



COMMUNITY
ENERGY PLANNING
**GETTING TO
IMPLEMENTATION**
IN CANADA

COMMUNITY ENERGY PLANNING:
The Value Proposition
Environmental, Health and
Economic Benefits

FEBRUARY 2016

www.gettingtoimplementation.ca



Acknowledgments

Lead Authors

Stephanie Cairns, Sustainable Prosperity
Adam Baylin-Stern, Sustainable Prosperity

Editors

Sara Jane O'Neill, Sustainable Prosperity
Tonja Leach, QUEST
Cheryl Ratchford, QUEST

Project Co-Directors

Dale Littlejohn, Community Energy Association
Richard Laszlo, QUEST

Project Manager

Sarah Marchionda, QUEST

Senior Project Advisors

Stephanie Cairns, Sustainable Prosperity
Brent Gilmour, QUEST

Research and Editing Support

Peter Robinson, Community Energy Association
Patricia Bell, Community Energy Association
Michael Lee, QUEST

Design and Layout

Justin Aitcheson, JUST AN H

The project team would like to acknowledge the contributions of those who provided valuable information, review and support for this report: Martin Brooks, Devin Causley, Luciano Dalla-Longa, Geneviève Gauthier, Mark Pauls, Mark Raymond, Jamie Skimming, and Christian Weber; and Sustainable Prosperity staff Michelle Brownlee, Mike Wilson, and Melanie Coulson.

Copyright © QUEST – Quality Urban Energy Systems of Tomorrow, 2016.

These materials may be reproduced in whole or in part without charge or written permission, provided that appropriate source acknowledgements are made and that no changes are made to the contents. All other rights are reserved.

The analyses/views in these materials are those of QUEST, and these analyses/views do not necessarily reflect those of QUEST's affiliates (including supporters, funders, members, and other participants). QUEST's affiliates do not endorse or guarantee any parts or aspects of these materials, and QUEST's affiliates are not liable (either directly or indirectly) for any issues that may be related to these materials.

Front cover image (bottom right)

Copyright Queen's Printer for Ontario,
photo source: Ontario Growth Secretariat,
Ministry of Municipal Affairs and Housing.

Back cover image

<http://www.meetingscalgary.com/photo-gallery>

Project Supporters

THE J.W. McCONNELL
FAMILY FOUNDATION
LA FONDATION DE LA
FAMILLE J.W. McCONNELL

 SUNCOR
ENERGY
SUNCOR
ENERGY
FOUNDATION

 ALBERTA
REAL ESTATE
FOUNDATION

 real estate
foundation
BRITISH COLUMBIA

 CONSEIL DE LA
COOPÉRATION DE LA
SASKATCHEWAN
CCS

 CDEM

 CDEA
conseil de
développement
économique
de l'alberta

 SDE
Colombie-Britannique

 Fondation ECHO
ECHO Foundation

Project Partners

 Community Energy
Association

 QUEST
Quality Urban Energy
Systems of Tomorrow

 SP Sustainable
Prosperity

Table of Contents

| | | | |
|--|-----------|---|-----------|
| Executive Summary | 4 | Conclusion | 34 |
| Introduction Community Energy Planning: The Value Proposition | 9 | Appendix I Approaches to Economic Analysis in CEPs | 35 |
| Section 1 CEPs: A Smart Approach to Achieving Environmental and Community Health Goals, as Well as Economic Ones | 14 | References | 36 |
| Section 2 Energy: A Significant Cost to Communities, Businesses, and Households | 16 | | |
| Section 3 Keeping More Energy Dollars in the Local Economy | 18 | | |
| Section 4 Contributing to Savings, Local Economic Development, and Jobs | 20 | | |
| Section 5 Mitigating Risk: Future Carbon Emissions Pricing and Regulation, and Future Energy Costs | 32 | | |

www.gettingtoimplementation.ca



Visit our website
to learn more about
the *Getting to
Implementation*
initiative.

Community Energy Planning: The Value Proposition

Executive Summary

Canadian communities have untapped opportunities to strengthen local economies, reduce current and future energy costs and greenhouse gas (GHG) emissions, and create jobs by investing in smarter and more integrated approaches to energy use at the local level. Communities that have analyzed these opportunities have consistently identified a strong value proposition for these approaches, with solid economic returns on investments, environmental gains, health benefits, and improved quality of life for local residents.

Energy is a significant cost in Canadian communities. Each year millions, and in some cases billions, of dollars are spent on energy, much of which leaves the local economy. This cost, illustrated in Table 1, plays a significant role in the financial well-being of Canadian communities, and to the businesses and households in these communities. It is expected to grow over time if no alternative actions are taken.

