thrms* Elec *kWh* Coal *tons*	Elec *CO2e* NG *CO2e*
Other Metrics	None	CO2e $ CO2e/cap/yr	CO2e Btu $	kWh/H CO2e/C Thrms/H kWh
Disaggregation	None	None	Res 1 # Com 1 # Ind 1 #	Res 1 # Com 1 # Ind 1 #
Transportation				
Source / Unit	Gas *CO2e* Dies *CO2e* NG *CO2e*	Gas *BTU* Dies *BTU* Prop *BTU*	Gas *gal* Dies *gal* Prop *gal* CNG *Thrms* Bunker *gal*	Gas *CO2e* Dies *CO2e*
Other Metrics	CO2e	CO2e	CO2e Btu	CO2e/C kWh
Disaggregation	None	LDV Bus HDV	None	None
Solid Waste				
Source / Unit	Land F *CO2e*	Land F *CO2e* Incin *CO2e*	Paper *CO2e* Food *CO2e* Plant *CO2e* Wood *CO2e*	Paper *CO2e* Food *CO2e* Plant *CO2e* Wood *CO2e*
Other Metrics	tons/year	-	-	CO2e/C
Additional				
Other Sectors	Industry Aviation Shipping Ferries	Industry	Industry Marine	-

4.2 General Observations and Findings

There is **significant variation in what local governments measure. These differences can be shaped by local climate program interests**, e.g. Seattle measures aviation emissions with the explicit intent of working with the airport authority to reduce emissions and encourage travel offsets.

If a local government has developed a **community energy plan, e.g. Yellowknife, or has a history of energy management, e.g. Boulder, data tends to be particularly rich and useful.** Energy planning objectives help strengthen the utility of useful parameters and formats.

It will be **impossible to meet all local government data needs**, notably providing data for unique sectors like aviation, marine or agriculture. **LGs can supplement the CEEI generated inventories** with their own data and **the CEEI will inevitably be iteratively strengthened.**

There is a tendency to measure energy activity only if has carbon implications. **To facilitate planning and monitor progress over the long-term, it will be useful to consider zero carbon energy activities**, e.g.

- modal splits including active transportation
- zero carbon electricity and heat sources

Strategic Recommendations

- **Rather than perfect inventories, the CEEI should consider what is practical in terms of initial data provision, and expect the CEEI will iteratively evolve.**

- The **CEEI should initially provide data to municipalities that is readily accessible and facilitates the development and monitoring of local climate and sustainability plans**, including considerations to consolidate support behind robust local action plans. Over and above GHGs and energy use by activity sector and energy source, the following secondary parameters or indicators should be considered:
    - CO_2e per unit of energy (easy calculation and good for monitoring)
    - Building typologies and #s, vehicle categories and #s (if available)
    - VKTs
    - Financial expenditures on energy (easy calculation and good for CED planning)

- Some of the **important indicators and functions to add in future iterations** either by the CEEI or by local governments with guidance include:
    - Modal splits including active transportation and public transit
    - Zero carbon electricity and heat sources
    - Criteria air contaminants
    - Floor space by building typology
    - Solid waste data: diversions, organics to landfill
    - Forecasting functionality
    - BAU GHG/energy forecasts compared to forecasts with action plans

5 Reporting Formats and Capacity Building

Regardless of the quality and quantity of data collected and analyzed, an inventory's utility is strongly shaped by the reporting format. These observations consider organization, length, data richness, and communication effectiveness.

Observations and Findings

5.1.1 Reporting Formats

Layering Information

Layering information **strengthens utility and interest for a wide range of audiences** who require varying degrees of depth. Councilors, transportation planners, utilities, the general public, the CAO all have different levels and types of interest that can be mostly met with good organization. Key layers are:

- **Executive Summary** with concise narratives and good graphics; total emissions; emissions broken down by sector and by fuel/energy source; general trends, drivers, and targets compared with forecasts if monitored.

- **Main Report** with concise narratives and good graphics; disaggregated sectoral emissions along with fuel/energy sources; trends, drivers, and targets compared with forecasts if monitored; a summary data sheet.

- **Appendices** with further disaggregations; methodologies if not included earlier.

