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Community Energy Planning: State of Practice in Canada

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Abstract

The purpose of this major paper is to broadly examine the state of practice of community energy planning (CEP) in Canada by exploring its definition, reasons for implementation, and differences between its theory and practice. Its principle objective is to bridge gaps in an area of study in which secondary literature has been sparse and limited in scope, providing insight on successful approaches to climate change mitigation through community energy planning. A comparative analysis is performed through a secondary literature review, multiple document analysis, and four case studies that employ the use of interviews.

The paper begins by studying the original conceptualization of CEP as well as how it has been characterized in practice, synthesizing select elements to produce a contemporary definition. CEP is thus defined as a local level planning process that aims to achieve sustainability goals through the management of energy production and consumption and anthropogenic greenhouse gas (GHG) emissions within a community's geo-political border. I argue CEP based on creating a community energy plan is the approach that has the potential of producing best results and I identify specific components that a community energy plan should include.

Using the four case studies, the paper identifies the specific community motivations and broad legislative and policy drivers for CEP in British Columbia (BC) and Ontario (ON). A number of environmental, economic, and/or social motivations are identified in the case studies. Of note is that despite differences in legislative and policy drivers, similar motivations exist between all the case study communities in both BC and ON.

Finally, differences between CEP theory and practice are explored by comparing the community energy plans of the four case studies to the guidelines of the CEP approach they chose to implement and the contemporary definition of CEP developed in this paper. In both cases CEP in practice deviates from theory. The successes and problems the case study communities have had in the implementation of their community energy plans are also studied. Reasons for success include community partnerships and local government employees with knowledge and skills applicable to CEP. A lack of support from higher levels of government, funding, resources, and provincial legislation and policy related to CEP are identified as barriers to implementation.

The results of the study suggest that a better understanding of CEP is needed in Canada. Once this has been established, a top-down provincial framework that encourages CEP should be pursued in order to increase adoption of community energy plans in communities across Canada. These changes may be facilitated by educational opportunities that enable learning about CEP as well as support from provincial and territorial governments in the form of legislation, policy, and programs. Community partnerships and strategic hiring decisions at the local level may also help achieve successful implementation of CEP.

Foreword

This Major Paper satisfies learning objectives under all three Components of my Area of Concentration – "Sustainable Energy Planning at the Local Level". This area of study involves learning about: policy tools aimed at reducing greenhouse gas (GHG) emissions in Canadian communities; urban planning and design methods that allow for spatially energy-efficient communities; and, energy management strategies that incorporate the use of sustainable energy sources as well as efficiency and conservation measures in community design and built forms.

In my first Component, "Climate Change Policy at the Local Level," I express a desire to develop a deep understanding of the roles of government and the influences of societal forces in environmental policy formulation and implementation, in order to understand where the key ideas, institutions and interests that inform climate change policy arise from. Studying the reasons for which local governments in Canada have engaged in their CEP exercises has helped satisfy this learning objective because I have gained an understanding of how legislative and policy drivers for climate change and community-specific motivations for sustainability have in part influenced the deliberation and decision making processes of communities. An examination of the various approaches to CEP in Canada has also enabled me to develop a deep understanding of community energy plans as policy tools to mitigate climate change, helping satisfy the learning objective of attaining a complete understanding of the different types of climate change policy tools available to governments in implementing methods of reducing GHG emissions at the local level.

In my second Component, "Urban Planning," I state that I want to develop a broad knowledge of planning theories, concepts, and tools to understand the different strategies available to Canadian local governments in developing more sustainable communities. The research I have conducted for this paper has supported achieving this goal because CEP and its related theories, concepts, and tools can be understood as planning methods that local governments employ to attain sustainability within their communities.

My last Component, "Sustainable Energy Management," outlines learning objectives to gain a broad knowledge of sustainable energy supply technologies and a deep understanding of energy efficiency and conservation measures that can be used in Canadian municipalities to decrease GHG emissions. An examination of the different approaches to CEP being promoted for practice in Canada and case studies of a few specific community energy plans has given me a general knowledge of sustainable energy supply technologies and a deep understanding of energy efficiency and conservation measures that can be implemented to reduce GHG emissions at the local level.

Acknowledgements

I would like to thank my advisor Laura Taylor for guiding me through the Master of Environmental Studies program as well as my supervisor Mark Winfield for helping me narrow down my research interest, or perhaps broadening it, in regards to community energy planning. I would also like to acknowledge my family, friends, and peers in British Columbia and Ontario, as well as Alexander Heath in particular, for supporting me throughout the research and writing process of this paper.

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Glossary

AEA	Arctic Energy Alliance
BC	British Columbia
CEA	Community Energy Association
CEEI	Community Energy & Emissions Inventory
CEEP	Community energy and emissions plan
CEP	Community energy planning
CEM	Community energy management
CH_4	Methane
CHMC	Canadian Housing and Mortgage Corporation
CO_2	Carbon dioxide
CoEM	Council of Energy Ministers
CUI	Canadian Urban Institute
eCO_2	Carbon dioxide equivalent
FCM	Federation of Canadian Municipalities
GHG	Greenhouse gas emissions
ICES	Integrated community energy solutions
IEMOC	Integrated Energy Mapping for Ontario Communities
ICLEI	Local Governments for Sustainability
LAP	Local Action Plan
MoCD	Ministry of Community Development
MoE	Ministry of Environment
N_2O	Nitrous oxide
NRCan	Natural Resources Canada
NWT	Northwest Territories
PCP	Partners for Climate Protection
PoBC	Province of British Columbia
QUEST	Quality Urban Energy Systems of Tomorrow
UBCM	Union of British Columbia Municipalities
VKT	Vehicle kilometres travelled

1. Introduction

Jaccard, Failing and Berry (1997) were the first scholars to develop a formal method for "community energy planning" (CEP) that integrates policy, urban planning, and energy management components into a single model – Community Energy Management (CEM). The CEM model is based on the idea that human settlements are important determinants of energy and materials throughput for a given economic system (Jaccard et al., 1997). It combines planning concepts such as neo-traditional design[1], complete communities[2], and green cities[3] with energy management concepts like energy cascading[4], industrial ecology[5], demand-side management[6], and integrated resource planning[7] (Jaccard et al., 1997). As such, the authors define CEP as a means of utilizing the synergies between urban design and energy management to create liveable communities with minimal energy use and environmental effects for a given standard of living at the local level—neighbourhoods, cities and small regions (Jaccard et al., 1997).

[1] Neo-Traditional Neighbourhood Design (also called New Urbanism) advocates mixed uses, tenures, and building types, a high standard of urban design for public places, and an interconnected web of street networks that accommodates cars, but is primarily designed to meet the needs of pedestrians, transit, and cyclists (Hodge and Gordon, 2008).
[2] Complete communities are those that are designed to support facilities to live, play, learn, shop and work (Sustainability Resources Ltd, n.d.).
[3] Green cities enable an environmentally sound manner of living by promoting sustainable methods of transportation, urban agriculture, composing and recycling, watershed protection, regional open space protection and resilience in the face of large-scale risks (Cohen, 2011).
[4] Energy cascading is, "the use of multiple energy products (e.g. thermal products such as steam or hot water) derived from the generation of power…" (Cohen-Rosenthal, and Musnikow, 2003, p.128).
[5] Industrial ecology looks to non-human natural ecosystems as models for industrial activity as well as puts industry in the context of the larger ecosystem that supports it in examining the sources or resources used in society and the sinks that may act to absorb or detoxify wastes (Ayres and Ayres, 2002).
[6] Demand side management is the planning, implementation and monitoring of activities (load management, strategic conservation, customer generation, etc.) designed to influence customer use of electricity in ways that will produce desired changes in the time pattern and magnitude of a utility's load (Kreith and Goswami, 2007).
[7] Integrated resource planning (or integrated water planning) is a "…planning and management strategy for long-range water resources issues that considers all water uses and water-related activities, within whatever political, administrative, economic, or functional boundaries they are defined" (Roseland, 2005).

Jaccard et al.'s (1997) paper not only introduces the CEM model, but also applies it in four communities in British Columbia (BC) with the intent of demonstrating why and how policy-makers might implement CEP. The results of their study suggest that CEP can be an important element in greenhouse gas (GHG) emission reduction strategies and that it requires a number of different policy initiatives from governments for its successful application (Jaccard et al., 1997).

Since Jaccard et al. (1997) formally conceptualized the CEM model, a number of non-profit organizations, think tanks, utilities and/or governments in Canada have played important roles in framing the discussion on, and practice of, CEP. Pertinent work on CEP by these entities includes:

- The Canadian Mortgage and Housing Corporation's (CMHC's) (1999) research paper exploring the potential of CEM to facilitate reduction of GHG emissions in Canada;
- Natural Resources Canada's (NRCan's) (2007) CEP guide promoting their Factor-2 principal of reducing the demand of non-renewable resources by up to 50 percent;
- The Federation of Canadian Municipalities' (FCM's) and Local Governments for Sustainability's (ICLEI's) Partners for Climate Protection (PCP) program;
- The Community Energy Association's (CEA's) (2006) three volume toolkit providing an introduction to the main concepts and tools for CEP in BC;
- The Artic Energy Alliance's (AEA's) (2006) toolkit targeted specifically at CEP in Northwest Territory communities;
- The CEA's and the Province of British Columbia's (PoBC's) (2008) collaborative guide prompted by provincial legislation adopted in 2007 that requires reducing the province's GHG emissions;
- BC Hydro's Sustainable Communities Program;
- Quality Urban Energy Systems of Tomorrow's (QUEST's) (2010) analysis of policies that encourage an approach to CEP called Integrated Community Energy Solutions (ICES); and
- The Canadian Urban Institute's (CUI's) integrated energy mapping approach to CEP that incorporates the use of Geographic Information Systems to produce an energy density map.

Although much of the contemporary work on CEP in Canada is situated outside of academia, a segment of its discourse still rests in secondary literature with a number of studies of an evaluative nature having emerged in the past decade. St. Denis and Parker (2009), for example, examine ten local action plans in Canada, which were created under the PCP program, to determine what strategies they encompass and to assess the role that renewable energy plays compared to energy efficiency and conservation measures. Other studies evaluating community energy plans have generally focused on areas outside of Canada. A few of these papers include: Nilsson and Martensson's (2003) study of twelve southern Swedish municipalities and how they promote oil reduction, efficient energy use, and renewables in their energy plans; Wheeler's (2008) analysis of the goals, measures, issues surrounding implementation and basic strengths and weaknesses of the first generation of climate change plans created in the United States under ICLEI's Cities for Climate Protection campaign; and Bassat and Shandas' (2010) examination of the process, products, and extent of innovation in planning of twenty American municipal climate action plans.

Given that studies on Canadian CEP appear to be sparse and limited in scope, and that there is a general lack of secondary literature on CEP in practice as a whole, the principle objective of this paper is to bridge these gaps in research by broadly examining the current state of practice of CEP in Canada. Specifically, this paper aims to answer, in a Canadian context, the following three main research questions: what is CEP; for what reasons have local governments engaged in CEP; and is CEP in practice consistent with its theory? Understanding the current state of practice of CEP in Canada is important and

worth researching because as Jaccard et al.'s (1997) research indicates, CEP can be an important tool for GHG emissions reduction and a broad understanding of what is occurring in Canada may provide insight to successful approaches for climate change mitigation. Moreover, because there are many different organizations promoting their own approaches to CEP in practice, and because Jaccard et al.'s (1997) research also suggests that CEP requires the implementation of a number of different policies, a broad understanding of what is occurring in Canada is also necessary to determine its current and potential role in the future.

2. Methodology

A comparative approach was used to understand the current state of practice of community energy planning (CEP) in Canada through the use of a secondary literature review, multiple document analysis, and four case studies that employed the use of interviews. Although comparative policy research has been limited in the past in incorporating Canadian case studies and has mostly focused on the comparison of national states (Bennett, 1996), information gathered from these sources was used for comparative analysis of CEP at the provincial and local level in Canada. Analysis of different cases of policy making within Canada allows for the depiction of potentially distinctive policy styles as well as features of Canadian institutions and society and how they interact to create public policy (Bennett, 1996). As Bennett (1996) explains, "in asking 'why here, not there' and 'why like that here and like that there' questions, we may gain theoretical insights about the wider capabilities and features of different political systems" (p.300).

Heidenheimer et al. (1990) also explain comparative public policy analysis as "the study of how, why and to what effect different governments pursue particular courses of action or inaction" (p.3). Bennett (1996) outlines that it entails the use of descriptive, explanatory and evaluative questions that potentially allow for three benefits: a more complete and balanced description of the performance of different political systems without culture-bound generalizations; an understanding of the dynamics of different political systems through the assumption that comparing policy output in different jurisdictions allows for insight on an array of social, economic, cultural, and institutional

variables that account for any variation; and it may help contribute to the solution of major policy problems. In effect, the purpose of comparative policy is, “to extend the process of policy search, policy formulation, and evaluation across jurisdictional frontiers of a single policy, and thus to enrich the problem-solving capabilities of any society” (Anderson, 1971, p.122).

Accordingly, the first stage of research in this study involved conducting a secondary literature review of CEP theory as well as a document analysis of the different approaches to CEP being promoted in Canada by non-profit organizations, think tanks, utilities and/or specific government agencies. The secondary literature review was used to understand the original conceptualization of CEP, while the document analysis was used to ascertain how CEP had been characterized in Canada since its original theory was developed. It is important to note that one interview was also conducted at this stage of research because little documentation was available about a particular approach to CEP. The purpose of this analysis was to synthesize a contemporary definition of CEP based on both its theory and its more recent depiction from approaches practiced in Canada. A comparison of the different approaches in practice to this definition was also used to help inform which specific approach to CEP had the potential of producing best results.

In the next stage of research, an inventory was created of all the local governments in Canada that had participated in CEP. Due to time restrictions however, only information that was readily available online was used to compile this list. The purpose of this analysis was not only to simply ascertain how many local governments had participated

in CEP in Canada, but also to help facilitate the selection of four municipal case studies. The four case studies were chosen in order to have a sample of lower-tier municipalities with small, medium and large urban population centres[8] as well as a rural community in the provinces of BC and Ontario (ON). Only municipalities that had completed their community energy plan or study were considered for inclusion. Another consideration taken into account in choosing the case studies was the Community Energy Association's[9] view of community energy plans in Canada that were particularly well done. The purpose of choosing case studies with these characteristics and considerations was to have a sample of communities with different populations in the provinces where most of the CEP activity occurs in Canada and to study communities that have the potential to demonstrate best practices in CEP.

The third stage of research involved conducting interviews with the key municipal officials in charge of administering the community energy plans in each of the four case studies as well as a document analysis of each municipality's community energy plan. The interviews were used to understand: the reasons for which the municipality initiated its CEP exercise; if there was any legislation or policies at the federal or provincial level that encouraged their decisions; and how many of the strategies listed in their community energy plans had been implemented. Moreover, the document analysis was used to

[8] Statistics Canada defines a population centre as an area with a population of at least 1,000 and a density of 400 or more people per square kilometre i.e. all areas outside a population centre are defined as rural (Statistics Canada, n.d.). Small, medium, and large population centres have populations of 1,000 to 29,999, 30,000 to 99,999, and100,000 and over, respectively (Statistics Canada, n.d.).

[9] The Community Energy Association is a non-profit organization with considerable knowledge and understanding about CEP. Not only do they have their own guide to practicing CEP, but they also support, "…local governments throughout British Columbia in accelerating the application of energy efficiency and renewable energy in all aspects of community design, infrastructure and community engagement for sustainability" (Community Energy Association, n.d.).

compare the municipalities' community energy plans with the guidelines that they were purportedly based on as well as the synthesized definition of CEP adopted in this paper. The purpose of this stage of the research was to understand the motivations and drivers for CEP as well as the differences, if any, between CEP theory and practice.

In general, interviews in this study were used as a knowledge-producing activity. As Kavale and Brinkmann (2009) explain, "the research interview is based on the conversations of daily life and is a professional conversation; it is an inter-view, where knowledge is constructed in the inter-action between the interviewer and the interviewee" (p.2). A structured interview, that involved the use of a formalized set of questions, was conducted in the first stage of research to help fill a specific research gap about a particular approach to CEP, whereas semi-structured (life world) interviews were conducted in the last stage of research involving the case studies. A semi-structured interview was used in the latter stage of research because it is, "a planned and flexible interview with the purpose of obtaining descriptions of the life world of the interviewee with respect to interpreting the meaning of the described phenomena" (Kavale and Brinkmann, 2009, p.327). This type of interview is beneficial in identifying new ways of seeing and understanding the topic at hand (Cohen and Crabtree, 2006). Further, although semi-structured interviews come close to an everyday conversation, they are purposeful interviews that involve a specific approach and technique including the use of an interview guide that focuses on certain themes (Kavale and Brinkmann, 2009, p.27). As such, suggested questions were provided to the case study interviewees prior to the interview, but other questions were also posed in response to what the interviewee said.

In terms of research limitations, this paper would benefit from expanding the sample size of its case studies in order to be able to draw more precise conclusions about the current state of practice of CEP in Canada. Since not all the community energy plans and studies that are currently in Canada were identified when the case studies were chosen, the study would also benefit from making a more complete list of communities engaged in CEP. Further, many of the conclusions about CEP theory compared to its practice solely relied on information written in the community energy plans of the four case studies and in some instances this information was often limited or lacking. The study would benefit from another set of interviews with the key municipal official in charge of administering the community energy plans in order to gather more information about the variables examined in the comparison of theory and practice section.

3. Community energy planning foundations

3.1 Community energy planning theory

Jaccard, Failing and Berry (1997) were the first scholars to develop a formal method for community energy planning (CEP) that integrates policy, urban planning, and energy management components into a model termed Community Energy Management (CEM). The motivation behind the creation of the CEM concept was threefold: an increasing recognition amongst energy analysts of the critical role urban infrastructure and urban land-use patterns play in determining energy consumption levels; a raising awareness of the environmental impacts associated with energy use in urban areas (e.g. smog and climate change); and a growing recognition of the improving cost-effectiveness of technologies for small-scale, decentralized cogeneration of heat and electricity as well as more environmentally benign energy technologies in urban settings (Jaccard et al., 1997).

CEM thus helps direct choices about urban design and infrastructure at the scale of the local community (Jaccard et al, 1997). More specifically, it encompasses energy strategies in the realm of land-use planning, transportation management, site design, and local energy supply and delivery planning (Jaccard et al, 1997). Some examples of the desired goals and potential strategies in these sectors are outlined in Figure 1.

Jaccard et al. (1997) also explain the relevance of urban land-use patterns and urban infrastructure to energy policy in a hierarchy of energy related choices depicted in Figure 2. Land-use and infrastructure is the top level because urban form influences density and land-use patterns which affect, “the level of energy service requirements (e.g. commuter

distances), the design of intra-urban transportation systems, the character of energy transmission systems, the potential for waste heat utilization, and even the possibilities for alternative energy supply systems" (Jaccard et al., 1997, p.1066). Building design, major industrial processes, and transportation mode options are at the next level because choices at this level determine the opportunities and constraints for specific energy using equipment that correspondingly are at the bottom of the hierarchy (Jaccard et al, 1997).

Further, when the authors applied the CEM model to the four case studies in their paper, the results suggested that at a minimum, local governments will need to: establish regional standards for new development and development cost charges to encourage preferred densities, use mixes, energy efficient construction, etc.; develop special zoning standards in consideration of energy objectives; introduce energy objectives into developer negotiations (for re-zoning, building permits, etc.) as well as informing developers about relevant new energy technologies and emerging opportunities for the private sector in independent power production; and involve energy utilities in developer negotiations and official community planning processes (Jaccard et al., 1997).

Sector	Goal	Sample Strategies
Land Use Planning	• Access-by-proximity • Support waste heat utilization	• Target strategic locations for high density, mixed use, transit oriented development • Offer financial incentives to developers for preferred densities, mixes and amenities • Increase proportion of multi-family housing • Establish a strict urban boundary • Locate heat sources near heat sinks • Establish district heating zones with special standards for density, diversity, growth etc.
Transportation Management	• Shift the mode of travel • Shift to alternative fuels	• Improved transit, high-occupancy vehicle, pedestrian and cycling facilities and services • Parking pricing strategies • Employer trip reduction programs • Fleet fuel switching
Site Design	• Increase efficiency • Increase use of micro-climate	• Reduced lot size and setbacks from street • Use of vegetation for shading or wind-shielding • Building standards/performance certification • Financing and technical assistance for efficiency improvements
Energy Supply	• Exploit local resources • Increase use of "clean" resources	• Distributed generation • District heating and cooling • Heat pumps, solar technologies • Recovery of waste heat • Financing and technical assistance for homeowners, businesses and developers to invest in alternative technologies

Figure 1 Sectors, goals and sample CEM strategies (Jaccard et al., 1997).

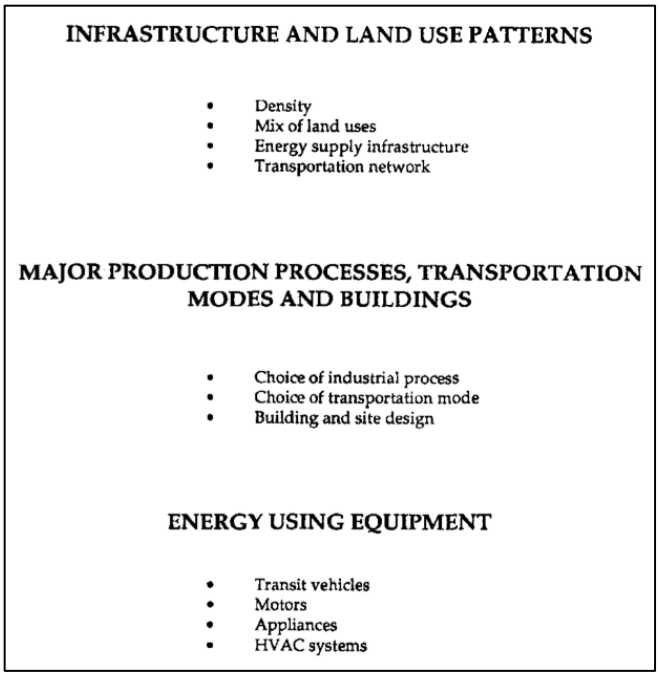

Figure 2 Hierarchy of energy-related choices (Jaccard et al., 1997).

3.2 Approaches to community energy planning

One of the first efforts in bringing the theories in Jaccard et al.'s (1997) paper into practice was the Canadian Housing and Mortgage Corporation's (CMHC's) research report about CEM for the Energy Planning Subcommittee of the National Climate Change Secretariat's Municipalities Table, as part of their *Healthy Housing and Communities Series* in 1999. The report explains that municipalities are not just locations that affect GHG emissions and sinks, but are also integrated systems that can be designed and planned to reduce energy requirements. CEM is introduced therefore as a method of achieving this goal and is defined as, "the integration of energy considerations into municipal planning and management processes in a way that can yield multiple benefits that exceed the impacts of individual and disjointed initiatives" (CMHC, 1999, p.1), or more simply, "…the integration of energy considerations into all aspects of local government strategies for sustainable development" (CMHC, 1999, p.20).

Although these definitions of CEM and the strategies they lead to are similar to the CEM model in Jaccard et al.'s (1997) paper, one of the highlights of the report is the list of broader community goals it describes CEM as having the potential to achieve. These benefits include: improving air quality and reducing GHGs through the use of fewer automobiles and more efficient built environments; creating more affordable housing and lower energy bills through more compact developments; creating better mobility i.e. less traffic congestion through easy and safe access to transit and mixing land-uses; reducing the cost of providing public services (compact developments save construction, operating and maintenance dollars); creating open space and agricultural land preservation

(compact communities reduce sprawl); increasing personal and business income with energy savings; and retaining and creating jobs through local reinvestment of the money from energy savings.

Since the release of Jaccard et al.'s (1997) paper, and the CMHC's (1999) related report, a number of other non-profit organizations, think tanks, utilities and/or specific government agencies in Canada have developed specific guidelines and programs for implementing CEP. These guidelines can be organized into three main streams of, or approaches to, CEP in practice: *community energy plans*, *integrated community energy solutions*, and *integrated energy mapping*.

3.2.1 Community energy plans

Within the stream of CEP that is based on creating a community energy plan, a number of different guides, toolkits and programs have been created in Canada, each with its own set of recommendations on how to create a community energy plan. These different approaches to creating a community energy plan include:

- Natural Resources Canada's (NRCan's) (2007) *Community Energy Planning Guide*;
- The Federation of Canadian Municipalities' (FCM) and Local Governments for Sustainability's (ICLEI's) Partners for Climate Protection (PCP) Program;
- The Community Energy Association's (CEA's) (2006) *Toolkit for Community Energy Planning in British Columbia*;
- The Arctic Energy Alliance's (AEA's) (2006) *Community Energy Planning Toolkit*;
- The Community Energy Association's (CEA's) and the Province of British Columbia's (PoBC's) (2006) *Community Energy & Emissions Planning: A Guide for B.C. Local Governments*; and
- BC Hydro's Sustainable Communities Program.

3.2.1.1 Natural Resources Canada's (NRCan's) Community Energy Planning Guide

NRCan created a *Community Energy Planning Guide* in 2007 that provides a procedure for communities to create a community energy plan as well as a list of energy efficiency programs and activities they can use. The notion of a community energy plan in the guide centres on the unique concept of a "Factor-2" community: "…the application of design practices, policies and technologies that can reduce a community's demand on non-renewable resources by up to 50% over current practices" (NRCan, 2007, p.8). The Factor-2 principle is explained as essentially promoting good design as a means of managing a community's energy supply and demand. The motivations outlined for implementing this approach include achieving energy security, accommodating municipal growth, and providing a high standard of living as well as a "thriving eco-structure."

Another element unique to this approach is how the CEP process is initiated. The process can start as a municipal or regional directive much like other CEP approaches or be initiated by community members. If the plan is a municipal directive, municipal staff is likely to be responsible for the process with council periodically reviewing progress. If the community initiates the plan, it is suggested that the community's Planning Advisory Committee, if present, be mandated to manage the process, otherwise volunteers would have to lead. In either case, public engagement is required and the following groups are suggested for consideration in the process: local business and industry; utility companies; educational institutions; community and non-governmental organizations; local media; interested residents and local professionals.

The creation of a community energy plan is emphasized through the following five steps that are meant to be followed in order: develop the final vision; acquire data on baseline conditions; set goals and targets; identify actions; and implement and monitor. More detail about these steps is provided in appendix A. The guide acknowledges that this comprehensive CEP process may be unnecessary however for small and/or rural communities and thus introduces the concept of a "CEP-LITE," which is a community energy plan created through a shorter process. In particular, a two-day planning charrette is suggested, relying on local knowledge that can be combined with specific utility and municipal data. These specific data requirements are not outlined in the guide for the CEP-LITE process nor its required steps.

3.2.1.2 Federation of Canadian Municipalities' (FCM) and Local Governments for Sustainability's (ICLEI's) Partners for Climate Protection (PCP) Program

The PCP program is the Canadian component of ICLEI's international Cities for Climate Protection Campaign and has been managed in partnership by both FCM and ICLEI in Canada since 1998 as, "…a network of Canadian municipal governments that have committed to reducing greenhouse gases and acting on climate change" (FCM, n.d.a). The PCP program was created principally to reduce GHG emissions for the purpose of climate change mitigation. This is outlined in a resolution that each municipality joining the PCP program must first sign. The resolution lists statements including: some of the most significant climate change related findings from the International Panel on Climate Change; the primary causes of climate change; and the need for joint authority and global action on climate change (FCM, n.d.b). Moreover, the resolution outlines other motivations through the following statement, "…municipal investments in building

retrofits, community energy systems, water conservation, renewable energy technologies, waste reduction, landfill gas capture, fleet management, public transit and other sustainable measures reduce operating costs, help maintain community services, protect public health and contribute to sustainable community development while cutting GHG emissions contributing to climate change" (FCM, n.d.b).

The PCP program is therefore based on a five-milestone framework that involves: completing a baseline GHG emissions inventory based on community energy use and solid waste generation as well as developing a forecast of GHG emissions for the business-as-usual scenario 10 years into the future; setting a GHG emissions reduction target of six percent below baseline year GHG emissions for the community within 10 years; creating a strategic document called a Local Action Plan (LAP) that outlines how the GHG emissions reduction target will be achieved; implementing the community energy plan; and monitoring its progress and reporting its results. Much like NRCan's guidelines for developing a community energy plan, the creation of the LAP requires considerable public engagement. The PCP program recommends gathering input through meetings and/or public consultation from residents, non-governmental organization and the private sector. More detail about each of the five milestones is provided in appendix A.

The five milestones of the PCP program do not need to be completed in order. There is flexibility in implementing the requirements in the order that is most appropriate for the community. Nevertheless, when each municipality completes a milestone, and its

municipal council endorses the work, the FCM must be contacted to undertake a technical review of the work to ensure consistency with the program protocols before completion of the milestone is officially recognized. It is important to note that the program has a separate five-milestone process for internal municipal operations. This paper will only focus on the community component of the program.

3.2.1.3 Community Energy Association's (CEA's) Toolkit for Community Energy Planning in British Columbia

The CEA first developed a *Toolkit for Community Energy Planning in British Columbia* in 1997 and its last revised version was released in 2006. The toolkit encompasses three comprehensive volumes that: outline the potential impacts of energy use and benefits of CEP; provide a list of strategies for CEP and municipal infrastructure and facilities planning as well as a guide to energy supply technologies; and showcase a number of case studies in British Columbia (BC). The overall aim of the toolkit is to introduce important concepts and tools in order to help communities use energy planning as a means of meeting broader liveability, climate protection, and sustainability goals. Some of the specific challenges the toolkit seeks to alleviate through CEP include: pressures to accommodate new growth; rising costs and stagnant local economies; demand for public infrastructure and services with a limited ability for communities to pay; GHG emissions and reduction targets; and a growing public dissatisfaction with community liveability. The toolkit highlights emerging opportunities to address these problems such as: new cost-competitive small-scale energy supply technologies allowing energy production at the local level; a changing regulatory environment allowing independent power producers; and a rising awareness of the hidden costs of energy.

The CEA defines CEP as involving, "…community and energy strategies that can be applied at the local level by planners, engineers, developers, and the public in cooperation with utilities. It involves land-use planning and transportation planning, site planning and building design, infrastructure design and efficiency, and planning for new energy supply options. It can be applied either comprehensively or incrementally, and it can be adapted to suit any community, small or large" (CEA, 2006, p.4). Given the variety of forms CEP can take, the CEA generalizes the practice into three categories: a "single issue" energy plan; an "energy component" of a community planning process; or, a "comprehensive" energy plan. The scope and drivers for these three types of CEP approaches are explained in Figure 3. In any case, the toolkit recommends the following steps in the CEP process: build the energy team; clarify community goals; draw the energy profile; take the message to the community; identify energy opportunities; create planning options; evaluate and select a preferred plan; make an action plan; and monitor the results. More detail about these steps is provided in appendix A.

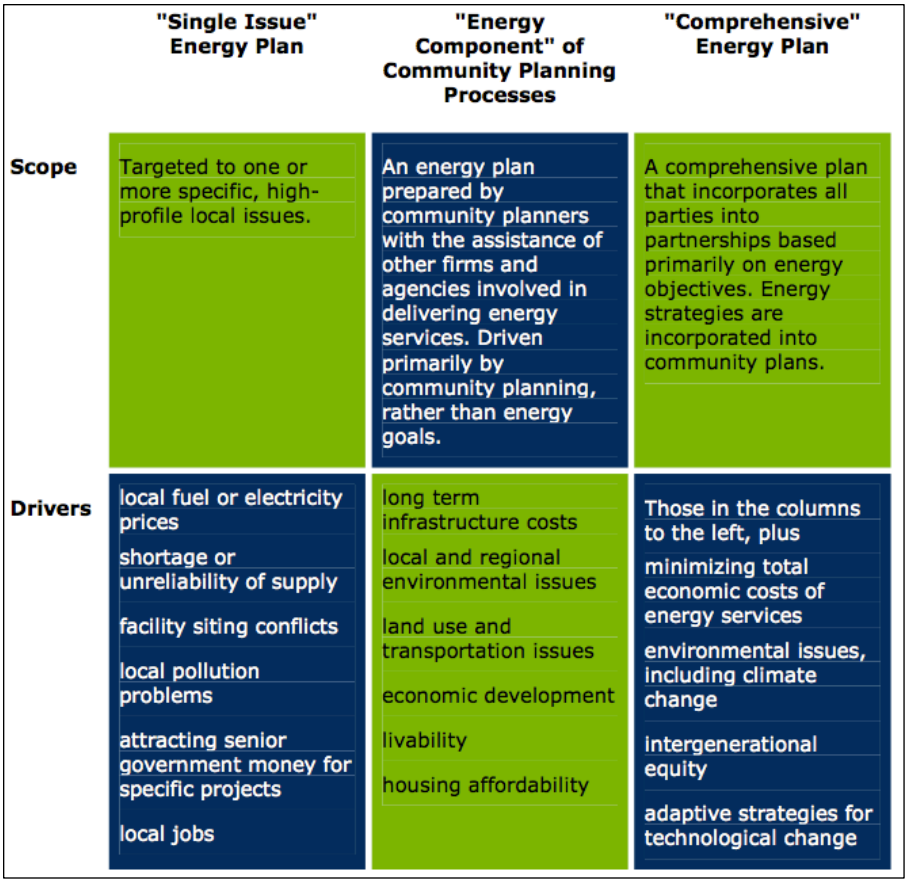

Figure 3 Approaches to CEP (CEA, 2006).

3.2.1.4 Arctic Energy Alliance's (AEA's) Community Energy Planning Toolkit

Similar to the CEA, which developed a toolkit for a specific region in Canada, the AEA developed a *Community Energy Planning Toolkit* in 2006 for communities in the Northwest Territories (NWT) with help from the NWT Literacy Council. The purpose of the toolkit is to provide all the necessary information a NWT community would need to successfully develop and implement a community energy plan. Like NRCan's guidelines for CEP, the AEA toolkit is not only developed for local governments, but also for community members interested in initiating the process themselves. The toolkit encourages people who live in the community to do as much of the work as possible on the community energy plan because when local people work on the energy planning

process, they develop and apply new skills that stay in the community. Nevertheless, the toolkit does acknowledge that consultants from outside the community may be needed to do some of the work and encourages developing partnerships with groups such as businesses, different levels of government, non-profit organizations involved with energy or sustainable living, and/or charitable foundations.

The motivations for initiating a community energy plan listed in the toolkit include an array of economic, environmental, and social benefits. A few specific examples are as follows: developing local jobs; maintaining local sources of energy; reducing negative environmental impacts from energy use (GHG emissions, noise, fuel spills, etc.); keeping money related to energy use in the community; getting the whole community involved in making decisions; and building community spirit and pride. Further, the toolkit notes that at the time it was being created, each NWT community government was required to create an Integrated Community Sustainability Plan[10], which included a community energy plan, as part of its Gas Tax funding agreement with the Department of Municipal and Community Affairs.

Community energy planning is defined in the toolkit as, "…a process that helps communities find the best ways to use energy more wisely" (AEA, 2006, p.9). As a result, a community energy plan is meant to demonstrate how a community will change its current energy consumption patterns to meet its vision of using energy more wisely in the future. Similar to the CEA, the AEA generalizes community energy plans into three

[10] An Integrated Community Sustainability Plan is a long-term plan that communities develop to identify and carry out sustainability objectives related to environmental, cultural, social, and economic issues (AEA, 2006).

categories: “comprehensive” energy plans that include all aspects of energy supply and demand in a community and incorporate detailed technical and economic analysis; “specific issue” energy plans that take into account only a few specific issues related to energy production and use in a community such as the economics of installing a turbine to produce electricity; and the “integrated approach” that incorporates energy issues into other community plans such as a Municipal Plan. In the comprehensive case, the toolkit outlines a six-step cycle for creating a community energy plan: launch the effort/get organised; create a community energy profile; evaluate energy opportunities; write a community energy plan; implement and monitor the plan; and revise the plan. More detail about these steps is provided in appendix A.

3.2.1.5 Community Energy Association’s (CEA’s) and the Province of British Columbia’s (PoBC’s) Community Energy & Emissions Planning: A Guide for B.C. Local Governments

Taking another look at BC, the CEA in collaboration with the PoBC developed, *Community Energy & Emissions Planning: A Guide for B.C. Local Governments*, in 2008. Much like the CEA’s toolkit (2006), the purpose of this guide is to support local governments in BC in the CEP process. In particular, the guide notes that the PoBC adopted legislation in 2008 requiring all local governments to identify GHG emissions reduction targets, policies, and actions in their official community plans and regional growth strategies, acknowledging that GHG emissions are the primary cause of climate change and that almost half of the GHG emissions the province has to reduce[11] are under the influence of local governments. As such, CEP, or “community energy and emissions

[11] The PoBC adopted the *Greenhouse Gas Reduction Targets Act* in 2007, which commits it to reducing its GHG emissions by at least 33 percent below 2007 levels by 2020 and by 80 percent below 2007 levels by 2050.

planning"[12] (which is the terminology the guide uses) can be understood as a method by which the PoBC promotes climate change mitigation. Other motivations listed in the guide for implementing CEP include benefits such as: economic development, energy independence and security, healthier communities, and future revenue streams.

The guide explains that there are five components in the process of developing a community energy plan: engagement; creating an inventory; setting a target; developing an action plan; implementation and monitoring. Much like the CEP processes already outlined, the guide suggests that the public be included early in the process. However, City councils, boards, and staff are stated to be the crux of the engagement process because the adoption of the community energy plan and its implementation are dependent on their buy-in.

In terms of creating a community inventory of energy use and GHG emissions, the guide acknowledges that the process can be time consuming, difficult, and may require a level of expertise that is not always found in local governments. It recommends therefore using the inventories that were created in 2008 for every local government in BC for the 2007 base year by the Community Energy & Emissions Inventory (CEEI) initiative that is administered by the Ministry of Environment (MoE). More detail about the five components required to create a community energy plan and the CEEI inventory are provided in appendix A.

[12] The rationale for using the term CEEP stems from the fact that most GHG emissions within a local government's jurisdiction result from energy consumption and the burning of fossil fuels (CEA and PoBC, 2008). The guide states therefore that addressing both GHG emissions and energy in one plan instead of two stand-alone strategies is preferable (CEA and PoBC, 2008).

3.2.1.6 BC Hydro's Sustainable Communities Program

Similar to the CEA's and PoBC's guidelines for CEP, BC Hydro has developed an approach for creating community energy plans or "community energy and emissions plans" (which is the terminology BC Hydro uses) under its Sustainable Communities Program. Unique to this approach are prescribed criteria communities must meet to participate in the program as well as prescribed steps they must take to create a community energy plan. In particular, BC Hydro's website explains that two different sub-programs exist – a free "QuickStart" initiative for small communities and a funding offer for large communities. More detail about these two programs and their prescribed steps are provided in appendix A.

The QuickStart initiative helps local governments with populations up to 20,000 in BC Hydro's service area create a community energy plan through a faster process than what is usually the case for a community going through a typical CEP exercise. The program's website states that it was created to alleviate the time and resource challenges faced by smaller local governments. As such, the program has an accelerated CEP process that consists of four steps: registration which requires committing to the program and providing BC Hydro with community documents; preparation by completing pre-workshop readings and attending a webinar; planning at a one-and-a-half day workshop to create the community energy plan; and implementation of the community energy plan. A BC Hydro brochure, *Community Energy and Emissions Planning for Smaller Communities* (n.d.b), identifies the potential benefits of participating in the QuickStart initiative for communities as: achieving energy conservation and GHG emissions

reduction targets set in official community plans and regional growth strategies; managing costs associated with carbon taxes and offsetting; reducing energy costs; creating jobs by stimulating the local economy through opportunities for community development; and demonstrating leadership.

The program for larger communities provides 50 percent funding up to $60,000 towards the creation of a community energy plan for local governments within the BC Hydro service area (unless otherwise agreed upon with BC Hydro): have a population greater than 20,000; have an annual growth rate greater than 1.5 percent; demonstrate a commitment towards energy and emissions reduction; have the potential for a District Energy System; and have plans to redevelop at least five million square feet of high density residential real estate within the next 10 years (BC Hydro, n.d.a, 2010). BC Hydro's Terms of Reference (2010) explains that a community energy plan developed through the program is meant to provide a local government with a comprehensive long-term framework to achieve energy and GHG emissions reductions. The overall objective of the community energy plan is to "…establish the Municipality/Regional District as a model community in the areas of energy supply reliability, sustainability, and climate change responsibility" (BC Hydro, 2010, p.1). Consequently, the content requirements outlined in the program's Terms of Reference for the community energy plan are extensive and must at minimum include the following sections: executive summary, background information; vision, goals, and targets; strategies; stakeholder engagement; recommendations, and implementation plan.

3.2.2 Integrated community energy solutions

Quality Urban Energy Systems of Tomorrow (QUEST) in collaboration with the Ontario Power Authority, Canadian Urban Institute (CUI), and Canadian Environmental Law Association created the *Integrated Community Energy Solutions: Municipal Policy Toolkit* in 2011. The toolkit introduces and promotes an approach to addressing energy issues in communities – Integrated Community Energy Solutions (ICES) – that is explained to have emerged due to concerns that existing CEP methods were becoming increasingly fragmented rather than integrated. The toolkit argues that by examining community sectors in a collective manner, rather than each independently, a community can be understood as a system, which then allows for potential cost savings as well as energy and GHG emissions reduction opportunities that cut across multiple sectors. This concept is reinforced by NRCan, which provides a definition of ICES in the toolkit as follows: "ICES is an approach that offers holistic solutions for reducing GHG emissions and addressing climate change by evaluating how energy is supplied and consumed across sectors. ICES capitalizes on cross-cutting opportunities and synergies available at the community level by integrating physical components from multiple sectors, including energy supply and distribution; transportation; housing and buildings; industry; water, waste management and other local community services; and land-use and community form" (QUEST, 2011, p.7).

The purpose of the toolkit is to aid decision-makers in adopting ICES by showcasing best practices through 17 case studies from communities across Canada and abroad. These are grouped with respect to six broad categories where ICES actions can be achieved – land-

use, transportation, buildings, infrastructure, waste, and water. The toolkit identifies six principles that guide the implementation of ICES, which can be used in a variety of combinations and can be scaled up or down given the needs and abilities of a community: improve efficiency, optimize “exergy” (i.e. avoid using high-quality energy in low-quality applications), manage heat, reduce waste, use renewable resources, and use grids (power, gas, and/or heat) strategically. As such, the overall focus of QUEST, as explained in the toolkit, is to have Canadian communities operate as an integrated energy system in order to reduce energy demand, while providing a wide variety of social, environmental and economic benefits. Some of the benefits listed include: increasing energy security; enhancing the quality of life of Canadians; lowering GHG emissions; reducing energy expenditures and associated energy costs; improving accessibility, energy resiliency, air and water quality, job creation, and energy performance; and becoming more competitive and attractive communities for investment.

The toolkit emphasises that local governments should facilitate the implementation of ICES because they have authority over a variety of policy tools and decisions that are required for its application. The main municipal tools outlined include: long-term integrated planning; official plans; zoning by-laws; transit policies; site plan control; height and density bonussing; development permit systems; local improvement charges; plans of subdivision; protection of settlement area boundaries; congestion charges; parking charges; community improvement plans; maximum/minimum building height and density standards; secondary suites; and municipal taxes. The toolkit includes a framework for choosing policy instruments, *Framework for Assessing, Selecting and*

Implementing Instruments for Government Action, developed by the Treasury Board of Canada Secretariat, to help decision makers choose the most appropriate instruments to implement ICES in their community. Further, to help with the complex policy making process, the toolkit also includes a policy development process adapted from the BC Ministry of Environment's *Stewardship Bylaws: A Guide for Local Government*.

Although local governments are stated to be central to the adoption of ICES, prior to the release of QUEST's (2011) toolkit, the Council of Energy Ministers (CoEM) developed a document about ICES in 2009 called, *Integrated Community Energy Solutions: A Roadmap for Action*, which is aimed at Canada's federal, provincial, and territorial governments. The purpose of the action plan is to advance ICES by: providing a broad strategy for its implementation; outlining the role higher levels of government can play in its application; and introducing a "Menu of Tools" that can be used in conjunction with existing energy efficiency activities. The motivations stated for implementing ICES in the action plan therefore include improving energy performance as well as helping achieve federal, provincial and territorial energy efficiency and climate change objectives. More details about the broad strategy for ICES implementation aimed at the federal, provincial, and territorial governments as well as the importance of engaging these levels of government in ICES implementation can be found in appendix A.

3.2.3 Integrated community energy mapping

Integrated community energy mapping, also referred to as integrated energy, land-use and transportation mapping, is a CEP approach developed by the Canadian Urban Institute, and highlighted by Gilmour and McNally (2010). It allows decision makers to

visualise the results of energy baselines and forecasts spatially with a map thus allowing them, "…to evaluate existing energy use in a community and plan to improve energy efficiency through the use of different land-use and built form patterns, better building standards, transportation options and the integration of local alternative and renewable energy sources" (Gillmour and McNally, 2010, p.4). Some of the motivations behind the implementation of this approach include achieving community goals related to energy, climate change, sustainability, and economic prosperity.

In terms of process, Gillmour and McNally state that the approach consists of eight steps divided into energy mapping baseline, assessment, and implementation stages. First, in the energy mapping baseline stage, a community vision with energy aspirations for the future is developed and all energy demand and supply sources in the community are identified. Collected baseline building and transportation energy data is then mapped as well as their resulting quantified GHG emissions. Next, in the energy mapping assessment stage, growth projections are used to create future business-as-usual building and transportation energy and GHG emissions forecasts and maps. Other "standard efficiency" and "ultrahigh efficiency" scenarios are also created taking into account different energy fuel, technology, conservation and/or policy options. The financial impacts of all the scenarios created are evaluated. Finally, in the energy mapping implementation stage, results are shared with community groups and stakeholders and a preferred scenario is implemented. The authors note that although engagement is specified in the last step, it is recommended that community engagement occur throughout the entire process through workshops about energy use in the community.

The CUI, in partnership with the Ontario Power Authority, NRCan, and the Ontario Centres of Excellence launched an Integrated Energy Mapping for Ontario Communities (IEMOC) initiative in 2009 in which they implemented a few steps of this approach in the Cities of Guelph, Hamilton, Barrie, and London (Gilmour et al., 2011). The project mapped out the effects of population and employment growth in the business-as- usual-case as well as evaluated how decisions about efficient land-use, transportation, buildings, and alternative energy technology measures could help meet energy and GHG emissions reduction goals (CUI, 2011). Subsequently, CUI released an *Integrated Energy Mapping For Ontario Communities: Lessons Learned Report* in 2011 that provides more detail on some of the steps in the approach. This information is summarized in Appendix A.

3.2.4 Summary of the different approaches to community energy planning

In general, *community energy plans*, *integrated community energy solutions*, and *integrated energy mapping* are similar in their motivations, engagement of actors, and areas of action. A variety of similar environmental, economic and social benefits are identified as motivations behind the creation and promotion of the different approaches to CEP. A list of these benefits is presented in the table 1. Reducing GHG emissions for climate change mitigation is the motivation cited in most of the approaches to CEP. This is then followed almost equally by motivations regarding: environmental protection; energy security, resilience and/or independence; economic development and/or growth; making or saving money for the municipality, land developers, local businesses and/or residents; and job creation.

Table 1 Community energy planning environmental, economic and social benefits.

Environmental	Economic	Social
• Climate change mitigation • Reduced GHG emissions • Improved air quality • Improved water quality • Reduced local pollution • Preserved greenspace • Preserved ecosystem services	• Energy security, resilience and/or independence • New revenue streams • Economic development and/or growth • Job creation • Stimulated local economy • Reduced energy expenditure • Reduced operating costs • Reduced infrastructure cost • Competitive communities that are attractive for investment	• Maintenance of community services • Accommodated new growth • Increased land values • Enhanced quality of life • Improved livability • More affordable housing • Better indoor conditions • Safer neighbourhoods • Public health protection and healthier communities • Improved accessibility • Community building

Most of the approaches to CEP identify the practice to be a local government initiated process, except for NRCan's (2007) guide and AEA's (2006) toolkit, which each recognize that community members can also start the development of a community energy plan. Nevertheless, all the approaches generally encourage the involvement of a variety of actors throughout the process. These actors include local, provincial and federal governments as well as community citizens, advocacy groups, businesses, industry, utilities, educational institutions, and media. The consensus among the approaches of the need for a broad engagement of actors is not surprising given the various potential areas of action identified to help achieve the motivations, visions, goals, and/or targets of CEP. A list of these areas of action is presented in Table 2. Land use planning, transportation planning, building planning and design, water infrastructure, as well as energy supply and distribution are the areas of actions cited by most of the approaches for GHG emissions reduction, energy conservation, energy efficiency, and/or renewable energy integration.

Table 2 Community energy planning areas of action.

Urban Planning	Infrastructure	Other
• Land use planning • Urban design • Building planning/design • Site planning • Transportation planning	• Water infrastructure • Waste (solid and liquid) infrastructure • Energy supply and distribution	• Education and information • Governance • Sustainable agriculture

In terms of differences, the three streams of CEP fundamentally differ in how they examine community sectors: *Community energy plans* largely follow a traditional (i.e. rational-comprehensive) approach to plan-making by examining different sectors largely in isolation in order to develop and implement sector-specific solutions; *integrated community energy solutions* seek to overcome the perceived "fragmentation" present in community energy plans through a focus on integrating different sectors in order to develop crosscutting solutions; and *integrated energy mapping* focuses on visually presenting spatial data on existing and future energy use in order to develop solutions in the building and transportation sectors. Some of the distinguishing or unique characteristics of the three streams of CEP are presented in table 3.

Table 3 Summary of the three streams of community energy planning.

Streams of CEP	Distinguishing or unique characteristic
Community energy plans	• Different approaches have been created in this stream of CEP. • Mainly examines sectors separately in order to develop and implement sector-specific solutions. • Requires going though a series of specified steps to create a community energy plan. • Some guidelines, toolkits, and programs are created for specific communities in Canada.
Integrated community energy solutions	• Examines sectors collectively in order to develop crosscutting solutions. • Six principles help guide its implementation. • City council, board and staff are the most important actors in the engagement process. • The use of policy tools is encouraged to achieve results. • Canada's federal, provincial, and territorial governments are outlined to play an important role in its implementation. • Can be applied to any community in Canada.
Integrated community energy mapping	• Examines sectors spatially using a map in order to develop solutions in the building and transportation sectors. • Different energy scenarios are modelled to help make decisions. • Calculates the financial impacts of potential actions. • Can be applied to any community in Canada, but the IEMOC study has only been implemented in ON.