These components include the high-value parameters, or secondary indicators, discussed in the previous section. Boulder is the best example. Duluth, Somerville, Yellowknife are also strong.

Strong Graphics

Good charts and tables **strengthen communication** of findings. They are usually a strong determinant of a concise and easy to read inventory. Boulder and Yellowknife are exemplary. Some of the strongest examples are shown in the *Compelling Graphics* appendix.

Ample Information

Ample information **strengthens relevance**. Some inventories, like Calgary's, are clear and concise, but omit useful information like disaggregations of building and transportation emissions. Yellowknife, Duluth and Arcata provide complete information through their appendices.

5.1.2 Capacity Building

Local Government Inventory Training

Several state/provincial or county level jurisdictions (e.g. Nova Scotia and the Bay Area Air Quality Management District covering 110 local governments) are **providing inventory-training seminars for local governments.** The primary objective is providing **guidance on inventory preparation** – potentially a **useful strategy in BC for those unique sectors** like agriculture and marine, where local governments may be better positioned to provide the data.

A **secondary objective is training for the practical application of inventories** in GHG management and sustainable energy planning. It does not follow that a good inventory leads to a good local climate plan and implementation. The correlation is, in fact, weak.

Ironically, depending on the approach, the conventional process of developing an inventory can help build capacity for climate protection as a core group of managers and staff across the organization procure and furnish information, and begin to see the impact of their decisions on GHG emissions. The CEEI compromises this opportunity. However, the CEEI's benefits far outweigh the costs in time and human resources expended, and given the BC government's interest in preparing inventories, there are other ways to build capacity for taking action and such activity should be considered if inventories are going to form the foundation of strong local action plans.

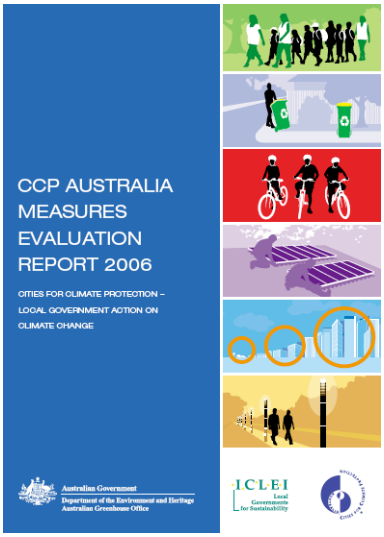
5.1.3 National and "Provincial" Reports on Local Action

National Reports on Local Activity

A number of national governments have produced useful reports on local government inventory and mitigation activity directly or tangentially related to the CEEI's objectives. These reports serve a number of **useful functions**:

- Strengthening **awareness** of local contribution to climate change
- Sharing knowledge of **best practices**
- **Quantifying emission reduction** activity
- **Recognizing** local government **leadership**
- **Building support** for local climate protection

Given provincial governments determine local authority in Canada, if such reporting is produced domestically, provincial governments would most likely undertake it.



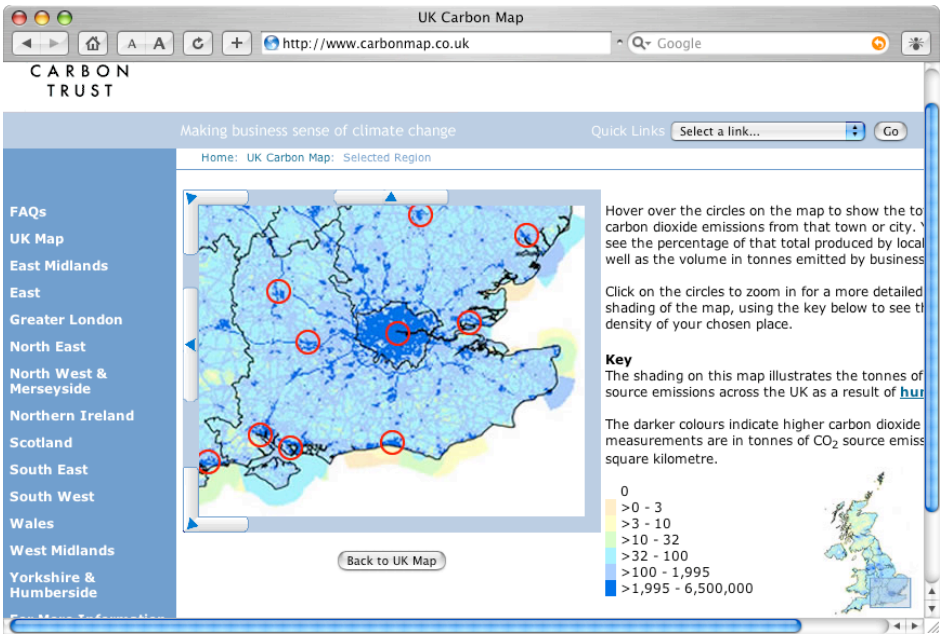
Australia's Annual Report on Municipal Climate Protection