The different approaches to CEP, based on creating a *community energy plan*, also differ as a result of the concepts and/or steps that each approach promotes. These approaches can be differentiated by their: recommendations for setting a reduction target; intent for application in specific communities in Canada; baseline inventory data requirements; forecast of future GHG emissions and/or energy use; methods of data analysis or interpretation; and other unique elements in or about their approach. A summary of these characteristics is presented in table 4.

NRCan's (2006) guide and FCM's and ICLEI's PCP program are the only two approaches that recommend specific guidelines for reduction targets. NRCan recommends a reduction of non-renewable resources by up to 50 percent over current

practices. The PCP program, which was specifically created for climate change mitigation, recommends a reduction of GHG emissions by six percent below the baseline year within 10 years. NRCan's (2006) guide and the PCP program are also the only two approaches that were created for application within any community across Canada. The other approaches were specifically created for use in BC or the Northwest Territories.

The AEA's (2006) toolkit, CEA's and PoBC's (2008) guide, and BC Hydro's funding offer for large communities provide more general guidelines for setting reduction visions and targets. The AEA recommends creating a vision statement that describes what the community wants for the future i.e. the end results as well as developing general targets for what it wants to aim for. The CEA's and PoBC's (2008) guide recommends taking a "visionary approach" that sets an aggressive target based on community objectives and goals and makes a statement about the importance of taking action on energy and climate change. BC Hydro's funding offer for large communities requires that local governments outline their aspirations and set energy and GHG emissions reduction targets for five, 10, and 15 years in the future.

The PCP program, the CEA's and the PoBC's (2008) guide, and BC Hydro's Sustainable Communities Program are the only approaches with specific data requirements for the baseline community inventory. The PCP program requires that a GHG emissions baseline inventory be created for the community from data collected on: electricity, natural gas, district energy, fuel oil, diesel, and propane use in the residential, commercial and industrial sectors; gasoline, diesel, propane, compressed natural gas, and ethanol blend

use in the transportation sector; and tonnes of solid waste directed to landfills from all community sectors. Communities have the option of including or excluding large, energy-intensive operations in the industrial building sector (e.g. pulp and paper mills, cement manufacturers, steel mills, etc.) from the inventory. This may occur, for example, when utilities cannot disclose detailed consumption datasets due to confidentiality issues. Communities also have the option of including or excluding off-road vehicles in the inventory, but no explanation is given as to the reason for this option.

The CEA's and the PoBC's (2008) guide and BC Hydro's Sustainable Communities Program recommend and require respectively the use of the CEEI inventory. The CEEI inventory creates a baseline community inventory of energy use and GHG emissions produced from data collected on: electricity and natural gas use in the residential and commercial/small-medium industrial sectors; residential heating oil, propane, and wood use where their use is deemed significant; on-road transportation fuel consumption of several specific passenger and commercial vehicle classes; and the amount of solid waste produced annually within the jurisdiction of the local government. Information about land-use change from deforestation and enteric fermentation from agricultural livestock are listed under "memo items" in the regional district reports. Large industrial facilities are also separated out from the inventory and instead the number of connections is listed as a memo item for both municipalities and regional districts. The large industrial sector is not included in the inventory because consumption data cannot be obtained from energy utilities when the energy consumed by a customer exceeds the utility's thresholds

for confidentiality or when a single customer exceeds 50 percent of the local government's total consumption.

The PCP program, AEA's (2006) toolkit, and BC Hydro's funding offered for large communities are the only approaches that require the creation of a forecast. The PCP program requires a GHG emissions forecast based on a business-as-usual scenario 10 years in the future calculated from information about population, economic growth, and fuel mix, but no specific methodological requirements are outlined in order to create the projection. The AEA's (2006) toolkit requires a forecast of energy use to compare total energy costs and GHG emissions 5, 10, 15 and 20 years in the future for the following scenarios: business-as-usual; energy efficiency (the community takes action only with energy efficiency projects); renewable energy (the community takes action only with renewable energy projects); energy efficiency and renewable energy together. A Microsoft Excel workbook is included in the toolkit to create these projects. Assumptions embedded within the workbook include population changes over 20 years as defined by the NWT Bureau of Statistics and the price of oil being static over time. Other assumptions would be associated with factors specific to the energy efficiency and renewable energy projects selected. BC Hydro's funding offer for large communities requires a business-as-usual forecast of energy use and GHG emissions for the residential, commercial, institutional, and industrial sectors. No specific data or methodological requirements are outlined for this projection.

In terms of methods of data analysis or interpretation, the PCP program is the only approach that has a specific tool that it recommends communities use. An Inventory Quantification Support Spreadsheet tool in the form of a Microsoft Excel workbook is provided to assist local governments with the calculations for the baseline GHG emissions inventory. Communities are able to use other calculators in lieu of the spreadsheet tool as long as they report the emission factors and global warming potential multipliers used by those calculators. NRCan's (2006) guide doesn't endorse the use of one specific tool, but does suggest a number of specific software such as: NRCan's EE4 which makes it possible to compare a building design with the 1997 Model National Energy Code for Buildings requirements and evaluate retrofit opportunities; NRCan's HOT2XP that analyses energy use in homes and is typically used for modeling heat loss; and Metro-Quest™ and CommunityViz™ which each simulate community urban planning scenarios. The CEA's (2008) toolkit generally suggests that alternative energy plans or scenarios be evaluated against community objectives using detailed modeling or by simply comparing and ranking. Similarly, the AEA's (2006) toolkit suggests the energy committee help develop and approve the criteria for making a scorecard that would be used to evaluate the strengths, opportunities, and barriers of each potential project suggested for implementation.

Table 4 Summary of the different approaches to community energy planning based on creating a community energy plan.

Approach	NRCan's *Community Energy Planning Guide*	FCM's & ICLEI's PCP program	CEA's *Toolkit for Community Energy Planning*	AEA's *Community Energy Planning Toolkit*	CEA's and PoBC's *Community Energy & Emissions Planning* guide	BC Hydro's QuickStart initiative	BC Hydro's Sustainable Communities funding offer for large communities
Guidelines for setting reduction vision(s) or target(s)	Reduction of non-renewable resources by up to 50 percent over current practices.	Reduction of GHG emissions by six percent below the baseline year within 10 years.	No	A vision statement is recommended with general targets.	A "visionary approach" is recommended that sets an aggressive target based on community objectives and goals as well as makes a statement about the importance of taking action on energy and climate change.	No	The local government must define their aspirations for the entire community and set energy and GHG emissions reduction targets must for five, 10, and 15 years in the future.
Document created for specific communities in Canada	No	No	Communities in BC.	Communities in the Northwest Territories.	Communities in BC.	Communities in BC Hydro's service area with populations up to 20,000.	Communities in BC Hydro's service area with a population greater than 20,000. Other conditions apply.
Distinguishing or unique elements in/about the approach	• Factor-2 principle. • The local government or community members can initiate the process. • Shorter CEP-LITE process for small and/or rural communities.	• Five-milestone framework. • Program administrators must undertake a technical review before completion of a milestone is recognized. • Separate five-milestone process for municipal operations. • Program was created principally to mitigate climate change. • Local Action Plan.	• Three methods of CEP defined: a single issue energy plan; an energy component of the community planning process; and a comprehensive energy plan.	• The local government or community members can initiate the process. • Three methods of CEP defined: a comprehensive community energy plan, a specific issues community energy plan; and an integrated approach.	• City council, board and staff are the most important actors in the engagement process. • Use of provincial CEEI inventory. • The "4 R's of Sustainable Community Energy Planning." • Document was created principally to meet provincial legislation regarding GHG emissions reduction.	• An accelerated CEP process through a one-and-a-half day workshop. • A prescribed set of steps that must be taken to create a community energy plan. • Requires the commitment of having a certain number of senior staff or elected officials involved in the process.	• Many prescribed requirements must be met for creating a community energy plan.
Baseline data required for the community inventory	No specific data requirement, but a high-level scan of key aggregated data	Data is collected on: electricity, natural gas, district energy, fuel oil, diesel, and	No specific data requirement, but the community's energy use should be	No specific data requirement, but in general: the fuels used to produce	CEEI inventory is used, which collects data on: electricity and natural gas use and the number of connections in the residential and commercial/small-medium industrial sectors; residential heating oil, propane, and wood use where their use is deemed significant; on-road		

	is suggested in order to highlight "hot spots" where problems may exist.	propane use in the residential, commercial and industrial sectors; gasoline, diesel, propane, compressed natural gas, and ethanol blend use in the transportation sector; and tonnes of solid waste directed to landfills from all community sectors. Inclusion of the large industrial sector and off-road vehicles is optional. The inventory also tracks CO2, N2O, and CH4 in eCO2.	determined as well as where it comes from and how much it costs.	energy and the amount of energy used; the amount of money spent on energy; the amount of GHGs each fuel produces; and the amount energy a community uses in homes, other community buildings, and for transport within the community.	transportation fuel consumption of several passenger and commercial vehicle classes; and the amount of solid waste produced annually within the jurisdiction of the local government. Information about land-use change, enteric fermentation, and large industrial facilities are listed as memo items. The inventory tracks CO2, N2O, and CH4 in eCO2.		
Forecast required	No	GHG emissions business-as-usual forecast 10 years in the future calculated from estimates about population growth or any other demographic projection. No specific methodological requirements are outlined.	No	Business-as-usual, energy efficiency, renewable energy, and energy efficiency as well as renewable energy scenarios are developed using a Microsoft Excel workbook included in the toolkit to compare total energy use, energy costs, and GHG emissions 5, 10, 15 and 20 years in the future.	No	No	GHG emissions and energy use business-as-usual forecast. No specific data or methodological requirements are outlined.
Methods of data analysis/interpretation	No specific method prescribed, but various tools are suggested.	Inventory Quantification Support Spreadsheet tool (in the form of a Microsoft Excel workbook).	No specific method prescribed, but it is suggested that alternative energy plans or scenarios be evaluated against community objectives using detailed modeling or by simply comparing and ranking.	No specific method prescribed, but it is recommended that the energy committee help develop and approve the criteria for making a scorecard that would be used to evaluate the strengths, opportunities, and barriers of each potential project.	No	No	No

3.4 Community energy planning defined

Jaccard et al. (1997) provide the fundamental definition of CEP as the integration of urban planning and energy management practices at the local level for the purpose of achieving liveable communities with minimal energy use and environmental effects. Similarly, over the last decade an half, CEP has been promoted in Canada as the integration of urban planning and infrastructure applications with GHG emissions reduction, energy conservation, energy efficiency and/or renewable energy measures at the local level for the purpose of achieving a variety of environmental, economic, and social benefits. In effect, CEP can be understood as sustainability-based planning[13]. Using this concept as a preliminary starting point for defining what CEP entails, a contemporary definition of CEP is developed along with a set of components it should include by drawing the best elements of the above-detailed approached to CEP.

The contemporary definition of community energy planning is as follows: *Community energy planning* is a local level[14] planning process that aims to achieve sustainability[15] goals through the management of energy production and consumption and anthropogenic GHG emissions release within a community's geo-political borders. Community energy

[13] Winfield et al. (2009) explain that sustainability-based planning is "…an approach to planning that aims to reverse trends that are leading us away from a desirable and durable future" (p. 4118). Specifically, the authors state that sustainability-based planning: recognizes the interdependence of ecological, social and economic objectives; takes into account global considerations and local contexts; and strives to identify and adopt the option that provides the greatest potential for achieving sustainability (Winfield et al., 2009).

[14] For the purposes of this paper, the local level is understood to encompass single tier, upper tier (regions, counties and districts), and lower tier (cities, towns, and townships) municipalities as well as aboriginal communities.

[15] The World Commission on Environment and Development (Brundtland Commission) can be attributed with popularizing the concept of sustainability in 1987 with its report, *Our Common Future*, which explains sustainable development as taking into account environmental, economic, and social consideration in development that meets the needs of current generations without compromising the ability of future generations to meet their own needs.

planning is implemented through the development and implementation of a *community energy plan*. A community energy plan should include the following components:

1. A baseline community inventory:
    a. Of primary energy consumed;
    b. Of anthropogenic GHG emissions produced;
    c. Developed from taking into account all community sectors and subsectors that consume primary energy and/or produce anthropogenic GHG emissions in significant amounts;
    d. Developed from taking into account all types of secondary energy consumed in significant amounts; and
    e. Calculated from actual consumption or production data, or estimated in cases when this data cannot be obtained.
2. Short, medium, and long-term business-as-usual community forecasts:
    a. Of primary energy that would be consumed;
    b. Of anthropogenic GHG emissions that would be produced; and
    c. Assessed from information about population and economic growth (at a minimum).
3. An engagement process that (at a minimum) includes:
    a. An internal advisory group of City staff, council and pertinent agencies, boards, and commissions, and broad engagement across departments and divisions;
    b. A stakeholder group of relevant advocacy groups, businesses, industry, utilities, and educational institutions; and
    c. A number of community-wide meetings.
4. Long-term vision(s), goal(s), and/or target(s):
    a. For a sustainable energy future that would encompass, among other things[16], a reduction of non-renewable sources of primary energy consumption and anthropogenic GHG emissions production as well as more energy conservation and efficiency; and
    b. Developed from taking into account (at a minimum) the results of the baseline community inventory, business-as-usual forecast, and engagement process.
5. Actions and implementation strategies that:

[16] Gibson et al. (2005) provision a set of generic criteria and trade-off rules that when coupled with case and context specific factors provide an assessment of progress towards sustainability. The eight sustainability requirements that are recommended for decision criteria are: socio-ecological system integrity; livelihood sufficiency and opportunity; intragenerational equity; intergenerational equity; resource maintenance and efficiency; socio-ecological civility and democratic governance; precaution and adaption; and immediate and long-term integration (Gibson et al., 2005). The trade-off rules include: maximum net gains; burden of argument on trade-off proponent; avoidance of significant adverse effects; protection of the future; explicit justification; and open process (Gibson et al., 2005). This framework was developed through, "…a synthesis of insights from the sustainability literature and applied sustainability experience as well as from a review of many other sets of sustainability assessment criteria developed for a wide range of particular applications" (Winfield et al., 2010, p.4119).

a. Include GHG emissions reduction, energy conservation, energy efficiency and/or renewable energy integrated with urban planning and infrastructure measures; and
b. Are chosen (at a minimum) based on the baseline community inventory, business-as-usual forecasts, public engagement, long-term vision(s), goal(s), and/or target(s), and methods of comparing and ranking actions.

The rationale for including the components outlined in the contemporary definition of CEP is based on the similarities between all the different approaches to CEP being promoted for practice in Canada as well as their strengths and shortcomings. Since the approaches to CEP are similar in their motivations, areas of action, and engagement of actors, a contemporary definition of CEP should incorporate these areas of commonality. A review of the strengths and shortcomings of the approaches to CEP also reveals characteristics that a contemporary definition of CEP should take into account in order to be robust. Table 5 provides a summary of the reasons for including the components in the contemporary definition of CEP.

Table 5 Summary of rational for including the components in the contemporary definition of CEP.

Component	Rational for inclusion
1.	A baseline community inventory is used to develop a site-specific situational analysis. It is advantageous to include because it helps provide insight on variables in the present day that may need to change in order to achieve sustainability goals. This information may thus help inform appropriate vision(s), goal(s), and/or target(s), suitable actions and strategies for implementation, and useful indicators that can be monitored to track progress and results.
1.a & 1.b	Some of the approaches to CEP take inventory of non-renewable resource consumption, energy use, and/or GHG emissions production. I argue CEP should always determine the amount of primary energy consumed and anthropogenic GHG emissions produced in a community. Taking inventory of primary energy use is important so that communities understand the source(s) of their energy supply and the extent of their energy use. Taking inventory of anthropogenic GHG emissions is important to highlight the connection between the use of certain types of primary energy and climate change as well as to capture anthropogenic GHG emissions that are not directly related to energy use such as community waste, deforestation, and enteric fermentation.
1.c	Some of the approaches to CEP either do not specify the community sectors and subsectors required to create a baseline community inventory or choose to provide a prescribed list, but fail to account for all the important community

	sectors and subsectors. I argue CEP should include all community sectors and subsectors that consume primary energy and produce anthropogenic GHG emissions in significant amounts, including ones in which local governments may not be able to have much impact on. This information is advantageous to include because it better represents the primary energy consuming and anthropogenic GHG emissions producing activities of a community's citizens, businesses, and industries.
1.d	Some of the approaches to CEP either do not specify the types of secondary energy required to create a baseline community inventory or choose to provide a prescribed list, but fail to account for all the types of secondary energy that may be consumed in significant quantities. I argue CEP should include all types of secondary energy consumed in significant amounts in order to better represent the primary energy consuming and anthropogenic GHG emissions producing activities of a community's citizens, businesses, and industries.
1.e	Some of the approaches to CEP do not require including certain significant community sectors, subsectors or types of secondary energy consumed in a baseline community inventory due to difficulties in retrieving actual consumption or production data. In instances when actual primary energy consumption or GHG emissions production data cannot be obtained, estimates should be calculated in order to create the most realistic baseline community inventory.
2.	A short, medium, and long-term business-as-usual community forecasts are used to understand what the future would encompass if CEP was not implemented. It is advantageous to include due to the same reasons provided for component 1.
2.a & 2.b	Some of the approaches to CEP develop a business-as-usual community forecast of energy consumption and/or GHG emissions production. I argue CEP should involve creating a business-as-usual community forecast of primary energy that would be consumed and anthropogenic GHG emissions that would be produced in a community. The reasons why it is important to include both primary energy and anthropogenic GHG emissions are equivalent to the explanation provided for component 1.a and 1.b.
2.c	None of the approaches to CEP provide methodological guidance for creating a business-as-usual community forecast and only one of the approaches outlines data requirements based on information about population growth or any other demographic information. Although detailed modelling or some sort of quantification would be preferred, local governments should at a minimum assess qualitatively how their community will change from population and economic growth. Taking into account economic growth is important because it may provide insight about major planned commercial and industrial activities that would likely impact primary energy consumption and anthropogenic GHG emissions production differently than just a general increase in population.
3.	An engagement processes is used to exchange information and feedback with different groups. It is advantageous to include because it may potentially help inform appropriate vision(s), goal(s), and/or target(s), suitable actions and strategies for implementation, and garner support for CEP.
3.a-3.c	All the approaches to CEP generally encourage the involvement of a variety of actors throughout the process: local, provincial and federal governments; community members; advocacy groups; businesses, industry, utilities, and educational institutions; and media. Because CEP has the potential to make significant changes to a community, I argue the engagement process for CEP should be equivalent to that of any other community-wide plan. This should

	therefore at a minimum include: an internal advisory group of City staff, council and pertinent agencies, boards, and commissions, and broad engagement across departments and divisions; a stakeholder group of relevant advocacy groups, businesses, industry, utilities, and educational institutions; and a few community-wide meetings. As noted by one of the approaches to CEP, City staff, council and pertinent boards are the most important players in the engagement process as they hold decision-making powers that would allow for the adoption and implementation of CEP. Particular effort should therefore be made to have broad engagement across departments and divisions within the local government's operations.
4.	Long-term vision(s), goal(s), and/or target(s) are used to picture the final outcomes of the CEP process. They are advantageous to include because they may help determine suitable actions and strategies for implementation, inform useful indicators that can be monitored to track progress and results, and encourage the community to keep working on the CEP process.
4.a	Some of the approaches to CEP provide specific or general recommendations on setting reduction visions or targets for non-renewable resources, energy use, and/or GHG emissions. I argue CEP should set long-term vision(s), goals(s), and/or target(s) for a sustainable energy future that would encompass, among other things, a reduction of non-renewable sources of primary energy consumption and anthropogenic GHG emissions production as well as more energy conservation and efficiency. This is advantageous because it enables moving a community's patterns of energy production, energy consumption, and anthropogenic GHG emissions release in a more sustainable direction.
4.b	Some of the approaches to CEP specifically or generally recommend using the baseline community inventory, business-as-usual forecast, and/or engagement processes to inform a reduction target. I argue at a minimum the results of all three factors should be taken into account in order to increase the potential of successfully achieving long-term reduction vision(s), goal(s), and/or target(s).
5.a	All of the approaches to CEP mainly recommend land use planning, transportation planning, building planning and design, water infrastructure, and energy supply and distribution as the areas of actions for implementing strategies to achieve GHG emissions reduction, energy conservation, energy efficiency, and/or renewable energy integration. This information is conducive to the successful achievement of the long-term reduction vision(s), goal(s), and or/targets for a sustainable energy future. I argue CEP actions and implementation strategies should therefore involve GHG emissions reduction, energy conservation, energy efficiency and/or renewable energy integrated with urban planning and infrastructure measures.
5.b	Although many of the approaches to CEP do not specify how to develop or choose between potential actions and implementation strategies, it seems obvious that the more background information that is used and evaluation of options that occurs before final strategies are chosen, the greater the potential for success. All the information developed through components 1 to 4 as well as methods of comparing and ranking[17] should therefore be used at a minimum.

[17] Scenario modelling, spatial visualisations of energy options and financial analysis as implemented in the CUI's integrated community energy mapping approach appear to be particularly advantageous as methods of comparing and ranking. As Gilmour and McNally (2010) explain, scenario modelling and spatial

Comparing the three different streams of, or approaches to, CEP being promoted for practice in Canada to the components outlined in the table above, community energy plans may be understood as the best practice of CEP. This stream of CEP allows for the possibility of meeting almost all of the components in the contemporary definition of CEP. The ICES approach on the other hand, tends to focus on choosing actions and implementation strategies, which are only one component of the CEP process. Moreover, the integrated community energy mapping approach, although it has the ability to perform and visually depict various data analyses, only focuses on the building and transportation sectors. This is inadequate when trying to take into account all the significant sources of anthropogenic GHG emission that may be in a community.

Comparing the different approaches to creating a community energy plan to the components outlined in the table above, FCM's and ICLEI's PCP program is the best practice in approaches to community energy plans. The PCP program, the CEA's and PoBC's (2008) guide, and BC Hydro's Sustainable Communities funding offer for large communities are the approaches to community energy plans that meet the most components of the contemporary definition of CEP. However, the PCP program is chosen over the others because it allows for the participation of any community from across Canada in its program, whereas the other two are restricted to communities in BC.

A comparison of the PCP program to the 15 specific requirements outlined in the components of the contemporary definition of CEP is provided in table 6. Four of the

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visualizations can help lead to strategic investments or actions for GHG emissions or energy consumption reductions instead of high-priced but less effective strategies.

requirements are shared by both the definition of CEP and the PCP program. These commonalities include: creating a baseline community inventory of anthropogenic GHG emissions; developing a baseline community inventory of anthropogenic GHG emissions by taking into account all types of secondary energy consumed in significant amounts; calculating the anthropogenic GHG emissions inventory from actual consumption or production data or estimating it in cases when this data cannot be obtained; and holding a number of community wide meetings during engagement processes. Four requirements in the definition of CEP are not met and six requirements are only partially met by the PCP program. This indicates that the PCP program does not fully meet the requirements of the contemporary definition of CEP.

Table 6 A comparison of the PCP program to the components of the contemporary definition of CEP.

Components	PCP guidelines
1.a	No
1.b	✓
1.c	The baseline inventory includes the building, transportation and waste sectors, but there is an option of including or excluding the large industrial building sector and off-road vehicles. Deforestation and enteric fermentation are not included, but may be significant in some communities.
1.d	✓
1.e	✓
2.a	No
2.b	Only a short to medium i.e. 10 year business-as-usual community forecast is projected.
2.c	The forecast for the community inventory can be developed based on projected population growth or any other demographic projection.
3.a	No
3.b	Stakeholder engagement is advised, but developing a stakeholder group is not specified.
3.c	✓
4.a	A GHG emissions reduction target of six percent below baseline year GHG emissions for the community within 10 years is recommended, but this target does not fully capture the concept sustainable energy because of its sole focus on GHG emissions reduction.
4.b	The reduction target is chosen based on the baseline community inventory and the business-as-usual forecast, but using the engagement process is not required.
5.a	No
5.b	No

4. Community energy planning in practice

4.1 Local governments engaged in community energy planning

Local governments engaged in community energy planning (CEP) in Canada can be identified by examining the participants listed on the websites of the Federation of Canadian Municipalities' (FCM) and Local Governments for Sustainability's (ICLEI's) Partners for Climate Protection (PCP) program and the Canadian Urban Institute's (CUI's) Integrated Energy Mapping for Ontario Communities (IEMOC) initiative. BC Hydro's Sustainable Communities Program website also lists a handful of the municipalities that have taken part in its QuickStart initiative. In total, as of May 18th, 2012, 232 local governments were identified as participating in CEP, of which 228 communities were in the PCP program, four municipalities had completed an integrated community energy mapping study, and four rural municipalities were identified as participants in BC Hydro's QuickStart initiative. Out of the 228 local governments that joined the PCP program, 12 communities had reached milestone one, 28 milestone two, 25 milestone three, 60 milestone four, and five communities had reached milestone five. All the municipalities in the IEMOC study were also participants in the PCP program, unlike the rural municipalities that had taken part in the QuickStart initiative.

It is important to note that the 232 local governments identified are not inclusive of all the communities taking part in CEP in Canada. It is known, for instance, that at least 10 other communities in British Columbia (BC) that are not part of the PCP program or QuickStart initiative have developed community energy plans. This is not surprising given the level of support and advocacy provided for CEP in BC by both the Community

Energy Association (CEA) and the Province of British Columbia (PoBC). Accordingly, of the 232 local governments identified as participating in CEP, with 68 communities listed in the PCP program and at least four others in the QuickStart initiative, BC has the most communities committed to engaging in CEP. BC is followed closely by Ontario (ON) with 57 communities listed in the PCP program and four communities that completed the IEMOC study. Not including the local governments who joined the PCP program and have yet to achieve a milestone, BC and ON have 41 and 30 communities respectively that are at or between milestone one and five.