Australian Annual Local Government Climate Report

The Australian Government and ICLEI Australia produce a very good annual report on local government activity with quantified emission reductions by measure.[21] It could be strengthened by including absolute emissions, as well as reductions over BAU. This report is currently somewhat tangential to the immediate CEEI objectives, but as emission reductions progress, such a report has great utility and the CEEI would have relevant data.

UK Carbon Map

The UK Carbon Map has been an effective way of generating awareness about local contributions to climate change. Users can mouse over their municipality to get a graphical in graphically illustration the of their community's emissions. While its contribution to mitigation has not been measured, web traffic is high. Given the geocoded data CEEI would have at its disposal, an even more potent educational tool could be developed.



UK Carbon Map provides insight into educational opportunities of provincial level reporting of community wide emissions

Strategic Recommendations

- **Develop a reporting format to present data in a compelling, coherent, user-friendly manner. If the CEEI is providing data and not generating reports, it should provide report format guidelines to facilitate this work at the LG level.**

- **Consider delivering capacity building programs** to enable local governments to A) collect data in unique sectors that are more appropriate for local governments to collect,

[21] http://www.iclei.org/index.php?id=4922 or http://www.greenhouse.gov.au/local/ccp/publications/reporting.html

e.g. agricultural and marine, and B) maximize the utility of inventories for GHG management and sustainable energy planning.

- As CEEI progresses, consider **developing provincial level reports and online reporting tools on local government activity** to strengthen awareness, recognize leadership and build support.

Bibliography

Inventories

Arcata, CA
http://www.arcatacityhall.org/energy/ghg_app_a.pdf

Boulder, CO
http://www.bouldercounty.org/sustain/pdf/Inventory%20Report%20updated%20final%20122706.pdf

Burlington, ON
http://www.sustainablecommunities.fcm.ca/files/Capacity_Building_-_PCP/City_of_Burlington_-_Inventory_Summary_Report.pdf

Calgary
http://www.calgary.ca/docgallery/bu/environmental_management/2003_community_emissions_report.pdf

Duluth MN
http://www.ci.duluth.mn.us/city/information/ccp/GHGEmissions.pdf
City staff using ICLEI

Seattle, WA
http://www.seattle.gov/climate/PDF/Our_Carbon_Footprint.pdf

Sommerville, MA
http://www.somervillema.gov/CoS_Content/documents/Somerville_GHG_Inventory%20Report.pdf

Yellowknife, NT
http://www.yellowknife.ca/__shared/assets/YK_Energy_Baseline_-_Final_report_June_20063475.pdf

Protocols and Protocol Related Documents

Boehmer, Kevin. 2005. *ISO's Climate Change Standards*. Canadian Standards Association. Source: http://www.team.gc.ca/english/pdf/cc_standards.pdf

CCAR. November, 2007. *GHG Inventories for Local Government Operations and Activities.* Stakeholder scoping paper.

GHG Protocol Initiative. 2004. *A Corporate Accounting and Reporting Standard.* Source: http://www.ghgprotocol.org/

GHG Protocol Initiative. 2005. *The GHG Protocol for Project Accounting.* Source: http://www.ghgprotocol.org/

Haycock, Russ. March, 2005. *Developing Greenhouse Gas Emissions and Energy Consumption Inventories: A Standards and Guidance Document for Canadian Municipalities* working draft 1. Federation of Canadian Municipalities. Unpublished.