4.2 Case Studies

From the 232 local governments identified as participating in CEP, the four case studies chosen were the Cities of Langley and North Vancouver in BC and the City of Guelph and Town of East Gwillimbury in ON. Table 7 lists the principle CEP documents that were examined from these four case studies.

Table 7 Case study documents examined.

Municipality	Document	Document date	Approach
Langley	Community Energy and GHG Emissions Plan	2010	PCP program
North Vancouver	Greenhouse Gas Local Action Plan	2005	PCP program
	Community Energy and Emissions Plan	2010	PCP program
Guelph	Community Energy Plan	2007	PCP program
	City of Guelph: Integrated Energy Mapping Strategy	2010	IEMOC study
East Gwillimbury	Community Energy Plan	2009	PCP program

4.2.1 City of Langley

The City of Langley has a population of 25,061 (2008) within its 10 square kilometre boundary and is located in the eastern portion of the Metro Vancouver Region, between the City of Surrey and the Township of Langley in BC (City of Langley, 2009, 2010). The City has a higher population density than other nearby municipalities, a natural wetland of regional significance, parkland exceeding 300 acres, a revitalized pedestrian oriented downtown, a regional shopping centre, a Kwantlen University College campus, and one of the most active industrial and service commercial land bases in the region (City of Langley, n.d., 2010). The City joined the PCP program in August 2002 and achieved its third milestone (FCM, n.d.d) with the completion of its Community Energy and GHG Emissions Plan, which was endorsed by City Council in May 2010 (City of Langley, 2010).

4.2.2 City of North Vancouver

The City of North Vancouver has a population of 48,168 (2011) (City of North Vancouver, n.d.a) within its 12 square kilometre boundary in the Metro Vancouver Region of BC (City of North Vancouver, 2009). It is located at the base of the North Shore Mountains, bounded by the Burrard Inlet to the south and the District of North Vancouver to the east and west (City of North Vancouver, 2009). The City has a relatively high density, provides workspaces for more than 23,000 jobs, connects conveniently to Vancouver's central business district with public transit, and has some of the region's finest outdoor recreation areas (City of North Vancouver, 2009; Metro Vancouver, n.d.).

The City joined the PCP program in October 1997 and achieved its third milestone with the completion of its GHG Local Action Plan (LAP) in February 2005 (City of North Vancouver, n.d.b, 2005). It then began to implement the actions in the plan as well as monitor, verify, and report GHG emission reductions allowing it to achieve the PCP program's fifth milestone in December 2010 (City of North Vancouver, n.d.b). It is important to note that the City also updated the community component of the LAP in April 2010 creating a new Community Energy and Emissions Plan (CEEP) (City of North Vancouver, 2010a).

4.2.3. City of Guelph

The City of Guelph has a population of 114,943 (2006) within its 86 square kilometre boundary (City of Guelph, n.d.a) and is located about 100 kilometres west of the City of Toronto's Central Business District, within southern ON's Greater Golden Horseshoe (City of Guelph, 2007). The City is an agricultural hub and well located for regional transportation (City of Guelph, n.d.a, 2007). It has various manufacturing, high tech and service industries (City of Guelph, 2007) including agri-food, life science, information technology, environmental, and automotive sectors (City of Guelph, n.d.b). It is also home to the University of Guelph, which adds an additional 18,000 student residents to the community during the academic year (City of Guelph, 2007). The City joined the PCP program in April 1998 and achieved its third milestone (FCM, n.d.e) with the completion of its Community Energy Plan, which was passed by Council in April 2007 (City of Guelph, n.d.c). Guelph was also the first community to participate in an IEMOC study, which was completed in August 2010, for the purpose of evaluating how integrated

community energy mapping could help achieve the goals in its community energy plan (CUI, 2010).

4.2.4 Town of East Gwillimbury

The Town of East Gwillimbury has a population of 22,473 (Statistics Canada, 2011) within its 238 square kilometer boundary and is located 60 kilometers north of Toronto in the northern part of York Region in the Greater Golden Horseshoe (Town of East Gwillimbury, n.d., 2009). As the City's official website explains, it has, "…a variety of living environments including fully serviced urban areas, partially-serviced suburban areas, rural hamlets, estate residential subdivisions and rural agricultural land" (Town of East Gwillimbury, n.d.). Farms, forests, countryside residences, and recreational areas also separate the City's main urban areas (Town of East Gwillimbury, n.d.). The City joined the PCP program in March 2007 (FCM, n.d.e) and has since completed a Community Energy Plan. It is currently in the process of having its first three milestones verified by ICLEI (Personal communication, June 19, 2012).

4.3. Reasons for engaging in community energy planning

4.3.1 Community specific motivations

Interviews with the key municipal official in charge of administering the community energy plans in each of the four case studies indicated that the communities in BC and ON had different motivations for initiating their CEP exercise. In BC, the Cities of Langley and North Vancouver expressed the concept of sustainability as a key stimulant for action. Langley viewed its community energy plan as one of the methods by which the City was doing its part in engaging with sustainability planning (personal

communication, May 1, 2012). Similarly, North Vancouver stated that its original LAP helped fulfill objectives in its Official Community Plan, which expressed a sustainable vision for the community (personal communication, May 7, 2012).

The City of Guelph and the Town of East Gwillimbury named a few other factors in creating their community energy plans. Guelph identified broad drivers such as global climate change or corporate citizenship, practical thinking around energy security, and economic development as reasons for creating its community energy plan (personal communication, May 16, 2012). The latter was expressed as the "most profound" driver because the notion of a strong local economy was a concept the whole community could gather around (personal communication, May 16, 2012). Similarly, East Gwillimbury emphasized practical thinking around energy supply reliability as a motivation (personal communication, Jun 19, 2012). The Town had knowledge that not only was it expected to increase its population more than four-fold, but that energy supply was also becoming tenuous in the northern portion of York Region (personal communication, Jun 19, 2012). Uncertain about what its energy future would look like, City Council had a specific desire to look at the question of energy in order to accommodate projected population growth (personal communication, Jun 19, 2012).

The CEP documents of the case study communities echoed these views and provided insight into some other potential motivations. This indicated that the communities in BC and ON also had similar reasons for initiating their CEP exercises. Not surprisingly, all of the municipalities depicted climate change as a global problem due to human activity that

could be mitigated with local solutions to reduce greenhouse gas (GHG) emissions such as the strategies outlined in their community energy plans. The Cities of Langley and Guelph also stated that their community energy plans were methods by which they could implement strategies in order to support sustainable growth. The community energy plans of the Cities of Guelph and North Vancouver described different sentiments of leadership. North Vancouver expressed a desire to be a leader in environmental stewardship and community sustainability, while Guelph stated that taking the lead in creating community energy solutions for the next 100 years was consistent with the city's tradition of being a key player in developing municipal energy distribution. East Gwillimbury's community energy plan explained CEP as an integral component of an overarching integrated community plan that emphasizes sustainability and includes the sustainability goals of its upper-tier municipality.

The CEP document(s) of the Cities of Langley and North Vancouver also identified potential motivations that were not explicitly described in any of the other case studies. Langley's community energy plan stated that non-renewable fuel sources should be conserved for future generations. The City of North Vancouver stated that the LAP embodied principles of Smart Growth BC[18] such as encouraging mixed-use development and focusing growth in development concentration areas. In its updated CEEP, the City also explained how taking action to reduce GHG emissions and encouraging

[18] Smart Growth BC emerged in 1999 in British Columbia and was founded by the West Coast Environmental Law Association and the Eco-Research Chair of Environmental Law and Policy at the University of Victoria (Curran and Tomalty, 2008). Its mandate was to establish a citizen movement to address growth and sprawl issues in British Columbia and to provide local and provincial government with alternative policy solutions (Curran and Tomalty, 2008).

sustainability could help achieve other community benefits such as improved long-term fiscal performance, better mobility and more liveable communities.

More details about some of the motivations described during the interviews were found in the CEP documents of the Cities of North Vancouver and Guelph. North Vancouver's first community energy plan stated that its Official Community Plan set goals for the City to manage energy and GHG emissions and articulated broader regional goals about sustainability such as protecting green zones, building complete communities, achieving a compact metropolitan region, and increasing transportation choices. This was highlighted again in its updated plan, which is described as putting a "climate change lens" on the city's current Official Community Plan vision[19]. Guelph's community energy plan stated that economic and population growth in Canada are putting strains on existing energy supply systems and that cities must take action to ensure sustainable supplies of energy and water in order to support this growth while also ensuring long-term competitiveness and environmental performance.

In effect, all the case study communities conveyed, either through their interviews or community energy plans, that climate change and growth management were key motivations for initiating their CEP process. Besides these two factors, the Cities in BC shared sustainability as common motivation, whereas the communities in ON shared

[19] The Official Community Plan vision described in the City of North Vancouver's (2010) Community Energy and Emissions Plan is as follows: "The City will establish a low carbon path that leads to a net zero carbon community while being vibrant, diverse, highly liveable and striving to balance the social, economic and environmental needs of our community. The City will work with senior governments, local governments, non-governmental organizations, businesses, and residents to achieve these deep emission reductions" (p.14).

energy security or reliability as a driver. A summary of all the motivations for CEP drawn from the interviews and community energy plans of the four case studies is listed in table 8.

Table 8 Motivations for community energy planning drawn from the interviews and community energy plans of the four case studies.

Motivations for CEP	Langley	North Vancouver	Guelph	East Gwillimbury
Sustainability	✓	✓		
Climate change	✓	✓	✓	✓
Environmental protection			✓	
Energy security/reliability			✓	✓
Economic development			✓	
Improved long-term fiscal performance		✓		
Long-term competitiveness			✓	
Better mobility		✓		
Growth	✓	✓	✓	✓
More liveable communities		✓		
Conservation for future generations	✓			
"Smart growth" planning		✓		
Corporate citizenship			✓	
Leadership		✓	✓	

4.3.2 Legislative and policy drivers

When asked about any potential legislative or policy drivers at the federal level, the case study interviewees were unanimous in stating that the federal government did not play any direct role in influencing the creation of their community energy plans (personal communication, May 1, 2012, May 7, 2012, May 16, 2012, June 19, 2012). However, the City of North Vancouver did explain that the Kyoto Protocol had been adopted at the time when it decided to pursue its original LAP highlighting climate change as an

important issue (personal communication, May 7, 2012). Similarly, the City of Guelph also indicated that since Kyoto did not filter down to the municipal level in any legislative way, it was more a motivation that a direct driver (personal communication, May 16, 2012). The City of Langley went on to emphasize that although there were no federal legislative or policy drivers, the FCM's Green Municipal Fund[20] facilitated the creation of its community energy plan because of its grant funding (personal communication, May 1, 2012).

In terms of provincial legislative and policy drivers however, the interviewees indicated that their respective provinces had influenced the initiation of their community energy plans. In BC, Langley and North Vancouver stated that Bill 27, the *Local Government (Green Communities) Statues Amendment Act*, was the most significant driver (personal communication, May 1, 2012, May 7, 2012). Although Bill 27 was enacted after North Vancouver created its LAP, it was one of the main reasons that it engaged in updating the community component of its original LAP to create its CEEP (personal communication, May 7, 2012). The updated CEEP provided analysis to support the requirements necessary for the City to comply with Bill 27 (City of North Vancouver, 2010a). Both cities relayed that they also signed a non-binding agreement with the Province of British Columbia (PoBC) and the Union of British Columbia Municipalities (UBCM) called the *Climate Action Charter* committing the Cties to measure and report their community's GHG emissions (personal communication, May 1, 2012, May 7, 2012).

[20] The Green Municipal Fund was created from a $550 million endowment from the federal government in order to fund municipal plans, studies, and projects in the brownfield, energy, transportation, waste, and water sectors (FCM, n.d.c).

In ON, both Guelph and East Gwillimbury explained that the *Places To Grow Act* and its corresponding *Growth Plan for the Greater Golden Horseshoe* were the main drivers for creating their community energy plans (personal communication, May 16, 2012, June 19, 2012). Guelph also emphasized that the *Green Energy Act*, which was passed after their community energy plan was created, was fundamental in defining its implementation strategy (personal communication, May 16, 2012).

4.3.2.1 Province of British Columbia

4.3.2.1.1 Bill 27: the Local Government (Green Communities) Statues Amendment Act

The PoBC passed Bill 27, the *Local Government (Green Communities) Statues Amendment Act*, in May 2008. The Bill amends the *Local Government Act*, *Community Charter*[21], *Vancouver Charter*, the *Greater Vancouver Sewerage and Drainage District Act* and the *Greater Vancouver Water District Act*. In general, these changes require municipalities and regional district to reduce GHG emissions, conserve energy, and make communities more socially and environmentally sustainable while also giving them more authority to do so.

In particular, the Ministry of Community Development (MoCD) (2008) states that Bill 27 mandates local governments to include targets, policies and actions to reduce GHG emissions by May 31, 2011 and May 31, 2010 in their regional growth strategies[22] and

[21] The PoBC does not have a "*Municipal Act*" or "*Planning Act*" like the Province of Ontario. Instead, the *Community Charter* establishes a basic structure and manner of operation for municipal councils and the *Local Government Act* addresses boundary expansions and amalgamations, elections, land use regulations, and regional districts (City of Whistler, n.d.).

[22] A regional growth strategy "…is a regional vision that commits affected municipalities and regional district to a course of action to meet common social, economic and environmental objectives" (MoCD,

official community plans[23] respectively. Accordingly, the Bill also provides local governments with the authority to provide exemptions from traditional off-street parking requirements and development cost charges[24] as well as to establish development permit areas[25] to promote energy conservation, water conservation, and GHG emissions reduction (MoCD, 2008a). Further, the regional growth strategy approval process is streamlined by: removing the requirement to hold a separate public hearing for adopting a regional growth strategy unless deemed required; allowing the request for a facilitator appointed by a Minister to help resolve issues during the development of a regional context statement; and enabling a regional district to make minor amendments to the strategy without requiring a full referral and acceptance process (MoCD, 2008a).

In terms of exemptions from traditional off-street parking, local governments may now: reduce the amount of off-street parking required for land or buildings based on transportation needs; remove the requirement to own a parking facility within a set distance from land or buildings by accepting "cash in-lieu"; and use cash in-lieu of off-street parking to create transportation infrastructure that supports walking, bicycling, public transit or other alternative forms of transportation (MoCD, 2008a). In terms of exemptions from development cost charges, small-unit housing that have dwelling units

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2005). In particular, it is initiated and adopted by a regional district and outlines where growth can occur within a region over time (MoCD, 2005; PoBC et al., 2010).

[23] An "official community plan" in British Columbia is similar to an "official plan" in Ontario.

[24] Development cost charges are one-time charges municipalities and regional districts can levy most new subdivisions and buildings at the time of approval (PoBC et al., 2010) to offset that portion of the costs related to services that are incurred as a direct result of the new development (Ministry of Community, Sport and Cultural Development, n.d.a).

[25] A development permit area is a set of development regulations pertaining to an area specified by a local government's official community plan (PoBC et al., 2010). Any proposed building and subdivision within a development permit area requires a development permit issued by the local government (PoBC et al., 2010).

that are 29 square meters or less as well as certain developments with larger units can be exempted from development cost charges and school site acquisition charges (MoCD, 2008a). The following larger unit developments are eligible for exemption: not-for-profit rental housing; affordable for-profit rental housing; subdivision of small lots designed to result in low GHG emissions; and development designed to result in a low environmental impact (MoCD, 2008a). Developments cost charges can therefore allow local governments to provide financial incentives for higher density, centrally located, and energy efficient development (PoBC et al., 2010).

In terms of establishing development permit areas to promote energy conservation, water conservation, and GHG emissions reduction, Bill 27 specifically allows local governments to establish requirements for development permits in regards to: landscaping; siting; form and exterior design; specific features in the development; and machinery, equipment and external systems (MoCSCD, 2008a). The BC Climate Action Toolkit website explains that therefore local governments can now establish development permit areas for green buildings, landscaping that requires less water, and glazing and orientation for solar energy gain.

Lastly, Bill 27 made changes that allow the Greater Vancouver Water District authority to generate and sell power related to its water supply activities to third parties (MoCD, 2008a). This amendment was adopted because the water district identified opportunities to capture energy from its waterworks (MoCD, 2008a). The excess water that spills over the Cleveland Dam in the District of North Vancouver during certain seasons of the year

could for example be used to generate electricity, avoiding 6,800 tonnes of GHG emissions per year that would otherwise be produced (MoCD, 2008b).

4.3.2.1.2 Climate Action Charter

The *Climate Action Charter* was launched in 2007 and is a non-binding agreement with the PoBC, the UBCM, and signatory local governments in BC. To date of the 188 municipalities in BC, 180 have signed the charter (PoBC, n.d.). Through the charter, all parties formally acknowledge the effects of GHG emissions and climate change, the benefits of emission reductions, and the need for action to address climate change. Moreover, by signing the charter, each local government commits to: making their corporate operations carbon neutral by 2012 (excluding the solid waste sector); measuring and reporting their community's GHG emissions; and creating more compact and energy efficient communities. In return, the PoBC and UBCM commit to helping the signatory local governments achieve these initiatives by developing options and actions. The charter intends that the signatory parties work together on climate change initiatives. Formal working groups and their responsibilities are also outlined in the agreement to support this process.

4.3.2.2 Province of Ontario

4.3.2.2.1 Places To Grow Act

The Ministry of Infrastructure (MoI) is responsible for administering the Province of Ontario's *Places to Grow Act*, which was passed in 2005. The Act provides the province with the authority to designate geographical growth areas and develop growth plans with local officials and stakeholders to coordinate planning and decision-making for long-term

growth and infrastructure renewal in the province (MoI, 2005). The Act essentially facilitates and enables: decisions about growth to be made with economic, social and environmental considerations; a decision making process that incorporates community priorities, strengths and efficient use of infrastructure; planning for growth reflecting various geographic perspectives and integration across natural and municipal boundaries; and coordination of long-term vision and goals about growth across all levels of government. A growth plan created under the Act may include population projections and allocations as well as policies, goals and criteria relating to issues such as intensification and density, land supply, expansions and amendment to urban boundaries, location of industry and commerce, protection of sensitive and significant lands, infrastructure development, affordable housing and community design (MoI, 2005). All municipalities in the province are required to ensure that their official plans conform to the growth plan for their area (MoI, 2005).

4.3.2.2.2 Growth Plan for the Greater Golden Horseshoe

The Growth Plan for the Greater Golden Horseshoe was prepared and approved under the *Places to Grow Act, 2005* and took effect on June 2006 (consolidated on January 2012) to manage growth to 2031 (MoI, 2012). The area is described as one of the fastest growing areas in Canada (MoI, 2012). It is projected to grow by an additional 3.7 million people (from 2001) to 11.5 million people by 2031 (MoI, 2012). This accounts for over 80 percent of ON's projected population growth (MoI, 2012). The purpose of the Growth Plan is to provide leadership and guidance to municipalities as they plan for growth through information about: where and how to grow; infrastructure to support growth; protecting natural and cultural heritage sites as well as renewable and non-renewable

resources; and implementation information (MoI, 2012).

In terms of some of the directives about where and how to grow, the plan envisions increasing intensification of existing built up area through urban growth centres, intensification corridors, major transit station areas, brownfield sites,[26] and greyfields[27] (MoI, 2012). The purpose of concentrating new development in these areas is to facilitate transit and infrastructure investments that will support growth (MoI, 2012). The growth plan also requires building more compact greenfield[28] communities at transit-supportive densities that reduce the rate at which land is consumed (MoI, 2012). Cities and towns are directed to plan for complete communities with a different mix of land-uses, employment, and housing types as well as high quality public open space and easy access to local stores and service (MoI, 2012). All development and growth however is required to occur in designated settlement areas (MoI, 2012).

Under the growth plan, Guelph has both designated built-up and greenfield area as well as an urban growth centre in its downtown. As such, the city is planned to achieve by 2031, or earlier, a minimum gross density target of 150 residents and jobs combined per hectare growing the City's population by over 180,000 and creating more than 80,000 jobs (MoI, 2012). Similarly, from an expected population and job increase of around 440,000 and 190,000 respectively in the municipality of York Region by 2031 (MoI, 2012), the Town of East Gwillimbury's population is expected to grow to 88,000 with an

[26] Brownfield sites are properties that may be contaminated (MoI, 2012). They are usually former industrial or commercial properties (MoI, 2012).
[27] Greyfield sites are properties that were previously developed, but may be underutilized, in poor condition, or vacant (MoI, 2012).
[28] A greenfield area is undeveloped land within a settlement area (MPIR, 2006b).

additional 44,000 jobs created by 2031 (Town of East Gwillimbury, 2009). It is important to note that the Town's growth is resdtricted by two other plans that were created before the growth plan. Specifically, the *Greenbelt Plan* and *Oak Ridges Moraine Conservation Plan* identify 75 percent of the Town's land to be protected for environmental and rural uses (Town of East Gwillimbury, 2008).

In terms of some of the directives protecting natural resources, the growth plan supports the role of municipalities in water and energy conservation as well as integrated waste management (MoI, 2012). Specifically, municipalities are required to develop and implement official plan policies and strategies to: conserve energy in municipally owned facilities; identify opportunities for alternative energy generation and distribution; apply water as well as energy demand side management; implement water recycling; and employ land-use patterns and urban design standards that encourage and support energy efficient buildings and cogeneration opportunities (MoI, 2012). They are also required to develop and implement official plan policies and strategies to: reduce waste and increase composting and recycling initiatives; develop a comprehensive plan with an integrated approach to waste management; promote the reuse and recycling of construction materials; and collaborate with regional municipalities in terms of long-term waste management planning (MoI, 2012).

4.3.2.2.3 Green Energy and Green Economy Act

Bill 150, the *Green Energy and Green Economy Act*, was passed by ON's legislature in May 2009 (Ministry of Energy, 2009a). Key elements of the legislation and its related policies include: streamlined approvals for renewable energy projects; developing North

America's first feed-in tariff system providing guaranteed prices for renewable energy projects as well as a smart grid that would support the new energy supply; opportunities for local governments and aboriginal communities to develop their own renewable energy projects; and an academic research chair to look into any potential health affects associated with renewable energy projects (Ministry of Energy, 2009a).

In terms of the feed-in tariff, the Ontario Power Authority launched the program in September 2009 (Ontario Power Authority, 2009). The program pays participants a fixed-price for the electricity they generate from the following renewable energy sources: solar photovoltaic, biomass, wind, biogas, hydro, and landfill gas (Ontario Power Authority, 2009). Some of the features of the program include: the ability of all sizes of generation projects to participate; prices that intend to cover total project costs and provide a reasonable rate of return; incentives for aboriginal projects; incentives for community-based projects; different prices for different technologies and project sizes; and domestic content requirements that entail a certain percentage of project costs come from ON goods and labour (Ministry of Energy, 2009b).

4.3.2.3 Legislative and policy driver differences between British Columbia and Ontario

The provincial legislative and policy drivers for CEP differ in many ways between the case studies in the provinces of BC and ON. In BC, all the local governments in the province were given specific directives and more authority to reduce GHG emissions and energy use in their communities through planning-type legislation comparable to the Province of Ontario's *Municipal Act* and *Planning Act*. Local governments were required to create targets, policies and actions by certain timeframes and they were given more

authority to use planning tools to achieve these goals. The great majority of the local governments also voluntarily signed a charter to work collectively with the PoBC and other municipalities to reduce their GHG emissions. Climate change mitigation appears to be the principle motivation behind the creation of both pieces of policy.

In the Province of Ontario, local governments in the Greater Golden Horseshoe were given specific directives to help them accommodate growth through a growth plan created by the Province and governed by provincial legislation. The most comparable piece of policy to the growth plan in the BC is a regional growth strategy. However, a regional growth strategy is prepared and passed by a regional district with the involvement of its municipalities, provincial agencies, and others, but does not need provincial government approval for its initiation (Ministry of Community, Sport and Cultural Development, n.d.b). The pertinent directives under the growth plan involve where and how future development occurs, specific growth projections for certain local governments, and official plan policy requirements in terms of water and energy conservation, alternative energy supply, and integrated waste management. Growth management, quite obviously, appears to be the principle motivation behind the creation of this piece of policy. Further, although local governments in ON are not provided with more authority to use land-use planning tools to achieve these goals like in BC, the *Green Energy and Economy Act* does facilitate renewable energy opportunities.

As a result, the provincial drivers for CEP in BC appear to be clearer than in ON. In BC, not only are there specific provincial mandates to local governments in regards to GHG

emissions reduction, but the PoBC in collaboration with the Community Energy Association (CEA) also developed a guide (2008) that promotes CEP as a clear method of achieving the provincial directives. The local governments in BC are therefore engaging in CEP with specific mandates, authorities, and guidance provide by the province.

In ON, the directives in the Growth Plan for the Greater Golden Horseshoe include some requirements for energy and waste management, but the province does not provide any clear direction as to how to achieve them. The local governments in ON are therefore engaging in CEP in the absence of specific mandates, authorities, and guidance from the province, or within a provincial policy vacuum as some characterize it. Accordingly, CEP in ON can be understood as a more bottom up phenomena with the local governments leading in its adoption and implementation without direct support from the province.