ICLEI. April, 1999. *ICLEI CCPC Protocol/Guidelines for Reporting draft 3.0.* Source: http://www.sustainablecommunities.fcm.ca/files/Capacity_Building_-_Energy/Resources_and_Tools/CCP-protocol.pdf

ICLEI. November, 2007. *International Emissions Analysis Protocol* draft. Released for Technical review.

Miscellaneous Publications

MacDonald, Ron. November, 2007. *Energy and GHG Inventory Practices by Local Governments in BC* prepared for the Ministry of Environment CEEI Initiative. Sheltair Group.

Ministry of Labour and Citizens' Services. June, 2007. *Greenhouse Gases: How are emissions measured?* developed for Ministry of Environment by Office of the Chief Information Officer.

Appendix 1: Interviewees

Canada

Causely, Devin	Sr Program Officer	Federation of Canadian Municipalities; Partners for Climate Protection
Gray, Jane	Executive Director	Manitoba Ministry of Energy; Energy Climate and Green Strategies
Haycock, Russ	Principal	Hyla Environmental Services
Hollet, Jason	Program Administrator	Nova Scotia Department of Energy
Jamieson, Megan	Executive Director	ICLEI Canada
Ribaux, Sidney*[*]	Executive Director	Equiterre
Rilet, John	Director	Climate Change Central Alberta; Energy Efficiency
Seabrooke, Amy	Program Officer	Federation of Canadian Municipalities; Capacity Building Program – Energy
Torrie, Ralph	Sr Associate	ICF International
Whitestone, Jim	Acting Director	Ministry of Environment, Air Policy and Climate Branch, Ontario

Europe

Bulkeley, Harriet*	Associate Director	Durham University; Centre for the Study of Cities and Regions
Curran, Lara*	Sr Planner	Woking Borough Council
Hewitt, Adrian	Sr Planner	Merton Borough Council
Liverman, Diane	Executive Director	University of Oxford; Environmental Change Institute
Van Staden, Maryke	Project Officer	ICLEI Europe

Oceania

Clarkson, Tom*	Staff Scientist	NIWA – National Centre for Climate–Energy Solutions, New Zealand
Jamieson, Dennis*	Professor Emeritus	NIWA – National Centre for Climate–Energy Solutions, New Zealand
Wenn, Patti*	Executive Manager	ICLEI; Cities for Climate Protection - Australia/New Zealand
Shand, Diana	National Programme Manager	ICLEI; Cities for Climate Protection New Zealand

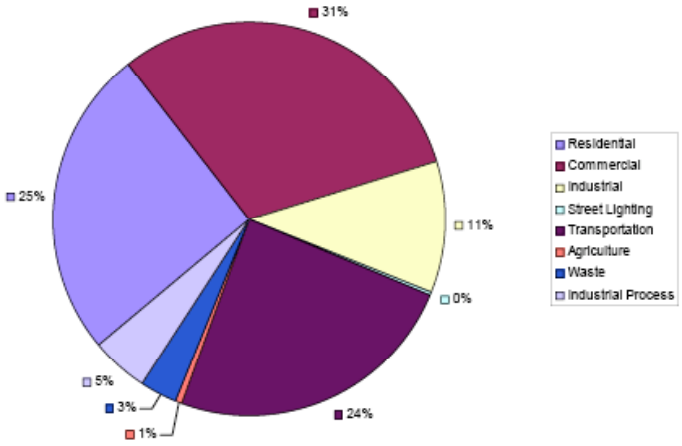
[*] All interviews are by telephone except where indicated by *.

USA

Barker, Lynn	Sustainable Development Planner	Seattle Department of Planning and Development
Bartholomy, Panama	Advisor to the Chair	California Energy Commission
Bennet, Rob	Sr Advisor	Clinton Climate Initaitive
Bhatia, Pankaj*	Co-Director	World Resources Institute; GHG Protocol Initiative
Broekhoff, Derik*	Sr Associate	World Resources Institute GHG Protocol Initiative
Eichel, Amanda	Climate Protection Advisor	Seattle Office of Sustainability and Environment
Fitzgerlad, Garrett	Director of Programs	ICLEI US
Gero, Gary	Interim President	California Climate Action Registry
McGraw, Jen	Climate Change Program Manager	Center for Neighborhood Technology
Sandoval, Ana	Principal Environmental Planner	(San Francisco) Bay Area Air Quality Management District
Tornek, Rachel*	Sr Program Manager	California Climate Action Registry

Appendix 2: Compelling Inventory Report Graphics

As discussed in section 5 *Reporting Formats*, good graphics strengthen the communication of findings. The inclusion of good charts, graphs and tables is usually a strong determinant of a concise and easy to read inventory. Some of the strongest examples are shown below.