The municipality of York Region in ON provides an example of this local level policy phenomenon through a requirement outlined in its Official Plan adopted in 2009 for community energy plans in its lower-tier municipalities (QUEST, 2011). Specifically, new growth areas and the four Regional Centres (Markham, Newmarket, Richmond Hill and Vaughan) will be required to create community energy plans during the secondary plan process in order help achieve energy conservation and energy efficiency goals as well as GHG emissions reduction. (QUEST, 2011). Community energy plans, "…should detail the municipality's energy use requirements, establish a plan to reduce energy demand, consider alternative forms of energy generation, intensify within the growth

centres near regional corridors, and improve building efficiencies and siting…" (QUEST, 2011, p.39). The Ministry of Municipal Affairs and Housing approved the community energy plan requirement in York Region's Official Plan in 2010.

5. A comparison of theory and practice

5.1. PCP program guidelines vs. case study community energy plans

The community energy planning (CEP) guidelines of the Federation of Canadian Municipalities (FCM's) and Local Governments for Sustainability's (ICLEI's) Partners for Climate Protection (PCP) program were compared to the community energy plans created by the four case studies. The comparison was based on the following PCP program requirements or recommendations:

- A greenhouse gas (GHG) emissions baseline inventory;
- A GHG emissions forecast of the business-as-usual scenario;
- A GHG emissions reduction target;
- A Local Action Plan outlining how the community will achieve its GHG emissions reduction target; and
- Engagement.

5.1.1 GHG emissions baseline inventory

In terms of the community GHG emissions baseline inventory, the Cities in British Columbia (BC) included all three sectors required for the PCP program – buildings, transportation, and solid waste – whereas the communities in Ontario (ON) only included building and transportation sectors in their inventories. In terms of the building sectors taken into account in developing the GHG emissions baseline inventory, all the communities followed the PCP guidelines and included residential, commercial and industrial subsectors, except the City of Guelph, which included an institutional subsector instead of a commercial subsector. Interestingly, the City of Langley also included an additional subsector, provincial public service organization buildings, that the other cases did not include. A summary of all the GHG emissions baseline inventories is provided in table 9.

In terms of the calculations used for the building sector GHG emissions baseline inventory, all the case studies used different methods to derive their estimates. The City of Langley's estimates were derived from actual consumption data provided by electricity and natural gas utilities. The City of North Vancouver's original Local Action Plan (LAP) indicated that the GHG emissions baseline estimates for all its sectors were derived from the Greater Vancouver Regional District's[29] air quality management forecasts and back-casts, whereas its updated Community Energy and Emissions Plan (CEEP) stated that the GHG emissions baseline estimates for all its sectors were obtained from the province's Community Energy & Emissions Inventory (CEEI) initiative.

The City of Guelph's building sector baseline estimate was derived from modelling energy use for each subsector and then comparing the results for accuracy with national and provincial statistics as well as utility data. Specific details were not provided in the Town of East Gwillimbury's community energy plan about how it determined its building sector GHG emissions baseline. Instead it explained that the inventory baseline estimates for all its sectors were derived from calculations and assessments based on primary and secondary data from the Town's Planning Department, electricity and natural gas utilities, other consultant reports, Statistics Canada, Transport Canada, the Ministry of Environment (MoE), and other government agencies at the federal, provincial, regional, and municipal level.

[29] The Metro Vancouver Regional District is now called the Metro Vancouver Regional District.

In terms of the transportation sector GHG emissions baseline, the communities in BC and the City of Guelph reported gasoline, diesel and propane use as directed by the PCP program. The communities in BC however included many more transportation subsectors than the City of Guelph, which was the only community to included ethanol data in its estimates. All three communities also estimated their transportation sector GHG emissions baseline using methods recommended by the PCP program. In particular, the City of Langley used the number of registered vehicles in its community and averages for fuel efficiency and vehicle kilometres travelled (VKT) in each vehicle class to estimate its transportation sector GHG emissions baseline. By using the Province's CEEI inventory, the City of North Vancouver by default also used this method of transportation sector GHG emissions estimation. The City of Guelph did not provide specific details in its community energy plan but stated that its transportation GHG emissions baseline was derived from transport patterns obtained from the city's Transportation Planning Department. The department's assessments were combined with national vehicle fuel use statistics and extrapolated using the city demographics.

In terms of the solid waste GHG emissions baseline, the City of Langley reported GHG emissions estimates based on total mass of solid waste produced by Langley residents, whereas the City of North Vancouver reported GHG emission estimates based on the total mass of solid waste both diverted to landfills and incinerated. North Vancouver included more detailed information about the total mass of waste that was recycled and composted. The City of Langley obtained its solid waste data from the Metro Vancouver

Regional District, where as the City of North Vancouver, as already discussed, acquired its estimates from the provinces CEEI initiative.

Table 9 GHG emissions baseline inventory information found in the community energy plans of the four case studies.

	Langley	North Vancouver LAP	North Vancouver CEEP	Guelph	East Gwillimbury
Baseline GHG emissions inventory sectors	• Buildings • Transportation • Solid waste	• Buildings • Transportation • Solid waste	• Buildings • Transportation • Solid waste	• Buildings • Transportation	• Buildings • Transportation
Baseline buildings inventory subsectors and data	• Residential: electricity and natural gas • Commercial: electricity and natural gas • Industrial: electricity and natural gas • Provincial public service organization: electricity and natural gas	The LAP's baseline inventory included the residential building, commercial building, solid waste, light-duty vehicle, heavy-duty vehicle, and industry sectors. Details were not in the LAP about the specific data used, any potential subsectors, or methods of baseline GHG emissions estimation.	• Residential: electricity and natural gas • Commercial: electricity and natural gas • Industrial: electricity and natural gas	• Residential: electricity, natural gas, heating oil, and wood • Institutional: electricity and natural gas • Industrial: electricity and natural gas	• Residential: electricity, natural gas, heating oil, wood and other sources (including coal and propane) • Industrial, commercial and institutional: electricity and natural gas
Baseline transportation inventory subsectors and data	• Small passenger gars: gasoline and diesel • Large passenger cars: gasoline and diesel • Motorhomes: gasoline and diesel • Commercial vehicles: gasoline, diesel, and mobile propane • Light trucks, vans and SUVs: gasoline, diesel, and mobile propane • Tractor-trailer trucks: diesel • Motorcycles and mopeds: gasoline • Buses: gasoline		• Small passenger cars: gasoline, diesel • Large passenger cars: gasoline, diesel • Motorhomes, motorcycles and mopeds: gasoline, diesel • Commercial vehicles: gasoline, diesel, and mobile propane • Light trucks, vans, and SUVs: gasoline, diesel, and mobile propane • Tractor-trailer trucks: gasoline, diesel • Buses: gasoline, diesel	• Gasoline, diesel, and biodiesel use in light vehicles (cars, SUVs and light trucks)	Details were not in the community energy plan about the specific data used or any potential sub-sectors.
Baseline waste inventory subsectors and data	Total amount of solid waste generated within the community by residents.		Total amount of solid waste generated within the community by residents that went to the landfill and was incinerated. Recycled and composted data also provided.	N/a	N/a
Baseline building GHG emissions estimation method	Actual consumption data provided by electricity and natural gas utilities.		CEEI initiative. See appendix A.	Modelling energy use for each subsector. The results were compared with national and provincial statistics for credibility as well as utility data.	Calculations and assessments based on primary and secondary data from the Town's Planning Department, electricity and natural gas utilities, other

Baseline transportation GHG emissions estimation method	The number of registered vehicles in its community and averages for fuel efficiency and VKT in each vehicle class.			Transport patterns from the city's Transportation Planning Department. The city assessment was combined with national vehicle fuel use statistics and extrapolated using the city demographics.	consultants reports, Statistics Canada, Transport Canada, MoE and other government agencies at the federal, provincial, regional and municipal level. Details were not provided regarding the specific methodology used.
Baseline waste GHG emissions estimation method	Total solid waste data provided by the Metro Vancouver Regional District.			N/a	N/a
Baseline year	2007	1995	2007	2005	2006
Total baseline GHG emissions (tonnes of eCO_2)	151,583	190,190	226,572	995,769	179,000

5.1.2 GHG emissions forecast

The case study communities in BC, unlike the communities in ON, followed the PCP guidelines in forecasting community GHG emissions for the business-as-usual scenario at least 10 years into the future from their GHG emissions inventory baseline year. The City of Langley used a specific framework and set of assumptions (about changes in energy use, built form, population growth, GHG emission factors, efficiencies in future technologies, etc.) in determining the business-as-usual forecast for each of its sectors individually and then determining what the total change in GHG emissions would be for the community as a whole. The City of North Vancouver, on the other hand, developed a forecast for the whole community based on a simplified assumption that energy use is directly related to population growth in its LAP and then used a "simple growth" scenario from the province's CEEI initiative that assumes emissions will increase with population and job growth in its updated CEEP.

Although the community energy plans of the case studies in ON did not forecast community GHG emissions for the business-as-usual scenario, the City of Guelph's Integrated Energy Mapping for Ontario Communities (IEMO) study forecasted the business-as-usual, high-efficiency, and ultra-high efficiency scenarios for GHG emissions to 2031[30]. A summary of all the GHG emissions baseline forecasts is provided in table 10.

[30] Details about integrated community energy mapping methodology can be found in section 3.2.3.

Table 10 GHG emissions forecast information found in the community energy plans of the four case studies.

	Business-as-usual scenario forecast projected?	Method of business-as-usual forecast?	Sector-specific reduction potential forecasted?
Langley	Yes, for energy consumption and GHG emissions to 2017.	A specific framework and set of assumptions was used to develop the forecast for each sector individually. Where possible, the forecast projections were on a trend line using actual consumption data for the City for 2007 and 2008.	Yes, for all the baseline inventory sectors.
North Vancouver LAP	Yes, GHG emissions to 2010.	Based on assumptions of population growth.	No
North Vancouver CEEP	Yes, for energy consumption and GHG emissions to 2050.	A "simple growth" scenario from the province's CEEI initiative that assumes emissions will increase with population and job growth.	Yes, for all the baseline inventory sectors.
Guelph	The community energy plan did not forecast GHG emissions, but the IEMOC study did project the business-as-usual, high-efficiency, and ultra-high efficiency scenarios for energy consumption and GHG emissions to 2031.	Integrated community energy mapping methodology as described in appendix A.	The community energy plan did not determine energy and GHG emissions reduction potential for the baseline sectors, but the IEMOC study did.
East Gwillimbury	No	N/a	No

5.1.3 GHG emissions reduction target

None of the case study communities followed the PCP program's recommended guideline of setting a specific community-wide GHG emissions reduction target of six percent below baseline year GHG emissions within 10 years. Instead, the communities in

BC set different community-wide GHG emissions reduction targets below their baseline year GHG emissions within different timeframes. The City of Guelph set a per-capita GHG emissions reduction target and the Town of East Gwillimbury set a GHG emissions reduction target based on its business-as-usual GHG emissions forecast. A summary of all the GHG emissions reduction targets is provided in table 11.

The City of Langley set a target that was calculated based on the GHG emissions reduction potential of the actions that were chosen for implementation within the community while also accounting for growth. The City of North Vancouver changed the initial GHG emissions reduction target set in its LAP for two more long-term targets set in its CEEP. The new targets were chosen with, "…GHG emission modeling techniques that forecast future GHG emissions levels based on hundreds of input variables developed through consultations with staff, Council and the community" (City of North Vancouver, 2010, p.26) as well as taking into consideration results of stakeholder engagement, "…and in recognition that there is much uncertainty regarding the future of technology, energy prices, the implementation of senior government policies and actions, and other important factors that will drive emission trends" (City of North Vancouver, 2010b, p.22).

No numeric GHG emission reduction target was found in the City of Guelph's community energy plan. Instead, one of the five goals outlined to help achieve Guelph's overall community energy plan vision stated that the City would achieve an energy use per capita and resulting GHG emissions that would be less than the current global

average. This goal was one of seven listed in the Town of East Gwillimbury's community energy plan. The Town of East Gwillimbury also set two long-term targets to achieve this goal. Interestingly, although not explicitly stated in Guelph's community energy plan, Guelph's IEMOC study stated that Guelph's community energy plan's goal was to reduce GHG emissions per capita by 60 percent.

Table 11 GHG emissions reduction target information found in the community energy plans of the four case studies.

	Community-wide GHG emissions reduction target
Langley	16 percent reduction of GHG emission below 2007 levels by the year 2017.
North Vancouver LAP	Six percent interim reduction of GHG emission below 1995 levels by the year 2010.
North Vancouver CEEP	15 percent reduction in GHG emissions below 2007 levels by the year 2020 and a 50 percent reduction in GHG emissions below 2007 levels by the year 2050. The City also envisions being a net zero carbon community by its 200th birthday in 2107.
Guelph	Guelph will achieve energy use per capita and resulting GHG emissions that will be less than the current global average. Guelph's IEMOC study states that the community energy plan's goal is to reduce energy use per capita by 50 percent and GHG emissions per capita by 60 percent.
East Gwillimbury	50 percent and 70 percent reductions in GHG emission below business-as-usual scenarios by 2031 and 2051 respectively were set for the community.

5.1.4 Local Action Plan

All the case studies followed the PCP program guidelines and included in their community energy plans (or "Local Action Plans" as referred to by the PCP program) a list of current and proposed actions that would reduce their community GHG emissions as well as varying degrees of compliance in terms of an implementation strategy.

5.1.4.1 Actions

In terms of actions, transportation planning, building planning and design, and energy supply and distribution were identified by most of the case studies for GHG emissions reduction, energy conservation, energy efficiency, and/or renewable energy integration. Because the communities often proposed similar initiatives, a list of some of these actions from all the case studies is provided in table 12. The community energy plans of the City of North Vancouver and the Town of East Gwillimbury also proposed unique actions that were not found in the community energy plans of the other communities.

The City of North Vancouver was the only municipality that included urban agriculture and landscape strategy recommendations in its updated community energy plan. Specifically, the City proposed increasing urban trees and forests to improve carbon sinks as well as creating community gardening opportunities to reduce GHG emissions associated with food supply. The City's updated community energy plan also included unique "Low Zone Design Guidelines" that applied the sector specific recommendations in the community energy plan to three urban zones in order to maximize GHG emission reduction opportunities. The concept behind this approach is that GHG emission reduction opportunities are not uniform across the City and different urban zones therefore offer different opportunities to manage GHG emissions and energy. The specific urban zones outlined in the community energy plan include: urban centre zones; medium density, mixed-use oriented zones; and residential oriented zones.

The community energy plan of the Town of East Gwillimbury uniquely proposed the creation of a "Sustainable University" supplied by a district energy system. The institution would have, "… a curriculum tailored to the various technical, economic, commercial and institutional aspects of sustainable energy and climate planning" (Town of East Gwillimbury, 2009, p.43). It would also serve as a living laboratory and support a business incubation park focused on green products and services. One of the living laboratory opportunities would be a passive net-zero village in a low-density area of the community, which is another unique project that the community energy plan recommended creating. The Town would create a "Sustainable Overlay Zone" for a small-scale mixed-use village that would meet or exceed German Passive House Institute standards with the maximum amount of viable renewable energy supply possible. Furthermore, the Town was the only community that suggested registering its GHG emissions baseline and monitoring its reduction in order to be eligible for monetization opportunities in the carbon market. In particular, the community energy plan suggested creating an advisory team that would identify activities that have the highest probability of creating tradable GHG emissions credits.

The British Columbian community energy plans shared recommendations that were not found in the case studies in ON and vice versa. For example, since the Cities of Langley and North Vancouver were the only municipalities that included the waste sector in their GHG emissions baseline inventories, they understandably were also the only communities that included strategies to reduce GHG emissions from the waste sector in their recommendations. Moreover, the City of Langley's community energy plan and the

updated community energy plan of the City of North Vancouver listed senior government (federal, provincial and/or regional) policy and programs in their recommendation sections that would be useful to their communities in reducing their GHG emissions.

Guelph's and East Gwillimbury's community energy plans shared similar proposals to create new employment corridors with energy services tailored to specific commercial and industrial investors in order to create a reliable and lower cost energy service package as well as have a lower GHG emissions footprint due to increased efficiency of fuel use. Both communities suggested creating an energy distribution architecture that would allow for fuel choices that optimize cost, availability, and environmental impact. This recommendation would require energy zoning for high-density areas appropriate for district energy or developments configured in a manner that would allow them to be connected to a network in the future. Both community energy plans also recommended creating an integrated metering, billing and management network that would not only allow for the management of all energy forms, but also facilitate ongoing network integration.

Finally, both Guelph and East Gwillimbury shared the same approach to choosing the final recommendations in their community energy plans called "Scale Projects," through which many of their GHG emission reduction actions are to be implemented. Both municipalities examined success stories from the Unites States, Canada, and Europe in order to identify best practices they could adapt to their own communities. Examples of some of the types of best practices identified include: building efficiency in California;

civic leadership and community engagement in Austin, Texas; district energy systems in the City of Markham, Ontario and the City of North Vancouver, BC; and integration of energy efficiency, supply, and distribution approaches in Copenhagen, Denmark and Mannheim, Germany. In terms of Scale Projects, both municipalities recommended their implementation in order to accelerate the successful implementation of their community energy plans. These projects are typically in defined parts of the community, have clear boundaries, are large enough to address energy efficiency as well as energy and water supply, and may include high-density urban villages, industrial estates or commercial parks, greenfield smart growth, sports and recreation centres, transportation facilities, downtown revitalization, and academic campuses.

Table 12 A list of actions proposed to reduce GHG emissions in the community energy plans of the four case studies.

Urban Planning	Infrastructure	Other
Land use planning • Concentrate residential development and increase density around transit oriented hubs, nodes, and corridors with commercial areas developed in appropriate locations • Create denser, mixed-use neighborhoods that encourage walking, cycling and smaller cars • Decrease distance between residential, commercial, and employment zones *Urban design* • Create street and road designs that are attractive to active transportation modes and public transit use • Enhance transit stop comfort, accessibility, convenience and safety *Building planning/design* • Promote uptake of building granting programs or other incentives that encourage energy efficiency retrofits in existing buildings • Require higher energy efficiency standards, as well as pursue increasingly aggressive energy standards over time, in new building construction and existing building renovation • Establish energy performance certification requirements for new building construction and major renovations in existing buildings • Adopt an energy performance labelling process for buildings as a voluntary initiative • Develop a program aimed at improved compliance to energy standards – both provincial code and municipality standards • Encourage construction of mixed-use, high density, multi-unit buildings • Require new buildings to be solar hot water ready and develop policies and programs that make it easier for developers and building owners to incorporate solar hot water into new and existing buildings • Develop policies that promote the use of passive energy efficient design to minimize the lighting, heating and cooling demands of new buildings • Develop a sustainability checklist that city staff can use to assess new building applications • Require locker/bike storage requirements for new developments • Create pre-approved construction standards and recommended voluntary codes for Passive Housing *Transportation planning* • Strengthen infrastructure such as crosswalks, bulges, signage, street lighting, traffic calming, and connectivity across highways • Extend network of bicycle routes, lanes and paths • Have high volume routes for high quality cost-competitive light rail or low-impact buses • Create programs encouraging fuel efficiency in personal use vehicles • Implement pay parking to fund alternative transportation initiatives • Require infrastructure for plug-in electric vehicles • Ensure effective public transportation connecting to employment zones • Create multi-modal transportation hubs	*Waste* • Investigate the opportunity for a waste to energy facilities • Develop community programs on zero waste, the 3Rs, and moving towards a broader conservation ethic regarding consumption and materials • Expand food waste diversion opportunities • Work with the private sector to increase the diversion of construction and demolition materials from disposal • Ensure adequate supply of land is available for recycling collection and processing • Encourage and support establishing extended producer responsibility for waste and instituting packaging standards *Energy supply and distribution* • Implement or expand Community Energy Systems (incorporating district heating and cooling, cogeneration, waste heat recovery, thermal storage, and/or local sources of renewable energy) as a means of providing heating, cooling and/or power to multiple buildings in high-density areas • Encourage developers to pre-service for district energy systems • Create industrial development sites that offer tailored energy supply infrastructure suited for target investors in order to create a reliable and lower cost energy service package as well as have a lower GHG emissions footprint due to increased efficiency of fuel use • Create a municipal energy services company that can deliver a more integrated and wide portfolio of energy services (including electricity, gas, heating, and cooling) with sufficient flexibility to adapt as costs and technologies change and is structured to ensure the highest reliability, least cost and least environmental impact energy services of all types • Explore opportunities for cooling via absorption chilling or ice-storage techniques as well as solar photovoltaic, wind, biomass energy, waste heat in buildings	*Education and information* • Develop a clearing house that provides information, application support, and outreach to ensure that all available energy and water related incentives are publicized and used • Partner with neighborhood and community groups that can ensure local understanding and engagement of community energy plan initiatives • Local academic institutions of all levels can be an area of focus for education on multiple aspects related to the community energy plan and can serve as a means of educating the community as a whole • Use education as a transportation demand management tool in reducing single occupant vehicle trips • Use communications, social marketing and school programs to reduce energy use *Other* • Team with the commercial and industrial sector to ensure energy efficient process upgrades • Increase the quantity, diversity and quality of local jobs by encouraging the appropriate types of commercial building development • Create local employment in a live-work-play environment to reduce outbound commuting

5.1.4.2 Implementation plan

In terms of implementation plans, the PCP program advises details on costs, responsibilities, schedules, and funding sources as well as outlining plans to monitor the progress made towards the emissions reduction target and the implementation status of GHG reduction measures. None of the community energy plans of the case studies included all four of these elements in their community energy plans. Table 13 indicates what elements each municipality included in their plans.

Most communities estimated the cost of implementing their GHG emission reduction actions and had plans to monitor, measure, and/or report on their progress. In terms of the latter, the City of Guelph and the Town of East Gwillimbury shared the same approach; both communities not only had a set of specific measures by which they planned to monitor their progress against the specific goals set out in their community energy plans, but also planned to use Copenhagen, Denmark and Mannheim, Germany as communities they could benchmark the progress of their implementation against. Unlike the communities in ON, the Cities in BC included details on which departments and/or working groups would be responsible for implementing each recommendation as well as a preliminary schedule by which they intended to achieve certain goals or recommendations.

Table 13 Implementation plan elements in the community energy plans of the four case studies.

Implementation plan	Langley	North Vancouver LAP	North Vancouver CEEP	Guelph	East Gwillimbury
Costs		✓	✓	✓	
Responsibilities	✓	✓	✓		
Schedule	✓	✓	✓		
Plans to monitor, measure and/or report progress	✓			✓	✓

5.1.5 Engagement

The community energy plans of all the case studies relayed minimal information on the specific details of their engagement processes. A summary of the information provided is outlined in table 14. In general, all the communities made some sort of effort to engage with residents, community groups, and the private sector as recommended by the PCP program. All the communities except for the City of Langley created working groups to help create and/or implement their community energy plan.

Table 14 Engagement process information in the community energy plans of the four case studies.

	Engagement		
	Staff and/or Council	**Residents, private sector, community organizations, and stakeholders**	**Other participants**
Langley	Yes	• Posted its draft community energy plan with a survey on its website to gather comments and responses. • Had an Open House for the public to which commission members and community sustainability stakeholders were also invited.	Not specified.
North Vancouver LAP	Yes	• Completed a series of workshops as part of developing the LAP to obtain input and feedback from business groups and the general public.	Not specified
North Vancouver CEEP	Yes	• Conducted a workshop and two public open houses.	A Climate Action Task Force, CEEP Implementation Team, and Energy Efficient Buildings Working Group were created to support the implementation of the community energy and emissions reduction measures.
Guelph	Yes	• Carried out a number of public input meetings and workshops to provide information and gain input. • It is estimated that in total five hundred people participated in the engagement process.	A consortium was formed to proactively develop the community energy plan. Its members included city staff, academia, business, gas and electric utilities, and other community groups. It also had a balance of local and global expertise.
East Gwillimbury	Yes	• Held two meeting with a local developer group in preparation of the community energy plan recommendations. • Held an information sharing and discussion workshop open to the public.	The process of creating the community energy plan was started with a team including representatives from the Town, Enbridge Gas Distribution, and Hydro One. The team was familiar with European, American and Canadian practices.

5.1.6 Deviations from the PCP program

The community energy plans of the four case studies deviated from the CEP guidelines of FCM's and ICLEI's PCP program in regards to setting a GHG emissions reduction target as well as creating an implementation plan. All the case studies set different community GHG emission reduction targets from each other as well as from the PCP program's recommendation of a community-wide GHG emissions reduction target of six percent below baseline year GHG emissions within 10 years. The PCP program guidelines could be too prescriptive in this community energy plan component, as the case study communities set GHG emissions reduction targets based on a number of community-specific variables including the GHG emissions reduction potential of their actions chosen implementation, overall community vision, and internal, stakeholder and public engagement. In terms of the implementation strategy component, all the case studies were lacking in one or more of the requirements. A potential reason for this may be the fact that local governments are required to create an organizational structure to oversee the community energy plan as well as review all their actions in the fourth milestone of the program. Therefore, some of the implementation strategies may be further developed later in the CEP process.

Other deviations from the PCP program were observed in the community energy plans of the case studies in ON. The Ontarian communities did not include the waste sector in their baseline GHG emissions inventories or forecast business-as-usual GHG emissions. As a result, the communities in BC appear to have followed the PCP program guidelines on how to create community energy plans more closely than the municipalities in ON. A

summary of all the PCP program guidelines for creating a community energy plan compared to the community energy plans of the four case studies is provided in table 15.

Table 15 Summary of the PCP program guidelines compared to the community energy plans of the four case studies.