Figures 1 and 2: Every inventory should have pie charts of emissions by activity sector and energy source. Pie charts should be developed for total community emissions as well disaggregated as in each activity sector.

Figure 1 Total Community Emissions by Sector

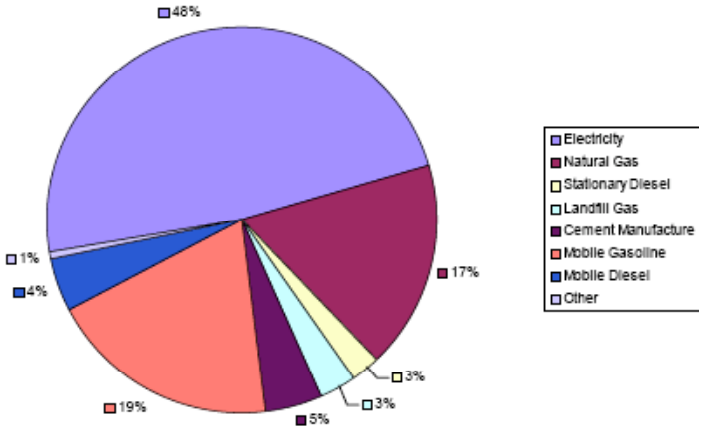


Figure 2 Total Community Emissions by Energy Source

Squamish

DRAFT Community Energy & Greenhouse Gas Emissions Inventory: 2005

2005

COMMUNITY BUILDINGS	Consumption by Type					Subtotal & Indicators			
	Type	Consumption	Energy	Indicators	CO_2e	Energy	Energy/Unit	CO_2e	CO_2e/Unit
RESIDENTIAL BUILDINGS	Electricity	85,815,914 kWh	308,937 GJ	6,023	2,832 t	**438,294 GJ**	14,248	**9,450 t**	0.5
	Natural Gas	129,357 GJ	129,357 GJ	1,778	6,618 t		73		3.7
COMMERCIAL BUILDINGS	Electricity	43,455,492 kWh	156,440 GJ	941	1,434 t	**309,778 GJ**	46,180	**9,279 t**	1.5
	Natural Gas	153,338 GJ	153,338 GJ	410	7,845 t		374		19.1
INDUSTRIAL BUILDINGS	Electricity	154,221,141 kWh	555,196 GJ	156	5,089 t	**555,196 GJ**	988,597	**5,089 t**	32.6
SUBTOTAL	Electricity	283,492,547 kWh	1,020,573 GJ		9,355 t	**1,303,268 GJ**		**23,818 t**	
	Natural Gas	282,695 GJ	282,695 GJ		14,463 t				

COMMUNITY TRANSPORTATION	Consumption by Type					Subtotal & Indicators			
	Type	Consumption	Energy	Indicators	CO_2e	Energy	Energy/Unit	CO_2e	CO_2e/Unit
PASSENGER VEHICLES	Gasoline	10,399,668 litres	360,452 GJ	7,165	26,029 t	**360,452 GJ**	1,451	**26,029 t**	3.6
LIGHT DUTY GASOLINE TRUCKS	Gasoline	4,443,076 litres	153,997 GJ	1,824	11,121 t	**153,997 GJ**	2,436	**11,121 t**	6.1
MEDIUM DUTY GASOLINE TRUCKS	Gasoline	584,439 litres	20,257 GJ	227	1,463 t	**20,257 GJ**	2,575	**1,463 t**	6.4
MOTORCYCLES	Gasoline	45,535 litres	1,578 GJ	344	114 t	**1,578 GJ**	132	**114 t**	0.3
MEDIUM DUTY DIESEL TRUCKS	Diesel Fuel	4,645,386 litres	179,684 GJ	295	12,921 t	**179,684 GJ**	15,747	**12,921 t**	43.8
LIGHT DUTY DIESEL TRUCKS	Diesel Fuel	279,435 litres	10,809 GJ	94	777 t	**10,809 GJ**	2,973	**777 t**	8.3
PASSENGER VEHICLES	Diesel Fuel	147,041 litres	5,688 GJ	136	409 t	**5,688 GJ**	1,081	**409 t**	3.0
SUBTOTAL	Gasoline	15,472,718 litres	536,284 GJ		38,727 t	**732,464 GJ**		**52,834 t**	
	Diesel Fuel	5,071,861 litres	196,180 GJ		14,107 t				