PCP guidelines	Langley	North Vancouver LAP	North Vancouver CEEP	Guelph	East Gwillimbury
All required baseline sectors in GHG emissions inventory	✓	✓	✓	No	No
All required building baseline sectors in GHG emissions inventory	✓	✓	✓	No	✓
All required transportation fuels in GHG emissions inventory	✓	✓	✓	✓	Not specified
GHG emission baselines calculated with appropriate methods	✓	✓	✓	✓	✓
Business-as-usual GHG emissions forecasted	✓	✓	✓	In IEMOC study	No
GHG emission reduction target created	✓	✓	✓	✓	✓
Guidelines followed for setting GHG emission reduction	Different percent reduction & timeframe	Different percent reduction & timeframe	Different percent reduction & timeframe	Per capita target and different timeframe	Per capita target and different time frame
List of current and proposed actions to reduce GHG emissions in Local Action Plan	✓	✓	✓	✓	✓
All four implementation plan elements included	No	No	No	No	No
Engagement with residents, community groups, and the private sector	✓	✓	✓	✓	✓

Each case study also included an array of other information in their community energy plans that was not prescribed or recommended by the PCP program. In general, all the community energy plans provided background information on GHG emissions, climate change and/or energy as well as a situational analysis of their community and/or its local context in regards to CEP. The communities in ON, unlike those in BC, provided information about the water profile of their communities as well as a list of specific benefits that arise from CEP for a number of community sectors and groups of people. The City of Guelph was the only community to list its "community assets in community related areas" i.e. individuals, physical structures, natural resources, institutions, businesses and informal organizations that exist within the community. A summary of all the extra information that each municipality included in its community energy plan is indicated in table 16.

Table 16 Other information in the community energy plans of the four case studies.

Other background information in the community energy plan	Langley	North Vancouver LAP	North Vancouver CEEP	Guelph	East Gwillimbury
GHG emissions, climate change, and/or energy	✓	✓	✓	✓	✓
Actions, agreements, legislation and/or policy of senior levels of government and/or international bodies pertaining to climate change and/or energy	✓		✓	✓	✓
Situational analysis and/or local context	✓	✓	✓	✓	✓
Community-wide vision and/or goals			✓	✓	✓
Sector/actor/group specific benefits that arise from implementing community energy plan				✓	✓
List of individuals, physical structures, natural resources, institutions, businesses and informal organizations that exist within the community in energy related areas				✓	
External financial incentives, funding sources and/or support identified		✓		✓	✓
Water use				✓	✓

5.2 Community energy planning definition vs. case study community energy plans

A review of the CEP documents of the four case studies, compared to the contemporary definition of CEP in section 3.4.1, revealed that the City of North Vancouver's Community Energy and Emissions Plan (CEEP) most closely fit the contemporary definition of CEP. North Vancouver's CEEP was followed by the City of Langley's Community Energy and GHG Emissions Plan, the City of Guelph's Community Energy Plan, and both the Town of East Gwillimbury's Community Energy Plan and the City of

North Vancouver's Local Action Plan (LAP) respectively. A summary of how each case study compared to the definition is provided in table 17.

The contemporary definition of CEP specifies that a baseline community inventory of primary energy consumed and anthropogenic GHG emissions produced be created. None of the case studies determined the amount of primary energy consumed in their communities. Instead, an inventory of the consumption of the output of primary energy conversion (secondary energy) was provided i.e. electricity, natural gas, and transportation fuel use. However, all the case studies satisfied the definition's requirement of developing a community baseline inventory of anthropogenic GHG emissions produced.

In terms of developing a baseline community inventory of anthropogenic GHG emissions by taking into account all community sectors and subsectors that produce anthropogenic GHG emissions in significant amounts, only the Cities in BC met this requirement. These case studies were also the only communities that developed the baseline community inventory of anthropogenic GHG emissions by taking into account all types of secondary energy consumed in significant amounts as well.

The case studies in ON did not include the community waste sector. The City of Guelph only included one transportation subsector in its baseline, which is inadequate as there are many types of vehicles that consume fuel and emit GHG emissions in a community. The Town of East Gwillimbury did not provide any details about the specific data or

subsectors used in its transportation sector baseline so a comparison could not be made in that case. This was also the case for the City of North Vancouver's LAP, which did not include details about specific data, subsectors, or methods of baseline GHG emissions estimation.

The contemporary definition of CEP specifies that short, medium, and long-term business-as-usual community forecasts be created for the primary energy that would be consumed and anthropogenic GHG emissions that would be produced. These consumption and emission forecasts should take into account, at a minimum, information about population and economic growth. None of the case study communities created a forecast of primary energy that would be consumed. Instead, the Cities in BC created business-as-usual community forecasts of secondary energy that would be consumed and anthropogenic GHG emissions that would be produced based on population and economic growth assumptions. The City of North Vancouver's LAP however only used a short to medium timeframe and population growth assumptions in its forecasts. Taking into account Guelph's IEMOC study, the City would have met the business-as-usual GHG emissions forecast and estimation requirements.

The case studies did not provide details in their community energy plans about their specific engagement processes or the specific participants that were involved. Accordingly, it was difficult to assess if the case studies met the definition of CEP's expectations in terms of engagement, which includes at a minimum: an internal advisory group of City staff, council and pertinent boards and broad engagement across

departments and divisions; a stakeholder group consisting of relevant advocacy groups, businesses, industry, utilities, and educational institutions; and a few community-wide meetings. Although all the case studies had some degree of internal engagement, they did not specify if there were any internal advisory groups involved or if there was broad engagement across departments and divisions. Only the City of Guelph's community energy plan met the definition's expectations in terms of stakeholder engagement by providing details about the specific participants in its consortium. Nevertheless, all the communities held some sort of community-wide engagement meeting open to the public and therefore met that particular CEP definition engagement criterion.

The definition of CEP requires a long-term vision(s), goal(s), and/or target(s) be set for a sustainable energy future that would encompass, among other things, a reduction of non-renewable source primary energy consumption and anthropogenic GHG emissions production as well as more energy conservation and efficiency. Both the City of Langley and the City of North Vancouver's LAP set a community-wide reduction target for GHG emissions. The City of North Vancouver's CEEP, besides setting a community-wide GHG emissions reduction target, outlined a long-term vision of becoming a net zero community through a "Low Carbon Energy and Emissions Path" and outlined two community goals that encompass all three pillars of sustainability. Similarly, the communities in Ontario set a long list of goals for more energy conservation, energy efficiency, and renewable energy as well as GHG emissions reduction that also addressed environmental, economic, and social considerations. However, since the contemporary definition of CEP requires that visions(s), goal(s), and/or target(s) be developed from

taking into account at a minimum a baseline community inventory, business-as-usual forecast, and the engagement process, only the City of North Vancouver met all the requirements for this component.

Consistent with the contemporary definition of CEP, all the case studies had actions and implementation strategies in their community energy plans that included GHG emissions reduction, energy conservation, energy efficiency and/or renewable energy integrated with urban planning and infrastructure measures. However, only the City of North Vancouver's CEEP met the definition's requirements of choosing the actions and implementation strategies based on the baseline community inventory, business-as-usual forecasts, public engagement, long-term reduction vision(s), goal(s), and/or target(s), and methods of comparing and ranking actions. The City of Langley made these decisions based on the GHG emissions reduction potential of each action, while the City of Guelph and Town of East Gwillimbury relied on their working groups and/or stakeholder engagement. North Vancouver's LAP made reference to using its baseline forecast and public engagement, but methods of comparing and ranking were not specified.

Table 17 A comparison of the four case studies compared to the components of the contemporary definition of CEP.

Components	Langley	North Vancouver LAP	North Vancouver CEEP	Guelph	East Gwillimbury
1.a.	No	No	No	No	No
1.b.	✓	✓	✓	✓	✓
1.c.	✓	Unknown	✓	No	No
1.d.	✓	Unknown	✓	✓	Unknown
1.e.	✓	Unknown	✓	✓	✓
2.a.	No	No	No	No	No
2.b.	✓	Yes, but only a short to medium forecast timeframe.	✓	Only in IEMOC study.	No
2.c.	✓	No	✓	Only in IEMOC study.	No
3.a.	Internal engagement, but advisory group and broad engagement not specified.	Internal engagement, but advisory group and broad engagement not specified.	Internal engagement, and potential advisory group, but members and broad engagement not specified.	Internal engagement through consortium, but advisory group and broad engagement not specified.	Internal engagement, but advisory group and broad engagement not specified.
3.b.	Stakeholder engagement, but group not specified.	Not specified.	Stakeholder engagement, but group not specified.	✓	Stakeholder engagement, but group not specified.
3.c.	✓	✓	✓	✓	✓
4.a.	Only set a GHG emissions reduction target.	Only set a GHG emissions reduction target.	✓	✓	✓
4.b	No	Not specified.	✓	No	No
5.a.	✓	✓	✓	✓	✓
5.b.	The GHG emissions reduction potential of each action was determined, but other factors were not specified.	Reference to baseline forecast and public engagement, but methods of comparing and ranking not specified.	✓	Reference to public engagement, but methods of comparing and ranking not specified. No forecast was created.	Reference to public engagement, but methods of comparing and ranking not specified. No forecast was created.

5.3 Implementation of case study community energy plans

Interviews with the key municipal officials in charge of administering the community energy plans in the four case studies relayed different degrees of accomplishment in implementing the actions outlined in their community energy plans. In terms of the City of Langley, 19 out of 68 greenhouse gas (GHG) emission reduction initiatives identified in its Community Energy and GHG Emissions Plan were implemented or were being worked on (personal communication, May 1, 2012). The City of North Vancouver, on the other hand, had implemented initiatives under all the energy objectives of its GHG Local Action Plan (LAP) and was planning to delve even deeper into each of the actions with its updated Community Energy and Emissions Plan (CEEP) (personal communication, May 7, 2012). Similarly, the City of Guelph was active on all 11 of the sub-targets outlined in its Community Energy Plan and had completed a few projects (personal communication, May 16, 2012). The Town of East Gwillimbury was at the very early stages of implementation and was "picking away" at the list of action in its Community Energy Plan (personal communication, June 19, 2012).

All the case studies had successfully implemented at least a few of the CEP actions. Specifically, the City of Langley noted success in the new building sector with the implementation of a sustainability checklist that all development applications must complete, the creation of homes by developers equivalent to LEED standard buildings, and potentially a feasibility study in the near future regarding community energy systems (personal communication, May 1, 2012). Other areas of success included two major transportation studies the City has partnered on, which examine options that would

provide the area with rapid transit as well as the development of a transit exchange plan with a neighboring municipality (personal communication, May 1, 2012).

Guelph made strides in updating its Official Plan and creating a secondary plan for its downtown that redefines how the city will grow with more intensification and efficient nodal transportation designs (personal communication, May 16, 2012). The City also accelerated its renewable energy development plans by applying for about 60 megawatts of solar photovoltaic and combined heat and power (cogeneration) to the Ontario Power Authority, which is very close to its 15 year target (personal communication, May 16, 2012). The Town of East Gwillimbury updated its Official Plan to codify and put into place policies to implement its community energy plan recommendations. Additionally, similar to the Merton Rule[31], the City examined the feasibility of requiring new developments to incorporate 10% of their energy needs from renewable sources (personal communication, June 19, 2012). These CEP actions as well as some of the other community initiatives the case studies have implemented, or are working on, are listed in table 18.

[31] The London Borough of Merton, in England, developed "The Merton Rule" policy, which is written as follows: "The council will encourage the energy efficient design of buildings and their layout and orientation on site. All new non residential developments above a threshold of 1,000sqm will be expected to incorporate renewable energy production equipment to provide at least 10% of predicted energy requirements" (Merton Council, n.d.)

Table 18 Community actions that have or are being worked on in the four case studies.

Municipality	Actions that have or are being worked on
Langley	• Is a partner in the Surrey Rapid Transit Alternatives Analysis Study with TransLink (the regional transportation authority), City of Surrey, and Ministry of Transportation and Infrastructure • Developed a Sustainability Checklist for new development applications in consultation with development industry • Adopted and implemented Solar Hot Water Ready Regulations. • Implemented new BC Building Code requirement for low flow plumbing fixtures • Replaced aging water meters with newer more accurate units • Completed a bridge project to reduce traffic congestion • Added bicycle lanes to a few areas • Optimized traffic signal timing on two streets • Implemented larger blue boxes for recycling • Planted 60 boulevard trees and 3,048 seedlings
North Vancouver	• Is a partner in an outreach program with the City of Vancouver Sustainability Office to promote LiveSmart BC residential efficiency incentive programs • The Lonsdale Energy Corporation's district heating system continues to expand as new residential buildings are constructed • Developed Sustainable Development Guidelines based loosely on the LEED criteria for developers • Adopted a density bonussing bylaw that ensures that higher energy efficiency standards are secured for all new homes and buildings • Created a comprehensive 20 year multi-modal Transportation Plan placing emphasis on enhancing pedestrian routes, greenways and bike corridors, and improving accessibility to transit • Adoption of a Zero Emission Vehicle Bylaw that allows electric vehicles on some City roads • Implemented an Anti-Idling bylaw • Provided a number of out reach programs to the community: Climate Change Showdown, Park & Environment Grant Program, Sustainable Transportation Grants, and Climate Smart • Added a community garden
Guelph	• Updated its Official Plan and its downtown Secondary Plan to accommodate growth with more intensification and efficient nodal designs for transportation. • Have applied to the Ontario Power Authority for about 60 megawatts of solar photovoltaic and combined heat and power and cogeneration energy projects. • Upgraded its Wastewater Treatment Plant to serve as a cogeneration facility for power production
East Gwillimbury	• Updated its Official Plan to accommodate the implementation of actions in its Community Energy Plan • Examined the feasibility of requiring new developments to incorporate 10% of their energy needs from renewable sources • Continued to implement its existing green building policy that requires all new residential developments to be built to ENERGY STAR standards • Implemented a policy that requires buildings within the institutional-commercial-industrial sector be built at efficiencies 40 percent greater than the National Building Code

In terms of planned actions that had not yet been implemented, the City of Langley expressed difficulties being able to influence energy efficiency and conservation in the community's existing building sector, but acknowledged that other municipalities in the lower mainland of BC had been more successful in this area (personal communication, May 1, 2012). A lack of resources, both in staff time and funding, to conduct outreach programs was identified as the reason why the City could not make changes in this sector (personal communication, May 1, 2012). In general, the City explained that it is a small community with a lean administration. Therefore, some of the employees at City Hall have to work on the CEP initiatives "off the side of their desks" (personal communication, May 1, 2012). Accordingly, although the City of North Vancouver successfully implemented all of the initiatives under the energy objectives of its community energy plan, it too stated that no comprehensive building retrofits had been completed and that it intends to address this issue with its updated plan (personal communication, May 7, 2012).

The Town of East Gwillimbury expressed difficulties in finding opportunities to implement the district energy systems as called for in its community energy plan. In particular, the Town explained it had yet to secure significant new development partners in terms of an institution or a major employer, which would give it the impetus to get started on the initiative (personal communication, June 19, 2012). The other general barriers described by the Town include a lack of legislative background, in for example, the *Planning Act* or the *Provincial Policy Statement* as well as some pushback from the development industry in the region that seem interested in building business-as-usual

(personal communication, June 19, 2012). The Town found addressing the greatest contributor to the community's GHG emissions baseline, the transportation sector, to be a challenge (personal communication, June 19, 2012). Specifically, many people commute outside of the Town for jobs and it has been difficult securing new offices and industrial uses in the community because of the Town's location to the Greater Toronto Area, a lack of servicing, and the general state of the economy (personal communication, June 19, 2012).

Since the City of North Vancouver implemented all the energy objectives of its LAP, it provides insight into some of the potential factors for success. In particular, the City relayed that some of its CEP work was and continues to be facilitated through partnerships with community groups that run educational outreach (personal communication, May 7, 2012). Moreover, not only is there support from all staff and departments including high level managers, but many of the City employees are also highly skilled and qualified as well as interested in working on the community energy projects (personal communication, May 7, 2012). The City of Guelph also attributed much of its success to partnerships within the community, but also highlighted that provincial programs, such as the Ontario Power Authority's Feed-in Tariff and Clean Energy Standard Offer programs[32], provided the City with opportunities to move forward with its community energy plan (personal communication, May 16, 2012).

[32] The Ontario Power Authority's Clean Energy Standard Offer Program was created from a Ministry of Energy directive to procure combined heat and power projects of 20 megawatts capacity or less, "… limited to cost-effective projects located in areas of the province where they can be accommodated in the local distribution system and where there are local benefits" (Ontario Power Authority, n.d.).

Although all the municipalities were in the process of implementing their community energy plans, they were still able to identify factors that could potentially help them be more successful. The City of Langley relayed that funding from the Province of British Columbia (PoBC) both directly through its ministries and indirectly through its crown corporations, such as BC Hydro, could help move their community energy plan forward (personal communication, May 1, 2012). For example, BC Hydro used to provide grants for partial funding of temporary community energy managers and for community energy system studies, but the programs have since been cut back due to funding constraints (personal communication, May 1, 2012). The City of Langley also explained that the PoBC had yet to provide the City with its updated CEEI inventory for 2010, although it did expect that the province would be releasing it in the near future albeit later than originally promised[33] (personal communication, May 1, 2012). The City of North Vancouver echoed the need for greater support, by explaining that attaining more financial aid from senior levels of government in the form of programs could help reinforce the City's CEP actions (personal communication, May 7, 2012).

The City of Guelph indicated two main areas in which they could use more support. First, although the City has community groups that are doing a lot of good work, it relayed that more could be done to build a strong grass roots community-based momentum towards the targets in its community energy plan (personal communication, May 16, 2012). In particular, the scale of change that the City wants to achieve is more ambitious than the status quo and it thus needs support from other parties to help meet the gap in expectations (personal communication, May 16, 2012). Much like the Cities of Langley

[33] Since the interview with the City of Langley was conducted, the province released Draft 2010 CEEI initiative reports on June 20, 2012.

and North Vancouver, the City of Guelph highlighted inadequacies in terms of programs from its provincial government. Specifically, the City emphasized that there is more to CEP than basic energy conservation measures such as encouraging efficient lighting – it is also about factors such as infrastructure, local generation and city design. The energy conservation programs the Province mandates are delivered through local utilities, such as Guelph Hydro, falls below the City's ambitions for efficiency (personal communication, May 16, 2012). Although the Province is trying to manage a provincial energy grid, it does not fully understand what each community specifically needs to conserve more and this disconnect between the objectives of both levels of government is difficult to sort out (personal communication, May 16, 2012).

Finally, the Town of East Gwillimbury highlighted the need for a greater degree of political leadership at all levels – local, regional and provincial (personal communication, June 19, 2012). It went on to commend the City of Guelph for its leadership in CEP. East Gwillimbury has been able to learn a lot from what Guelph has been able to do (personal communication, June 19, 2012). From participating in an ongoing municipal working group of the Quality Urban Energy Systems of Tomorrow (QUEST) Ontario Caucus[34], created and chaired by Guelph's Community Energy Manager, the Town explained that a lot has been learned from collaboration with other municipalities that are doing CEP (personal communication, June 19, 2012). By participating in the network, East Gwillimbury believes that it will learn from past mistakes and successes, which will

[34] The QUEST Ontario Caucus was established in spring 2009 with a three-fold role: raising awareness about the QUEST idea; networking and creating connections; and developing activities to enable QUEST action (Leach and McNally, 2009). It includes a coalition of municipalities, the energy sector, non-governmental organizations, and the provincial government (Leach and McNally, 2009).

provide guidance to the Town and enable it to move forward with its community energy plan (personal communication, June 19, 2012).

6. State of practice of community energy planning in Canada

6.1. Summary of study results

By exploring its definition, reasons for implementation, and differences between its theory and practice, the state of practice of community energy planning (CEP) in Canada was assessed. Its original conceptualization as well as how it has been characterized in practice were studied in order to develop a contemporary definition of CEP. A comparison of the contemporary definition of CEP to the approaches in practice was conducted to determine which specific approach to CEP had the potential to produce the best results. Local governments engaged in CEP in Canada were identified and four case studies were chosen from the sample in order to understand the specific community motivations and broad legislative and policy drivers for CEP in British Columbia (BC) and Ontario (ON). Differences between CEP theory and practice were explored by comparing the community energy plans of the four case studies to the guidelines of the approach they chose to implement and to the contemporary definition of CEP. The successes and problems the case study communities have had in the implementation of their community energy plans were also explored.

The original concept of CEP has been outstripped by its practice over the last decade and a half. Since Jaccard et al. (1997) first released their cornerstone paper, three streams of CEP emerged in practice – community energy plans, integrated community energy solutions, and integrated community energy mapping. Half-a-dozen different guides, toolkits, and programs were also developed in the stream of CEP based on creating a community energy plan, each promoting its own approach. Although none of the streams

of CEP fully satisfied all the components of the contemporary definition of CEP, the Federation of Canadian Municipality's (FCM's) and ICLEI – Local Governments for Sustainability's (ICLEI's) Partners for Climate Protection (PCP) program was identified as the most compatible approach and thus a best practice in CEP.

In terms of local governments engaged in CEP in Canada, as of May 18th, 2012, 228 communities were in the PCP program, four municipalities had completed an integrated community energy mapping study, and four rural municipalities were identified as participants in BC Hydro's QuickStart initiative. A number of environmental, economic, and social motivations were identified by the case studies in BC and ON as reasons for initiating their CEP exercises. Two motivations shared between all the case studies, and thus both provinces, were climate change and managing population growth. The Cities in BC shared one other common motivation of sustainability, whereas the communities in ON shared the motivation of energy security or reliability.

Further, the case studies suggested that provincial climate change as well as growth management related legislation and policy, in BC and ON respectively, were key drivers for initiating CEP exercises. A top-down approach was apparent in BC where the Province gave specific directives to local governments to develop GHG emissions reduction targets, policies, and actions in their official community plans. Whereas in the Greater Golden Horseshoe area of Southern ON, the creation of community energy plans appeared to be driven by local governments striving to achieve directives in regards to where and how their future development and population growth could occur as well as

vague Official Plan policy requirements in terms of water and energy conservation, alternative energy supply, and integrated waste management.

In terms of the examination of theory versus practice, the community energy plans of the four case studies compared to the PCP program guidelines as well as the contemporary definition of CEP revealed CEP in practice deviated from its theory. The case studies differed from the PCP program guidelines in terms of setting community-wide GHG emissions reduction targets as well as in the fullness of their implementation plans. They also fell short of achieving some of the components of the contemporary definition of CEP due to: a lack of primary energy considerations; their engagement processes; and how vision(s), goal(s) and/or target(s) as well as implementation strategies were chosen.

Putting their community energy plans into practice, all the case studies implemented at least a few CEP actions. The City of North Vancouver, which had the most time to implement its community energy plan, had the most success in implementation attributing much of its accomplishment to its community partnerships as well as the skills and knowledge of its staff and departments. The latter theme was also echoed by the City of Guelph for its success. Programs administered under the Ontario Power Authority also facilitated Guelph's renewable energy projects. The City of Langley identified a lack of resources and funding as barriers to the implementation of its community energy plan while the Town of East Gwillimbury acknowledged a lack of development partners and CEP related legislation as problems. All the communities identified support from higher levels of government as important to achieving success in implementation.

Overall, the compliance with CEP theory demonstrated in the Cities of North Vancouver and Langley compared to the City of Guelph and Town of East Gwillimbury may be attributed to the nexus of support in BC for CEP. The Community Energy Association (CEA), the Province of British Columbia (PoBC) in collaboration with the CEA, and BC Hydro developed a toolkit for CEP, a guide for creating a community energy plan, and programs to support and fund the process, respectively, for communities specifically in BC. The PoBC also created the Community Energy and Emissions Inventory (CEEI) initiative to take the burden off local governments in developing community energy and GHG emissions baseline inventories. A legislative and policy framework centred on climate change mitigation further supported all these actions by providing local governments with directives to reduce their GHG emissions and more authority to use planning tools for CEP.

In ON, communities did not have nearly as much support for CEP. Besides the Integrated Community Energy Mapping for Ontario Communities (IEMOC) study, no CEP guides, toolkits, or programs were specifically tailored for communities in ON. Instead, local governments in Southern ON pursued CEP as a method of achieving growth management related directives from the Province of Ontario. The development of renewable energy projects in their community energy plans however was facilitated through other legislation unique to the province. This bottom-up approach to CEP was further exemplified by the municipal working group of QUEST Ontario that was not only

initiated by the City of Guelph, but also brought together other local governments interested in collaboratively accelerating the implementation of CEP in ON.

6.2 Strategies for success

6.2.1 Recommendations for educational institutions and professional organizations

Since none of the CEP streams, or approaches, to making a community energy plan, or case studies fully met the synthesized definition of CEP, the results of the study suggest that a better understanding of CEP is needed in Canada. Specifically, a general knowledge of CEP and its connection to sustainability is needed by society as a whole. One way to enable this change would be for educational institutions and professional organizations in the realm of urban planning and infrastructure to provide classes, workshops, and/or seminars on CEP. This would ensure that future and current policy makers, urban planners, engineers, developers, and others would have the opportunity to not only gain an understanding of CEP, but also potentially develop skills to actively engage in its implementation.

6.2.2 Recommendations for provincial and territorial governments

The case studies have demonstrated that community energy plans that are more compatible with the synthesized, contemporary definition of CEP may be created as a result of a top-down provincial policy framework that encourages local governments to engage in CEP. Through legislation, policy, and programs, provincial and territorial governments across Canada should provide the direction, incentives, and financial support that create the conditions for the development and implementation of community

energy plans in accordance with the contemporary definition of CEP in section 3.4.1.

Specifically, provincial and territorial governments should:

1. *Provide local governments with planning tools to encourage CEP:* Planning legislation should be amended giving local governments the explicit authority to use planning tools to encourage renewable energy production, energy demand-side management, and GHG emissions reduction. As exemplified in BC, the authority to provide exemptions from parking requirements and development cost charges as well as to establish development permit areas to achieve these goals is fundamental to CEP. With explicit authority to use these planning tools for CEP, local governments would have more power when negotiating with developers who want to build business-as-usual.

2. *Develop baseline community inventories for each local government:* An initiative similar to the PoBC's CEEI should be created that regularly produces baseline community inventories for local governments in order to support and accelerate their CEP process. Senior levels of government should work with utilities, vehicle registration bodies, waste management facilities, and others to create a formal process that provides communities with their primary energy use and anthropogenic GHG emissions production information. This would not only offload work that local governments may not have the time or resources to accomplish, but it would provide more accurate results for communities that would otherwise use estimates instead of actual data in their calculations.

3. *Set standards for defining customers consistently between different energy utilities*: Creating a formal process that provides communities with primary energy use and anthropogenic GHG emissions production information would be facilitated and data accuracy issues would decrease if provincial and territorial standards were set in defining customers consistently between different energy utilities. For example, since local level policies are generally applied on a spatial basis and because different community sectors generally require specific strategies to reduce their primary energy use and anthropogenic GHG emissions production, customers could be defined according to typical land use planning sectors, which would support the development and application of sector specific policy to achieve CEP vision(s), goals(s), and/or target(s).

4. *Mandate and support the industrial sector to perform energy audits:* The amount of primary energy an industrial facility consumes and anthropogenic GHG emission it produces not only depends on its building, but also on the industrial processes of its operations. Utility data alone therefore would not be useful for this sector in developing meaningful reduction vision(s), goals(s), and/or target(s) and successful actions and implementation strategies. With information from energy audits the large industrial sector could potentially take measures to

maximize its energy performance.

5. *Develop legislation that supports a Feed-in tariff system and smart grid:* Legislation similar to Ontario's *Green Energy and Economy Act* should be pursued to enable the development of initiatives that support renewable energy projects at the local level. This will facilitate an active approach in reducing the consumption of non-renewable sources of primary energy and thus potentially start moving communities towards using more reliable and benign energy sources.

6.2.3 Recommendations for the Partners for Climate Protection Program

Although the PCP program is the most compatible approach to the synthesized, contemporary definition of CEP, the program could be changed to better capture all the required components of a community energy plan as outlined by the contemporary definition of CEP. Since none of the case study communities followed the PCP program's recommendations of setting an emission reduction target of six percent below the baseline year within 10 years, this may suggest that the program does not fully meet the needs of the local governments that try to use it to engage in CEP. Taking into account community specific factors such as business-as-usual forecasts (based on population and economic growth) and public engagement, as required by the synthesized, contemporary definition, may be a more practical approach for setting an emission reduction vision(s), goals(s), and/or target(s). This may be especially true for communities like the Town of East Gwillimbury that expect to significantly increase their population and perform greenfield development.

6.2.4 Recommendations for local governments

In order to ensure the successful implementation of community energy plans, lessons from the City of North Vancouver's success should be taken into account. Specifically, community partnerships should be pursued to leverage time and resources in

implementing CEP actions. Hiring employees that have knowledge and skills relevant to CEP may also be advantageous.

6.3. Concluding remarks

Although CEP in Canada can be improved in areas such as theory, policy, and implementation, the current state, as a whole, demonstrates many factors needed to shift the practice to be more compatible with the contemporary definition of CEP. The organizations that currently promote approaches to CEP provide a starting point for providing literature and programs, and advocate for change. The PoBC provides an example to other provincial and territorial governments in using legislation and policy to support local governments in their CEP exercises. The communities that have engaged in CEP provide practical experience and knowledge to share lessons learned. In effect, there is a wealth of opportunity and potential in the current state of practice of CEP that if harnessed, while attempting to address the recommendations in the subsection above, will provide communities with the tools to better achieve sustainability goals at the local level.

Reference List

Anderson, C. W. (1971). Comparative policy analysis: The design of measures. *Comparative Politics*, 4(1), 117-131.

Ayres, R. U. and Ayres, L. W. (2002). *A handbook of industrial ecology*. Cheltenham, UK: Edward Elgar Publishing Limited.

Bassett, E. and Shandas, V. (2010). Innovation and climate action planning. *Journal of the American Planning Association*, 76(4), 435-450.

BC Hydro. (n.d.a). Community Energy & Emissions Planning. Retrieved from: http://www.bchydro.com/powersmart/ps_communities/ceep.html

BC Hydro. (n.d.b). Community Energy and Emissions Planning for Smaller Communities. Retrieved from: http://www.bchydro.com/etc/medialib/internet/documents/power_smart/sustainable_communities/ceep_quickstart_brochure.Par.0001.File.ceep_quickstart_brochure.pdf

BC Hydro. (2010). Terms of Reference. Community Energy and Emissions Plan: Program Description.

Bennett, C. (1996). Comparative policy studies in Canada: What state? What art? In L. Dobuzinskis, M. Howlett, and D. H. Laycock (Eds.), *Policy studies in Canada: the state of the art*. Toronto: University of Toronto Press.

Canada Mortgage and Housing Corporation. (1999). Community Energy Management: Foundation Paper. (Cat. no. NH15-331/1999E). Retrieved from: https://www03.cmhc-schl.gc.ca/catalog/productDetail.cfm?cat=123&itm=56&lang=en&fr=1321313053809

Canadian Urban Institute. (2010). City of Guelph: Integrated Energy Mapping Strategy. Retrieved from: http://www.canurb.org/sites/default/files/projects/2010/405_EnrgyMpng/Guelph_Final_IEMS_Aug2010.pdf

Canadian Urban Institute. (2011). Integrated Community Mapping for Ontario Communities: Lessons Learned Report. Retrieved from: http://canurb.org/sites/default/files/projects/2010/405_EnrgyMpng/IEMOC%20Lessons%20Learned%20-%20Nov%202011.pdf

City of Guelph. (n.d.a). Demographics. Retrieved from: http://www.guelph.ca/communityprofile/demographics.html

City of Guelph. (n.d.b). About Guelph: Introduction. Retrieved from: http://www.guelph.ca/communityprofile/intro.html

City of Guelph. (n.d.c). Guelph's Community Energy Initiative. Retrieved from: http://guelph.ca/living.cfm?subCatID=1831&smocid=2407

City of Guelph. (2007). Community Energy Plan. Retrieved from: http://guelph.ca/uploads/ET_Group/admin/CEP_report_web.pdf

City of Langley. (n.d.). About Langley. Retrieved from: http://www.city.langley.bc.ca/index.php/discover-langley/about-langley

City of Langley. (2009). Statistical Profile. Retrieved from: http://www.city.langley.bc.ca/images/Profile/statistical_profile.pdf

City of Langley. (2010). Community Energy and GHG Emissions Plan. Retrieved from: http://www.city.langley.bc.ca/images/Reports/community_energy_plan.pdf

City of North Vancouver. (n.d.a). Community profile. Retrieved from: http://www.cnv.org/server.aspx?c=3&i=254

City of North Vancouver. (n.d.b). Partners for Climate Protection (PCP) Program. Retrieved from: http://www.cnv.org//server.aspx?c=3&i=440

City of North Vancouver. (2005). Greenhouse Gas Local Action Plan. Retrieved from: http://www.cnv.org/c//DATA/3/496/GREENHOUSE%20GAS%20LOCAL%20ACTION%20PLAN.PDF

City of North Vancouver. (2009). City of North Vancouver 2009 Community Profile Release 1 – Data Inventory. Retrieved from: http://www.cnv.org/c//data/3/254/Community%20Profile%202009%20-%20Release%201%20-%20Data%20Inventory.pdf

City of North Vancouver. (2010a). Community Energy and Emissions Plan. Retrieved from: http://www.cnv.org/c//DATA/3/591/COMMUNITY%20ENERGY%20AND%20EMISSIONS%20PLAN.PDF

City of North Vancouver. (2010b). Corporate and Community Update for Greenhouse Gas Emissions Reduction and Monitoring: FCM/ICLEI Partners for Climate Protection Program "Milestone 5." Retrieved from: http://www.fcm.ca/Documents/reports/PCP/The_City_of_North_Vancouvers_Corporate_and_Community_Update_for_Greenhouse_Gas_Emissions_Reduction_and_Monitoring_EN.pdf

City of Whistler. (n.d.). Community Charter and Local Government Act. Retrieved from: http://www.whistler.ca/residents/about/community-charter

Cohen, D. and Crabtree, B. (2006). Qualitative research guidelines project. Retrieved from: http://www.sswm.info/sites/default/files/reference_attachments/COHEN 2006 Semistructured%2 0Interview.pdf

Cohen, N. (2011). *Green cities: An A-to-z guide.* Los Angeles, CA: Sage Publications Inc.

Cohen-Rosenthal, E. and Musnikow, J. (2003). *Eco-industrial strategies: unleashing synergy between economic development and the environment.* Sheffield, UK: Greenleaf Publishing Limited.

Community Energy Association. (n.d.). About the Community Energy Association. Retrieved from: http://www.communityenergy.bc.ca/about-the-community-energy-association

Community Energy Association. (2006). A Toolkit for Community Energy Planning in British Columbia. Retrieved from: http://www.communityenergy.bc.ca/community-energy-planning-toolkit-rev-2006

Community Energy Association and Province of British Columbia. (2008). Community Energy & Emissions Planning: A Guide for B.C. Local Governments. Retrieved from: http://www.env.gov.bc.ca/cas/pdfs/ccei_cea-planguide.pdf

Council of Energy Ministers. (2009). Integrated Community Energy Solutions: A Roadmap for Action. Retrieved from: http://oee.nrcan.gc.ca/publications/cem-cme/9529

Curran, D. and Tomalty, R. (2003) Living It Up. *Alternatives Journal*, 29(3), 10-18.

Federation of Canadian Municipalities. (n.d.a). Partners for Climate Protection. Retrieved from: http://fcm.ca/home/programs/partners-for-climate-protection.htm

Federation of Canadian Municipalities. (n.d.b). Council Resolution to Join the FCM–ICLEI (Local Governments for Sustainability) Partners for Climate Protection Program. Retrieved from: http://www.fcm.ca/Documents/tools/PCP/Council_Resolution_to_Join_the_FCM_ICLEI_Local_Governments_for_Sustainability_Partners_for_Climate_Protection_Program_EN.pdf

Federation of Canadian Municipalities. (n.d.c). Green Municipal Fund. Retrieved from: http://fcm.ca/home/programs/green-municipal-fund.htm

Federation of Canadian Municipalities. (n.d.d). Members: British Columbia. Retrieved from: http://fcm.ca/home/programs/partners-for-climate-protection/members/british-columbia.htm

Federation of Canadian Municipalities. (n.d.e). Members: Ontario. Retrieved from: http://fcm.ca/home/programs/partners-for-climate-protection/members/ontario.htm

Federation of Canadian Municipalities and ICLEI – Local Governments for Sustainability. (n.d.). Developing Inventories for Greenhouse Gas Emissions and Energy Consumption: A Guidance Document for Partners for Climate Protection in Canada. Retrieved from: http://sustainablecommunities.fcm.ca/files/capacity_building_-_pcp/pcp-ismd-pub-en.pdf

Gibson, R.B., Hassan, S., Holtz, S., Tansey, J., Whitelaw, G. (2005). *Sustainability assessment: Criteria and processes*. London: Earthscan.

Gilmour, B., Geraght, S., Margerm, K. and Molina, J.C. (2011, June). Integrated Energy Mapping: Preparing energy resilient communities. *Municipal World*, 11-13.

Gilmour, B. and McNally, J. (2010). Integrated Energy Mapping in Ontario Communities. Retrieved from: http://eec.ucdavis.edu/ACEEE/2010/data/papers/2287.pdf

Heidenheimer, A., Helco, H., and Adams, C. (1990). *Comparative public policy: The politics of social choice in America, Europe, and Japan*. New York, NY: St. Martin's Press.

Hodge, G. and Gordon, D. (2008). *Planning Canadian Communities: An Introduction to the Principles, Practices, and Participants, 5th Edition*. Toronto: Thomson Nelson.

Intergovernmental Panel on Climate Change. J.T. Houghton et al., editors. (2001). Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, U.K.: Cambridge University Press.

Jaccard, M., Failing, L. and Berry, T. (1997). From equipment to infrastructure: community energy management and greenhouse gas emission reduction. *Energy Policy*, 25(13), 1065-1074.

Jaccard, M. (2005). *Sustainable Fossil Fuels: The Unusual Suspect in the Quest for Clean and Enduring Energy*. Cambridge: Cambridge University Press.

Kaval, S. and Brinkmann, S. (2009). *InterViews: learning the craft of qualitative research interviewing*. Thousand Oaks, CA: SAGE Publications, Inc.

Kreith, F. and Goswami, D. Y. (2007). *Handbook of energy efficiency and renewable energy*. Boca Raton, FL: CRC Press.

Leach, T. and McNally, J. (2009). *Integration of Energy Systems in the development of Sustainable Canadian Communities* [PowerPoint slides].

Merton Council. (n.d.). Merton Rule – the exact policy text. Retrieved from: http://www.merton.gov.uk/environment/planning/planningpolicy/mertonrule/merton_rule_the_exact_policy_.htm

Metro Vancouver. (n.d.). North Vancouver – Lonsdale. Retrieved from: http://www.metrovancouver.org/planning/development/livablecentres/Pages/northvancouver.aspx

Ministry of Community Development. (2008a). *Summary of Local Government Legislation 2008*. Retrieved from the Legislative Assembly of British Columbia website: http://www.llbc.leg.bc.ca/public/pubdocs/bcserials/372618/2008_leg_summary.pdf

Ministry of Community Development. (2008b). *Frequently Asked Questions: Local Government (Green Communities) Statutes Amendment Act, (Bill 27) 2008*. Retrieved from: http://www.cscd.gov.bc.ca/lgd/intergov_relations/library/Bill27_Green_Communities_FAQs.pdf

Ministry of Community Services. (2005). Regional Growth Strategies: An explanatory Guide. Retrieved from: http://www.cscd.gov.bc.ca/lgd/intergov_relations/library/RGS_Explanatory_Guide_2005.pdf

Ministry of Community, Sport and Cultural Development. (n.d.). Development Cost Charges. Retrieved from: http://www.cscd.gov.bc.ca/lgd/finance/development_cost_charges.htm

Ministry of Community, Sport and Cultural Development. (n.d.b). Regional Growth Strategies. Retrieved from: http://www.cscd.gov.bc.ca/lgd/planning/growth_strategies.htm

Ministry of Energy. (2009a). Ontario Legislature Passes Green Energy Act. Retrieved from: http://news.ontario.ca/mei/en/2009/05/ontario-legislature-passes-green-energy-act.html

Ministry of Energy. (2009b). Ontario Makes It Easier, Faster To Grow Green Energy. Retrieved from: http://news.ontario.ca/mei/en/2009/09/ontario-makes-it-easier-faster-to-grow-green-energy.html

Ministry of Environment. (n.d.). Climate Action Charter. Retrieved from: http://www.env.gov.bc.ca/cas/mitigation/charter.html

Ministry of Environment. (2010). Technical Methods and Guidance Document for 2007 CEEI Reports: Community Energy and Emissions Inventory (CEEI) Initiative. Retrieved

from:
http://www.env.gov.bc.ca/cas/mitigation/ceei/CEEI_TechMethods_Guidance_final.pdf

Ministry of Infrastructure Renewal. (2005). Backgrounder: Places to Grow Act 2005 – Bill 136. Retrieved from: https://www.placestogrow.ca/images/pdfs/backgrounder-PTG_Act.pdf

Ministry of Infrastructure. (2012). Growth Plan for the Greater Golden Horseshoe 2006 (Office Consolidation, January 2012). Retrieved from: https://www.placestogrow.ca/content/ggh/plan-cons-english-all-web.pdf

Natural Resources Canada, CanmetENERGY. (2007). Community Energy Planning Guide. Retrieved from: http://canmetenergy-canmetenergie.NRCan-rncan.gc.ca/eng/buildings_communities/communities/publications/2008_sbc_05.html

Nilsson, J. S. and Martensson, A. (2003). Municipal energy-planning and development of local energy- systems. *Applied Energy*, 76, 179-187.

Ontario Power Authority. (n.d.). Clean Energy Standard Offer Program. Retrieved from: http://www.powerauthority.on.ca/clean-energy-standard-offer-program

Ontario Power Authority. (2009). Ontario's Feed-in Tariff program backgrounder. Retrieved from: http://www.powerauthority.on.ca/news/ontarios-feed-tariff-program-backgrounder

Quality Urban Energy Systems of Tomorrow. (2011). Integrated Community Energy Solutions: Municipal Policy Toolkit. Retrieved from: http://www.questcanada.org/pdf/CUI_MPTK.pdf

Province of British Columbia. (2008). *Bill 27 – 2008: Local Government (Green Communities) Statutes Amendment Act*. 3rd reading May 22, 2008, 38th Parliament, 4th Session. Victoria: Queen's Printer. Retrieved from: http://www.leg.bc.ca/38th4th/3rd_read/gov27-3.htm

Province of British Columbia, Fraser Basin Council, and the Union of British Columbia Municipalities. (n.d). [Website]. Retrieved from: http://toolkit.bc.ca/

Province of Ontario. (2005). *Places to Grow Act, 2005*, S.O., 2005, c.13. Retrieved from: http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_05p13_e.htm

Roseland, M. (2005) *Toward Sustainable Communities: Resources for Citizens and their Governments, Revised Edition*. Gabriola Island, BC: New Society Publishers.

Statistics Canada. (n.d.). From urban areas to population centres. Retrieved from: http://www.statcan.gc.ca/subjects-sujets/standard-norme/sgc-cgt/urban-urbain-eng.htm

Statistics Canada. (2011). Focus on Geography Series, 2011 Census – Census subdivision of East Gwillimbury, T – Ontario. Retrieved from: http://www12.statcan.gc.ca/census-recensement/2011/as-sa/fogs-spg/Facts-csd-eng.cfm?Lang=Eng&TAB=0&GK=CSD&GC=3519054

St. Denis, G. and Parker, P. (2009). Community energy planning in Canada: The role of renewable energy. *Renewable and Sustainable Energy Review*, 13, 2088-2095.

Town of East Gwillimbury. (n.d.). About Our Town. Retrieved from: http://www.eastgwillimbury.ca/Town_Hall/About_Our_Town.htm

Town of East Gwillimbury. (2008). Growth Management Status Report. Retrieved from: http://www.eastgwillimbury.ca/Assets/Town+Hall/Branches/Development+and+Legal+Services/OP+Review/GM+Report+-+Part+2.pdf

Town of East Gwillimbury. (2009). Community Energy Plan. Retrieved from: http://www.eastgwillimbury.ca/Assets/Town+Hall/Branches/Development+and+Legal+Services/OP+Review/EG+CEP.pdf

Wheeler, S. M. (2008). State and municipal Climate Change Plans: The first generation. *Journal of the American Planning Association*, 74(4), 481-496.

World Commission on Environment and Development. (1987). *Our Common Future*. Oxford: Oxford University Press.

APPENDIX A: Approaches to community energy planning

A1. Community energy plans

Natural Resources Canada's (NRCan's) Community Energy Planning Guide

The first step of the energy planning process for larger communities in NRCan's *Community Energy Planning Guide* (2007) involves developing a long-term vision for the future (20, 30, 50 or more years) regarding what the Factor-2 community should look like and how it should perform as well as the development area for the vision. It is suggested that the vision statements express goals (short-, medium-, and long-term) in the form of qualities and desires, and when possible, quantifiable actions or sets of qualifying criteria in the form of goals. An alternative approach suggested is to replace the long-term objectives with a set of criteria that qualify the decision-making process.

Following this step, primary energy users and consumption patterns within the community are determined as well as a list of "areas of concern" that are identified as using a disproportionately high level of resources and/or creating a high level of pollution. Again, specific data requirements are not outlined in the guide, but in general, a high-level scan of key aggregated data is suggested in order to highlight "hot spots" where problems may exist. This is explained to also help prioritize issues quickly, maintain public interest, and generate momentum. Later, gathering more detailed data is suggested to reflect principle goals and targets for the community and when program concepts need elaboration.

Accordingly, in the goals and target-setting step, the community vision is quantified to achieve a reduction of non-renewable resources by up to 50 percent over current practice using the baseline conditions as well as information on current and predicted technologies, the community's capacity to achieve future targets, and/or the community's environmental carrying capacity. Indicators that will help monitor progress when the community energy plan is implemented are also chosen in this step. Next, actions to achieve the targets are identified and evaluated in terms of specific projects, programs and technologies then finalized and scheduled. Numerous strategies are suggested in the guide to achieve Factor-2 goals and targets through programs and projects in land-use planning, transportation, building planning, water use, solid waste reduction, alternative energy supply, education and information, sustainable agriculture, procurement policies and practices, and governance. Finally, once the plan is implemented, it is advised that council periodically review and revise the community energy plan concurrently with the revision of the community's official plan.

In terms of data analysis, interpretation and decision-making, the guide lists various tools that can be used in the community energy planning (CEP) process. Tools outlined for data analysis include manually presenting data on a map and creating sankey diagrams that graphically depict a balance sheet for the community's energy pathways identifying both energy type and quantity. Tools suggested for interpreting data include energy density maps and evaluating the use of energy from an exergetic perspective. Recommended decision-making tools include specific software such as: NRCan's EE4 which makes it possible to compare a building design with the 1997 Model National

Energy Code for Buildings requirements and evaluate retrofit opportunities; NRCan's HOT2XP that analyses energy use in homes and is typically used for modeling heat loss; and Metro-Quest™ and CommunityViz™ which each simulate community urban planning scenarios.

Federation of Canadian Municipalities' (FCM) and Local Governments for Sustainability's (ICLEI's) Partners for Climate Protection (PCP) Program

The first step in the five-milestone framework of the FCM's and ICLEI's PCP program involves creating a baseline GHG emissions inventory for the community and developing a forecast of GHG emissions for the business-as-usual scenario. In terms of the GHG emissions inventory, the PCP website explains that data on community energy use and solid waste generation are brought together in order to estimate total GHG emissions for a chosen baseline year. Data is collected on: electricity, natural gas, district energy, fuel oil, diesel, and propane use in the residential, commercial and industrial sectors; gasoline, diesel, propane, compressed natural gas, and ethanol blend use in the transportation sector; and tonnes of solid waste directed to landfills from all community sectors. The inventory tracks three principal GHGs – carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4) – expressed as a CO_2 equivalent (eCO2). The PCP program also provides an Inventory Quantification Support Spreadsheet tool (in the form of a Microsoft Excel workbook) to assist communities with the calculations. Local governments are able to use other calculators in lieu of the spreadsheet tool as long as they report the emission factors and global warming potential multipliers used by those calculators.

The FCM and ICLEI's *Developing Inventories for Greenhouse Gas Emissions and Energy Consumption: A Guidance Document for Partners for Climate Protection in Canada* (n.d.), explains that communities also have the option of including or excluding large, energy-intensive operations in the industrial building sector (e.g. pulp and paper mills, cement manufacturers, steel mills, etc.) from the baseline GHG emissions inventory. This may occur, for example, when utilities cannot disclose detailed consumption datasets due to confidentiality issues. In general, when actual consumption data is not available for buildings in the community, estimates may be used if the average number of establishments and the average energy consumption for buildings in each sector are known. Residential sector estimates are required to be based on local average consumption data instead of national or provincial estimates in order to account for potential differences in climate and energy efficiency construction practices. Further, in densely populated metropolitan areas, the average energy consumption for low and medium-density urban areas is advised to be taken into account separately to more accurately reflect the lower per capita energy consumption of high-density urban areas.

In terms of estimating transportation GHG emissions, the document explains that values can be calculated using estimates on fuel sales, vehicle kilometres travelled (VKT) or the number of registered vehicles in the community and averages for fuel efficiency and VKT in each vehicle class. In communities where data is not available for using any of these methods, a consultation with a transportation specialist is recommended to determine how transportation GHG emissions could be modeled. In all cases, marine, rail, air traffic, and traffic from large highways or freeways that cross local government

boundaries are excluded from the inventory. Further, communities have the option of including or excluding off-road vehicles in the inventory, but no explanation is given as to the reason for this option.

When estimating GHG emissions from solid waste generated in the community, the document explains that this data is usually tracked and may be obtained from the local government, waste disposal contractor, or landfill operations personnel. If data is not tracked (for example in an unmanaged landfill), the volume may be determined based on an estimate of the number of trips by garbage trucks to the landfill in a given year. The United States Environmental Protection Agency's Landfill Gas Emissions Model (LandGEM) is suggested as a tool than can be used instead of the PCP Inventory Quantification Support Spreadsheet tool. In any case, the document explains that demolition and construction wastes are not included in the inventory, but does not provide a reason for this exclusion.