COMMUNITY SOLID WASTE	Consumption by Type			Subtotal & Indicators			
	Type	Mass	CO_2e	Energy	Energy/Unit	CO_2e	CO_2e/Unit
COMMUNITY SOLID WASTE	Solid Waste	8,712.20 t	4,095 t			**4,095 t**	
SUBTOTAL	Solid Waste	8,712.20 t	4,095 t			**4,095 t**	

GRAND TOTAL		Consumption	Energy	CO_2e				
	Electricity	283,492,547 kWh	1,020,573 GJ	9,355 t	**2,035,732 GJ**		**80,747 t**	
	Natural Gas	282,695 GJ	282,695 GJ	14,463 t				
	Gasoline	15,472,718 litres	536,284 GJ	38,727 t				
	Diesel Fuel	5,071,861 litres	196,180 GJ	14,107 t				
			Mass	CO_2e				
	Solid Waste		8,712 t	4,095 t				

Figure 3 The summary sheets Hyla developed for BC communities are an important part of a good report.

The use of CO2e per unit of energy is very useful for long-term program evaluation. An additional parameter to further strengthen this summary is financial expenditures on energy.

Figure 6: Boulder County GHG Emissions Profile by Sector, 1990-2012

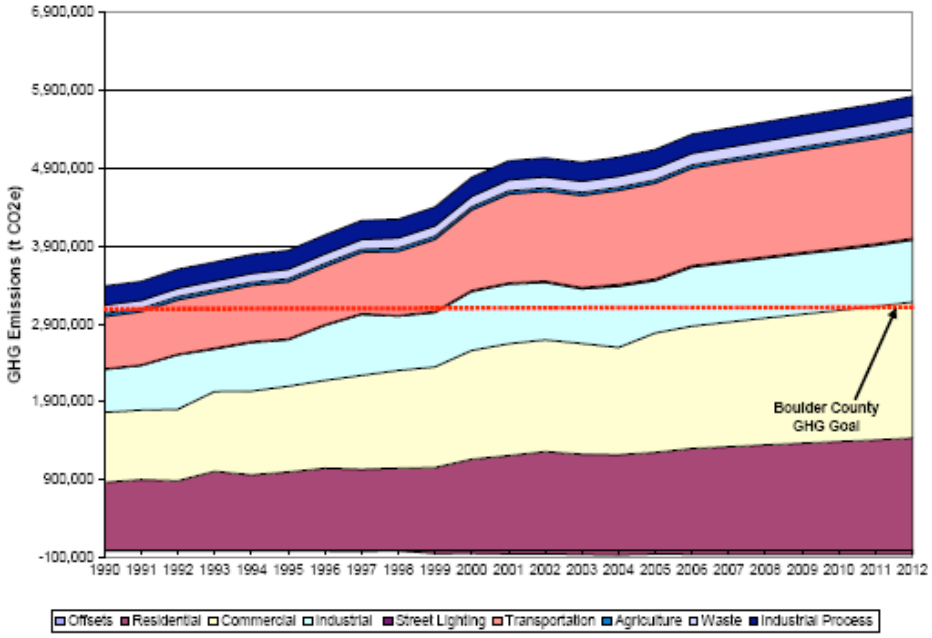


Figure 4 Projection graph with wedges and GHG target (Boulder county inventory, p 17).