In terms of the forecast of GHG emissions for the business-as-usual scenario in the first milestone, a projection 10 years into the future is required (FCM, n.d.a). Forecasts are to be based on assumptions about population growth or any other demographic projection[35], (FCM and ICLEI, n.d.), although no specific methodological requirements are outlined. Instead, local governments are advised to document the method they chose to derive the

[35] A discrepancy exists in the PCP program's requirements for developing a forecast of the business-as-usual scenario. The FCM website explains that, "the forecast projects future emissions based on assumptions about population, economic growth and fuel mix," (FCM, n.d.a) where as FCM and ICLEI's *Developing Inventories for Greenhouse Gas Emissions and Energy Consumption: A Guidance Document for Partners for Climate Protection in Canada* (n.d.) relays that, "the forecast for the community inventory can be developed based on projected population growth or any other demographic projection" (p.9). This paper will assume the latter to be the correct requirement for creating a forecast of the business-as-usual scenario under the PCP program.

forecast with as well as calculations used to determine the percentage change in each sector (FCM & ICLEI, n.d.). This forecast is especially important for achieving the second milestone of the PCP program, which requires that local governments set a community-wide GHG emissions reduction target (FCM, n.d.a). A GHG emissions reduction target of six percent below baseline year GHG emissions for the community within 10 years is recommended (FCM, n.d.a). No explanation is provided for this specific GHG emissions reduction recommendation.

When both these milestones have been achieved, local governments can start developing a Local Action Plan (LAP), which may be interpreted as a type of community energy plan. A LAP is a strategic document that outlines how a municipality will achieve its GHG emissions reduction target. It typically includes: the results from the baseline emissions inventory and emissions forecast; a list of current and proposed actions that reduce emissions; and implementation strategies. The implementation strategies are to have details on costs, responsibilities, schedules, and funding sources as well as outline plans to monitor the progress made towards the emissions reduction target and the implementation status of GHG reduction measures. Much like NRCan's guidelines for developing a community energy plan, the creation of the LAP requires considerable public engagement. In particular, the PCP program recommends gathering input through meetings and/or public consultation from residents, non-governmental organization and the private sector.

Once Council has adopted the GHG emission reduction target and the LAP, the local government enters the implementation stage. For this milestone, communities are required to establish an organizational structure to oversee the LAP. Data must also be reviewed again to ensure that the opportunities with the greatest reduction in GHG emissions are being pursued. Existing programs and projects that are or have previously resulted in GHG emissions reduction since the baseline year should be identified. New planned projects that may increase emissions should be acknowledged and reviewed in order to minimize their GHG emissions. Finally, to achieve the fifth milestone, the results of the GHG emission reduction actions are to be monitored and reported using the framework set out in the third milestone.

Community Energy Association's (CEA's) Toolkit for Community Energy Planning in British Columbia

When building an energy team, the CEA's *Toolkit for Community Energy Planning in British Columbia* (2006) recommends that two groups form – an energy steering committee to lead the plan through the political and planning process as well as a technical advisory committee that can identify opportunities and challenges. Staff members from local government departments are identified as important participants in these teams. The next step in the CEP process, clarifying community goals, is explained to often depend on the scope of the plan. For example, goals in regional growth strategies, official community plans or neighbourhood concept plans can be examined to see how energy initiatives could help achieve them, or energy goals can be developed more independently through public involvement processes.

In the energy profile step, the community's energy use is to be determined as well as where it comes from and how much it costs. The purpose of this exercise is to understand broadly how energy use in the community affects the local and global environment. Once the energy profile is known, elected officials and the public are engaged in discussions about the benefits of alternative approaches and how energy relates to other community goals and priorities. All the groups that need to be involved in the implementation of the community energy plan are identified so they can work together in finding energy opportunities. Reviewing success stories from other jurisdictions is also recommended in this step to help initiate ideas for local initiatives.

Various specific CEP actions are described in the toolkit that can be incorporated in regional growth strategies, official community plans, and zoning bylaws. In general, they either relate to land-use and transportation, site planning and building design, infrastructure efficiency, or alternative energy supply. When local governments are ready to consider planning options, it is recommended that a range of supply and efficiency options be examined. Alternative energy plans or scenarios are evaluated against community objectives using detailed modelling or by simply comparing and ranking.

Next, in developing an action plan for the preferred options: commitment from key players is required to lead each item; a completion date and/or interim reporting deadline must be set; a communications plan for the public must be determined; and the implementation of highly-visible projects needs to be prioritized to build momentum. Finally, indicators are chosen to monitor results and to help determine if the action plan

needs to be revised. Overall, involvement opportunities are to be available at each stage of the CEP and development process for government, private developers, utilities (energy and transit), community or environmental groups, and the public.

Arctic Energy Alliance's (AEA's) Community Energy Planning Toolkit

The AEA's *Community Energy Planning Toolkit* (2006) explains that in the first step of developing a comprehensive community energy plan, a CEP committee is formed with broad representation of different community members, groups, businesses, utilities, Councils, and institutions in order to run the CEP process. Next, a vision statement is created with general targets as well as a work plan that describes what will be done, how it will be accomplished and who is responsible. Involving many community members in this step is encouraged including elders, youth, businesses, community groups, elected leaders, utilities, people who buy and sell fuel, home owners and renters, and people from the local housing authority. Local government is also approached to pass a resolution to create an energy planning committee and/or to support the energy planning process.

Next, information is gathered to understand how the community uses energy in order to create an energy profile poster and report. In terms of data requirements, the community energy profile does not typically include energy related to air and truck transport that bring goods into the community. Instead, the data required for the community energy profile includes: the fuels used to produce energy and the amount of energy used; the amount of money spent on energy; the amount of GHG emissions each fuel produces; and the amount of energy a community uses in homes, other community buildings, and

for transport within the community. The base year chosen for the energy profile is advised to be the most recent year for which all of this information can be attained.

Once the energy profile is created, potential energy efficiency and renewable energy projects are required to be identified as well partnerships that may help the community use energy more efficiently. Suggested energy efficiency projects include renovating older buildings, encouraging energy efficient habits, ENERGY STAR products, and more energy efficient transportation. Possible renewable energy projects include solar hot water, solar air heating, solar electricity, passive solar heating, run-of-river hydro, wind turbines, efficient wood heating, and cogeneration. It is recommended that the energy committee help develop and approve the criteria for making a scorecard that would be used by the energy committee, a local team of energy experts, or the hired consultant to evaluate the strengths, opportunities, and barriers of each project. More information would then be gathered for the top five to ten ranked projects. In this step, methods suggested to raise awareness and gather ideas include community meetings or workshops; presentations to business groups, school classes, or government agencies; door-to-door surveys; and community energy mapping.

Next, different scenarios of future energy use are developed using a Microsoft Excel workbook included in the toolkit to compare total energy costs and GHG emissions 5, 10, 15 and 20 years in the future for the following scenarios: no energy-saving projects/business-as-usual; energy efficiency (the community takes action only with energy efficiency projects); renewable energy (the community takes action only with renewable energy projects); energy efficiency and renewable energy together (AEA,

2006). Assumptions embedded within the workbook include population changes over 20 years as defined by the NWT Bureau of Statistics and the price of oil being static over time. Other assumptions would be associated with factors specific to the energy efficiency and renewable energy projects selected in the previous step.

At this point, a draft version of the energy plan is typically created and feedback is collected from key stakeholders. Once the plan is revised, a final version is written and presented to the community council for approval. With approval to implement the energy plan, an implementation team may be created to oversee the execution of each project. Each project may also include a pre-feasibility study, feasibility study, engineering design, and/or construction. Finally, after the projects have been completely implemented and their results monitored, the energy plan may be revised thus starting the process again if needed.

Community Energy Association's (CEA's) and the Province of British Columbia's (PoBC's) Community Energy & Emissions Planning: A Guide for B.C. Local Governments

The CEA's and PoBC's *Community Energy & Emissions Planning: A Guide for B.C. Local Governments* (2008) suggests that the public be included early in the CEP process through workshops, open houses, charettes, surveys, booths, information campaigns and/or stakeholder participation. Because City councils, boards, and staff are stated to be the crux of the engagement process, a wide range of city staff is encouraged to participate. This includes the Chief Administrative Officer, Finance Officer, Planning Director, Engineering Director, Communications Director, and Environmental Manager. Further, partnerships with community groups, non-profit organisation, businesses, senior

levels of government, major utilities, neighbouring jurisdictions, and energy service companies are outlined as potential methods of enhancing community participation, acquiring information and expertise, helping increase the cost effectiveness of projects, receiving funding, and/or assisting in the development of larger projects. Finally, the formation of an energy planning committee consisting of members of city council, boards, and staff as well as stakeholders is recommended to ensure the effective implementation of the community energy plan.

In terms of creating a community inventory of energy use and GHG emissions, the guide recommends using the inventories created under the Community Energy & Emissions Inventory (CEEI) initiative administered by the Ministry of Environment (MoE). The guide indicates however that local governments may wish to expand the level of detail and accuracy as well as include additional sectors beyond what the CEEI inventory provides due to its limitations. The MoE released a document in 2010 that outlines the process by which the CEEI inventories for the 2007 base year were created called the *Technical Methods and Guidance Document for 2007 CEEI Reports: Community Energy and Emissions Inventory (CEEI) Initiative*.

Similar to FCM's and ICLEI's PCP program, the technical methods and guidance document explains that the CEEI inventory includes CO_2, CH_4, and N_2O GHG emissions estimates from the building, transportation and solid waste sectors in eCO_2 totals. Unique to the CEEI inventory however, information about land-use change from deforestation and enteric fermentation from agricultural livestock are listed under "memo items" in the

regional district reports. Large industrial facilities are also separated out from the inventory and instead the number of connections is listed as a memo item for both municipalities and regional districts.

The large industrial sector is not included in the inventory because consumption data cannot be obtained from energy utilities when the energy consumed by a customer exceeds the utility's thresholds for confidentiality or when a single customer exceeds 50 percent of the local government's total consumption. Large industrial customers are defined as customers using more than seven gigawatts of electricity per year, or in terms of natural gas, they are defined based on the rate structure they are charged under. Examples of some of these industrial customers given in the document include cement plants, pulp and paper mills, sawmills, and mining operations as well as universities. One last unique feature of the inventory is its use of five supporting indicators – housing type, residential density, commute to work, commute distance, and green space – that are meant to help monitor the progress and impact of local governments efforts.

Examining the building sector of the CEEI inventory in more detail, energy and GHG emissions from electricity and natural gas use are reported for residential and commercial/small-medium industrial subsectors based on actual consumption data provided by energy utilities. Specifically, the number of connections, amount of actual energy consumed, and resulting eCO_2 totals are reported. Rough estimates for residential heating oil, propane, and wood use are also included for communities where their use is deemed significant. The residential subsector includes single-family housing, row

housing, multi-family housing and other housing types such as mobile and vacation homes. Commercial and small-medium industrial buildings, which are reported as one subsector because of difficulty in further delineation, include offices, commercial retail outlets, government buildings, small-medium industrial facilities, and other customers that do not fall under the residential subsector or large industrial sector. Data accuracy issues exist for the building sector because energy utilities do not often aggregate consumption data by local government region and different energy utilities assign customers to residential, commercial, and industrial building categories in an inconsistent manner.

In terms of the transportation sector, on-road transportation fuel consumption and its resulting eCO_2 totals are reported for several passenger and commercial vehicle classes. A resident-based methodology is used to calculate energy and GHG emissions for each local government utilizing: the number and type of vehicles registered in a geopolitical boundary provided by the Insurance Corporation of British Columbia; the fuel consumption rate of individual vehicles sourced from existing consumption tables developed by NRCan; and an estimate of the annual VKT by various vehicle classes provided by Pacific Analytic. Data accuracy issues potentially exist because even though vehicles are assigned to a municipality or regional district according to the registered owner's postal code, some vehicles may operate predominantly in other communities and are not confined to a geopolitical border. Moreover, fuel consumption rates for large commercial diesel trucks are inaccurate because their manufacturers do not assign them

fuel consumption rates and they cannot be estimated due to their highly variable loaded weight.

The CEEI's third and final inventory component, the municipal solid waste sector, reports the amount of solid waste produced annually within the jurisdiction of the local government and its resulting eCO_2 total from the decomposition of organic matter. The GHG emissions from biogenic decomposition and incineration are considered "carbon-neutral" in the CEEI inventory and are therefore not included in eCO_2 totals. Estimates are determined using a waste-in-place method that requires information on historical municipal solid waste tonnages sent to managed and unmanaged landfills as well as the waste's decay rate and methane generation potential. Significant uncertainty issues potentially exist for this inventory component because of the mixed data sources as well as the lack of landfill management records regarding operational characteristics such as landfill opening dates and the amount of waste individual municipalities disposed in regional landfills or other closed landfills.

Following the creation of an inventory of energy consumption and GHG emissions, the CEA's and PoBC's guide (2008) states that the next step in the CEP process is to set an energy and GHG emissions reduction target. The action is explained to be in line with the provincial legislation that requires local governments in British Columbia to include GHG reduction targets and strategies in their official community plans and regional growth strategies. A visionary approach is recommended that sets an aggressive target based on community objectives and goals as well as makes a statement about the

importance of taking action on energy and climate change. In addition to a single community-wide GHG emissions reduction target, it is advised that local governments also include energy efficiency, energy security, and reduced energy cost goals because most of the electricity in British Columbia is generated by hydro, which has minimal GHG emissions. GHG emissions and energy targets focused on individual sectors or secondary indicators are also encouraged. In any case, both short-term and long-term targets are recommended.

After targets have been set, local governments are expected to create an action plan to achieve results. Similar to the CEA's toolkit (2006), the guide recommends incorporating various policy strategies in official plans and regional growth strategies. Further, much like Jaccard et al.'s (1997) paper, the guide generalizes five main areas in energy and GHG emissions planning: land-use; transportation; buildings; infrastructure; and energy supply. A concept developed by Robyn Wark and Jorge Marques from BC Hydro – the "4 R's of Sustainable Community Energy Planning" – is also outlined in the guide to: reduce energy demand through community design, green buildings and efficient technologies; re-use waste heat (e.g. industrial or commercial waste heat, sewer and wastewater heat recovery, etc.) to heat buildings and hot water; use renewable heat sources to heat buildings and hot water (e.g. solar thermal); and use renewable energy for electricity (e.g. biomass/biogas combined heat and power, micro-hydro, wind, solar, tidal and geothermal). In effect, a community energy plan may include a wide variety of actions from guiding policies to major infrastructure projects for local governments to consider.

Finally, in order to implement the community energy plan actions, an implementation schedule is to be created separately or in the action plan. In terms of monitoring, the guide explains that the CEEI initiative intends to provide annual energy and emissions reports in order to simplify the process, although it cautions that energy and GHG emissions reductions will likely be difficult to achieve and monitor in the short term.

BC Hydro's Sustainable Communities Program

BC Hydro's Sustainable Communities Program's QuickStart initiative

A BC Hydro brochure, *Community Energy and Emissions Planning for Smaller Communities* (n.d.b), explains that in the QuickStart registration step, local governments are required to provide BC Hydro with various community documents that it can analyse prior to meeting together at the workshop. These documents may include: maps indicating community zoning, sewer alignment, LEED gold buildings and/or key public sector buildings; the official community plan; regional growth strategies; any carbon neutral strategy or climate action plan; information about unique factors or planned initiatives that would influence energy and GHG emissions; relevant case studies; and topics of special interest that the community would want to discuss during the workshop. An interview with a Sustainable Communities Senior Key Account Manager at BC Hydro revealed that this step also requires that local governments commit to having a certain number of senior staff or elected officials involved in the QuickStart process to ensure buy-in and commitment to follow through with the community energy plan implementation (personal communication, April 10, 2012). Workshop attendees from the city might include one or more councillors and maybe the mayor as well as two or three

staff that are usually from planning or engineering departments (personal communication, April 10, 2012). Non-governmental organisations that are interested or active in the community may also be invited to attend the workshop (personal communication, April 10, 2012).

In the next step of the QuickStart process, local government are required to complete a bit of pre-workshop reading and attend a one-hour webinar that builds on the readings. In particular, the Sustainable Communities Senior Key Account Manager at BC Hydro explained that the webinar, which is executed by the CEA, is meant to put the QuickStart initiative into context of what is happening provincially (CEEI initiative, legislated GHG emission reduction targets and policies in official plans and regional growth strategies, etc.) as well as get the local government thinking and ready for a productive workshop (personal communication, April 10, 2012). The first day of the workshop, which is administered by BC hydro Staff and a CEA representative, consists of presentations, break out sessions, and discussions about some of the typical energy conservation and GHG emissions reduction actions a community can take in the building, land-use planning, and transportation sectors (personal communication, April 10, 2012). The expert energy facilitator provides the local government with a number of note cards, each having a different potential action written on it, that the local government must go through and assert if it is an action they want to pursue, don't want to pursue, might want to pursue, or have already pursued (personal communication, April 10, 2012). The note cards with the actions that the local government wants to pursue are then taken and put on a board in order to distribute the actions in what can be realistically achieved in a five-

year time span (personal communication, April 10, 2012). These actions and their time frames are used by the CEA facilitator and the main contact for the community on the following half-day of the workshop to work through writing up what a community energy plan might look like for the local government (personal communication, April 10, 2012).

Following the workshop, in the implementation step, communities are expected to gain council approval for the community energy plan and report back to BC Hydro when this has been achieved. The community energy plan is to then be put into practice in order to achieve energy conservation and GHG emissions reduction. The Sustainable Communities Senior Key Account Manager at BC Hydro explained that none of the community energy plans created through the program have been implemented so far since the QuickStart initiative only recently completed its pilot phase last year (personal communication, April 10, 2012). Further, the QuickStart program may change a bit in the future in order to include another potential step for six months after the workshop in order to follow-up with the community and to help ensure that implementation occurs (personal communication, April 10, 2012).

BC Hydro's Sustainable Communities Program's funding offer for large communities

According to BC Hydro's funding offer for large communities' Terms of Reference (2010), a community energy plan is expected to span at least a 25-year time frame as well as be integrated into all other municipal planning and infrastructure documents in order to provide direction for future land-use patterns, energy infrastructure and utility systems. The background section therefore must provide an overview of the community with information on local concerns and issues, growth rate, demographics, and land-use

characteristics. Baseline energy and GHG emissions data from the CEEI inventory must be included as well as a forecast of the business-as-usual scenario for energy use and GHG emissions for the residential, commercial, institutional and industrial sectors. Moreover, the following subject areas must be depicted visually on a map: existing and future business-as-usual energy demand scenarios as well as conservation opportunities by area and land-use type; existing energy sources and potential new alternative energy sources; opportunities for integrated community energy systems, and existing and future infrastructure requirement scenarios.

For the vision, goals and targets section, the local government must define its aspirations for the entire community. This requires that it clearly articulate and communicate the social, economic and financial benefits of the CEP. Moreover, local energy and water use as well as GHG emissions creation must be communicated relative to global and/or national levels as well as other appropriate local jurisdictions. Further, the energy and emissions baseline data and business-as-usual trends from the background section must be used to set energy and GHG emissions reduction targets for five, 10, and 15 years in the future. Seven guiding principles are also provided in the program's Terms of Reference in case local governments need help establishing a vision or setting goals or targets.

In terms of strategies, both conservation and supply-side methods of reducing energy and GHG emissions are required, while energy efficiency measures are identified as the preferred source of energy. Technologies such as district energy systems and combined

heat and power as well as long-term infrastructure plans that support them are required. Renewable energy sources such as wind, geothermal, biomass, and solar energy as well as waste heat recovery strategies are encouraged. Sustainable transportation measures are also required that have minimal noise and impact on land-use as well as use renewable resources for fuel or non-renewable resources at or below rates of renewable fuel production. Other potential measures listed include the monetization of GHG emissions, corporate specific strategies for municipal operations, and a variety of policies. The final community energy plan strategies that are chosen as recommendations are expected to be ranked in terms of priority and explicated in terms of how they would be implemented. The implementation plan therefore must include action-oriented information such as resources required, roles and responsibilities, and schedules. Moreover, the community energy plan is to be continuously updated when actions have been implemented and when new opportunities emerge.

Finally, much like the previous CEP approaches outlined, at least one broad public engagement process. Unlike the other approaches however, it also requires at least three engagement workshops with key stakeholders. A Mayor's Task Force on Energy and Emissions is also suggested to ensure leadership as well as a multi-disciplinary staff task force that will run the CEP process. Further, a comprehensive list of potential organizations and individuals that may help accelerate the successful implementation of the community energy plan is advised to be included in the final community energy plan.

A2. Integrated community energy solutions

The Council of Energy Ministers's (CoEM's) *Integrated Community Energy Solutions: A Roadmap for Action* (2011) outlines a broad strategy for ICES implementation aimed at Canada's federal, provincial, and territorial governments through a three-phase approach: quick starts for early impact (2010-2015); acceleration (2010-2020); and large-scale adoption (2020-2050). In the first phase, pilot projects that are able to achieve results quickly as well as an increase in the number of community energy plans and climate action plans that incorporate ICES concepts are encouraged in order to provide lessons learned and to identify opportunities and business cases for ICES projects. Next, in the acceleration phase, research and development as well as programs, policy and regulations that support large-scale adoption of ICES are required to create an enabling environment for private sector investment. Finally, in the last phase, policies and regulations, training programs and certification processes, and funding covering all stages of the innovation cycle are required to support the adoption of ICES and the next generation of its technologies and methods.

The action plan states that higher levels of government play a key role in the successful implementation of ICES because they have the power to define the legislative framework under which municipalities, utilities, and energy companies operate. Moreover, their departments and agencies can potentially provide essential supports in the forms of information, training, research, coordination, and facilitation. The Menu of Tools in the action plan lists a number of strategies the federal, provincial and territorial governments can use to encourage the adoption of ICES. These strategies are organized into the

following subsections: policy and regulation; technology, best practices and decision-support tools; information; capacity building; leadership opportunities; and market stimulation.

A3. Integrated community energy mapping

The Canadian Urban Institute's (CUI's) *Integrated Energy Mapping For Ontario Communities: Lessons Learned Report* (2011) explains that the baseline energy map depicts the amount of electricity and natural gas consumed by all existing buildings in a community for a given year by integrating building, land-use, and energy data into one database in order to show the potential relationships between energy consumption and building characteristics as well as to identify neighbourhood trends. To create the map, the community's GIS parcel fabric (digital mapping file) and property tax assessment roll is first obtained from the local government. Next, since each building in the community is assigned a unique "roll number" on the property tax assessment roll that also identifies which parcel the building belongs to on the GIS parcel fabric, the roll number is used to match building data from the assessment roll (street address, building footprint, structure code, property code, year of construction, etc.) to its corresponding parcel. Each parcel on the parcel fabric is then assigned a building type based on the structure codes of the building on the property. Finally, electricity and natural gas data are obtained from the community's utility providers and matched to the parcel fabric.

The report explains however, that because energy utilities often define their buildings differently, assumptions are made at this stage about which customer class belongs to

which building type. Further, since the energy data is usually provided by the utilities in an aggregate form, NRCan's *Screening Tool for New Building Design* is used to match the data to each parcel on the parcel fabric. The NRCan model is used to calculate an energy intensity factor, which describes the amount of energy a certain type of building space is expected to consume (in units of energy per unit area) for each building type. Next, building floor space from the property tax assessment roll is aggregated for each building type to the same level of aggregation as the utility data. The relative energy calculated for each building type and the aggregated building space is then used to disaggregate the energy data to each individual building. The utility data is then tagged to the geographic location on the parcel fabric and building data from the assessment roll.

When creating future energy building maps, the report states that official plans and growth management studies are first reviewed to retrieve information on: total projected population increase; total employment increase; total number of residential units by building type (low density, medium density, high density); average people per unit for residential units; total floor space for industrial, commercial and institutional building types; and average floor space per job. Assumptions are then made (unless this work has already been completed by the local government), with the guidance of the local government's planning staff, in terms of where development would occur as well as how projected residential units, population, and jobs around the city would be distributed. Once the future distribution of the floor space around the community is understood for the year of choice in the business-as-usual scenario, an energy simulation model is used to calculate the annual energy consumed for each building type and the information is

incorporated into the parcel fabric. This process is explained to be similar to the baseline energy mapping steps, which required the use of NRCan's *Screening Tool for New Building Design*.

In order to create the high efficiency and ultra-high efficiency scenarios, which help determine what measures are needed in order to reach an adopted energy reduction target, assumptions are made taking into account higher building code standards for new buildings and retrofit measures for existing buildings. Different energy generation technology scenarios are considered for proven technologies such as solar air, geoexchange, solar hot water, district energy, photovoltaics, biomass, and wind power. Specifically, CUI partners with Enermodal Engineering, who use NRCan's *Screening Tool for New Building Design* and *RETScreen* software, to model the potential energy savings that could be achieved from the measures in the high efficiency, ultra-high efficiency, and energy generation technology scenarios. The cost of implementing the different scenarios is calculated, based on the investment's internal rate of return, allowing for the adoption of the most cost-effective strategies first. Lastly, the report states that potential job creation can also be evaluated in these scenarios using Statistics Canada employment multipliers for specific industries in Ontario.

In terms of the energy transportation maps, the report does not fully explain the required steps needed to create the baseline and future scenario maps. In general however, existing origin destination matrices[36] are retrieved from the local government and assumptions are

[36] Origin destination matrices divide communities into different zones and then count the number of trips people make between the zones (CUI, 2011).

made to change the data from the matrices into the appropriate form required to make the final energy map. High efficiency and ultra-high energy efficiency scenarios are created that incorporate different levels of the following measures: increase in transit, cycling, and walking; reduction of trip lengths; and reduction of the number of trips made. The purpose of the energy transportation maps therefore are to depict the energy impacts of trips taken by personal vehicles, commercial vehicles, and public transit within a community as well as shed light on which transportation demand management strategies have the greatest impact on reducing energy and GHG emissions.