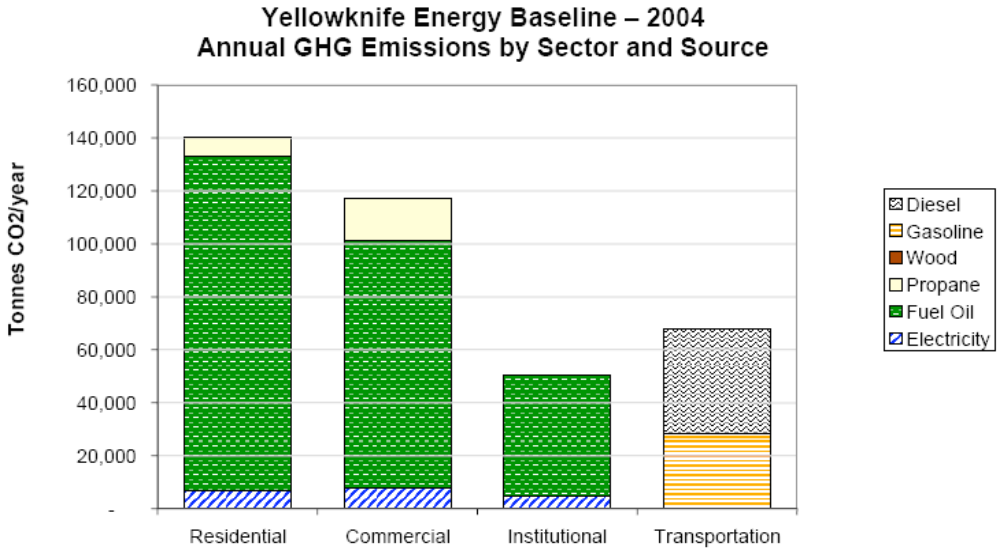


Figure 5 Bar graph, clearly showing emissions by sector and source (City of Yellowknife inventory, p 37).

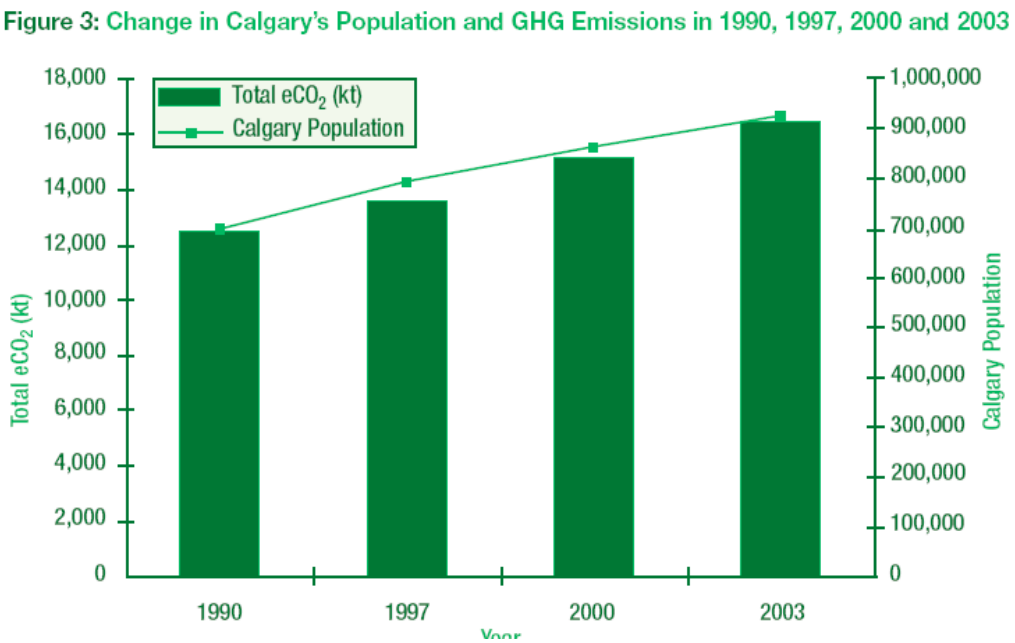
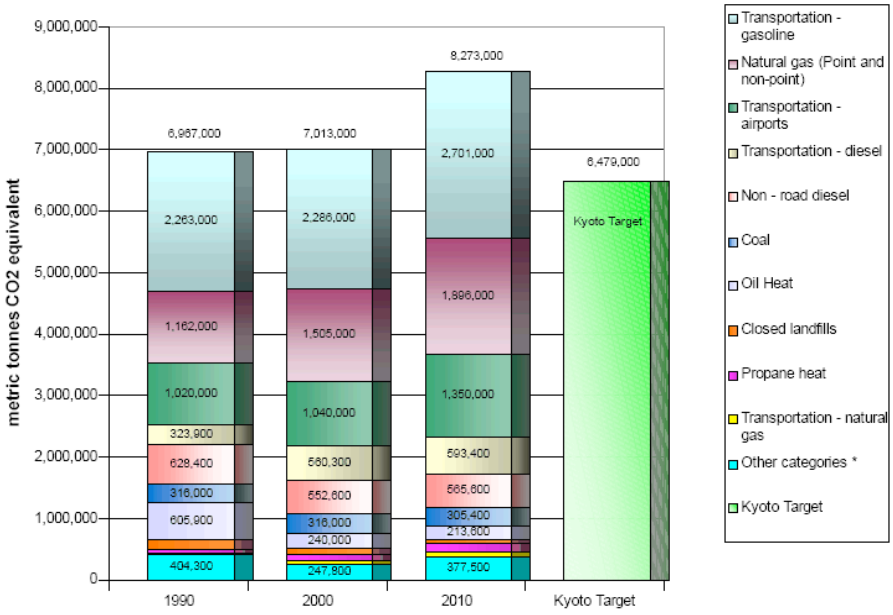


Figure 6 Bar/line graph comparing population growth to emissions growth (City of Calgary inventory p 8).



Graph 3: ***GHG Emissions by Source for Seattle*** (All emissions within City limits and a proportionate percentage of the SeaTac and King County airports. Data primarily courtesy of the Puget Sound Clean Air Agency.)

Figure 7 Graph showing GHG emissions by source with projections and Kyoto target (City of Seattle inventory, p 16).

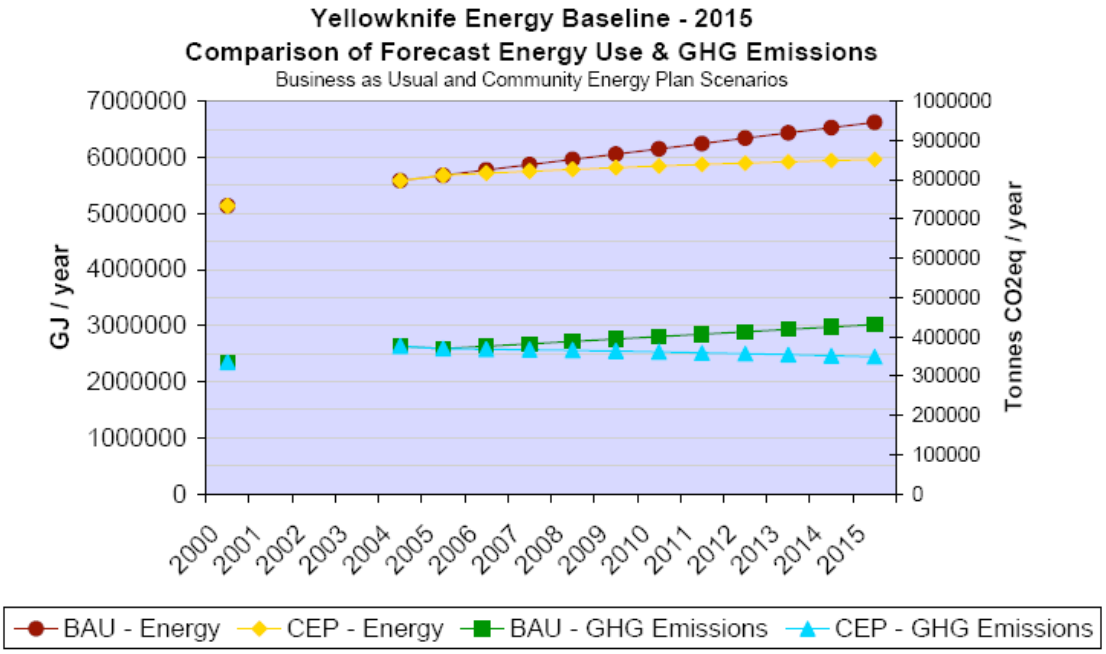


Figure 8 Graph showing BAU vs. CEP energy use and emissions (City of Yellowknife inventory p 42).

T: 604 688 9769
www.hollandbarrs.com