Table 1 – Energy Spending in Small, Mid-sized and Large Communities

| Community Size | Average Spending on Energy in the Community |
|---|---|
| Small Communities (less than 20,000 people) | Up to \$80 million |
| Mid-sized Communities (20,000 to 100,000 people) | \$60 million to \$400 million |
| Large Communities (100,000 people to 2.5 million people) | \$200 million to \$10 billion |

Source: QUEST, 2015b

Decisions made within communities regarding land use and urban form, buildings, transportation, waste, and distributed energy resources¹ can reduce these energy costs and present an opportunity to recirculate dollars back into the local economy. The initiatives of communities to reduce energy costs will also reduce operating costs for businesses, making a community attractive to investors. These decisions can also make communities more futureproof to the risks of rising energy costs from potential carbon emissions pricing and regulation, and to disruptions in energy supply or changes in energy costs.

Canadian communities play a particularly important role in national and global efforts to address climate change as they have direct or indirect control of 60 percent of Canada's total GHG emissions.² Community-level decisions can consequently drive significant emissions reductions and are critical to nation-wide efforts to address climate change.

Equally, these decisions can support social priorities at the community level. Energy efficient buildings, complete and compact neighbourhoods, and access to convenient public transportation lower household expenses for heating and mobility, and are key elements of tackling energy poverty. There are also direct health benefits from reducing energy related to transportation and land use: improved air quality, and improved public health through more active, healthy lifestyles. Land use and urban form can be designed to reduce the urban heat island effect, reducing energy costs and negative health impacts.

¹ Distributed energy resources include renewable energy, district energy and combined heat and power, and storage.

² (M. K. Jaccard and Associates, 2010); (New Climate Economy, 2015); (Natural Resources Canada, 2012)

³ Successful implementation can enable communities to become Smart Energy Communities: communities with improved energy efficiency, enhanced energy reliability, lower energy costs, and reduced greenhouse gas emissions. Such communities will often integrate conventional energy networks (electricity, natural gas, district energy, and transportation fuel) to better match energy needs with the most efficient energy source; integrate land use; and harness local energy opportunities. Such communities can be characterized by 6 technical principles and 6 policy principles. Read the principles at <http://www.questcanada.org/principles-smart-energy-communities>

⁴ (QUEST, 2015a)

⁵ Ibid.

Community Energy Plans (CEPs) provide the pathway for communities to realize these many opportunities, by becoming Smart Energy Communities and introducing smarter approaches to energy use at the local level.³

A CEP is a tool that drives community priorities around energy with a view to increasing efficiency, reducing emissions and driving economic development.⁴ More than 180 communities across Canada, representing over 50 percent of the population, have a CEP, as illustrated in Figure 1.

Based on a sample of 50 CEPs, roughly half have examined the cost-effectiveness of their proposed programs, with only some analyzing the direct economic impacts of CEP implementation to their communities.⁵

This report draws primarily on the findings of six comprehensive economic analyses of CEP actions and programs, along with case studies, to illustrate the potential value proposition to communities from the implementation of CEPs, as identified in Figure 2.

In addition to retaining money spent on energy within the local economy, there are other direct and indirect economic benefits to the broader community from implementing a CEP:

- **Direct economic benefits** are gained to the businesses or households directly implementing a particular investment to reduce energy costs, through changes in savings or spending, new income to businesses, and new jobs.
- **Indirect benefits** arise in economic sectors that supply the inputs for that investment, such as equipment or technical services. The more a community can provide the goods and services needed for the CEP, the greater the share of indirect benefits that will remain in the community.
- **Induced benefits** result from a trickledown effect which arises when dollars generated from energy savings or from new local energy-related jobs are re-circulated in the local economy.
- **Co-benefits** are bonus benefits additional to those directly targeted by the CEP. These are often significant, but harder to quantify: for example, reduced congestion, improved air quality, improved community health, and increased community interactions as a result of an active transportation initiative would be indirectly supported by the implementation of a CEP.

The report aims to inform, motivate, and build the political, staff, and stakeholder support needed for CEP implementation.

Communities are balancing a growing emphasis on meeting environmental concerns alongside constrained budgets. The ability to demonstrate the value proposition of CEPs, as outlined in this report, will prove critical to securing the required investment and the political, staff, and stakeholder support to implement CEPs, and to achieving their economic, environmental, and social promise.

CEP implementation is still in the early days. As more and more communities implement CEPs and analyze their results, continued assessment of the findings will be needed to provide additional evidence on the effectiveness and usefulness of a CEP.

Figure 1 – Community Energy Plans across Canada

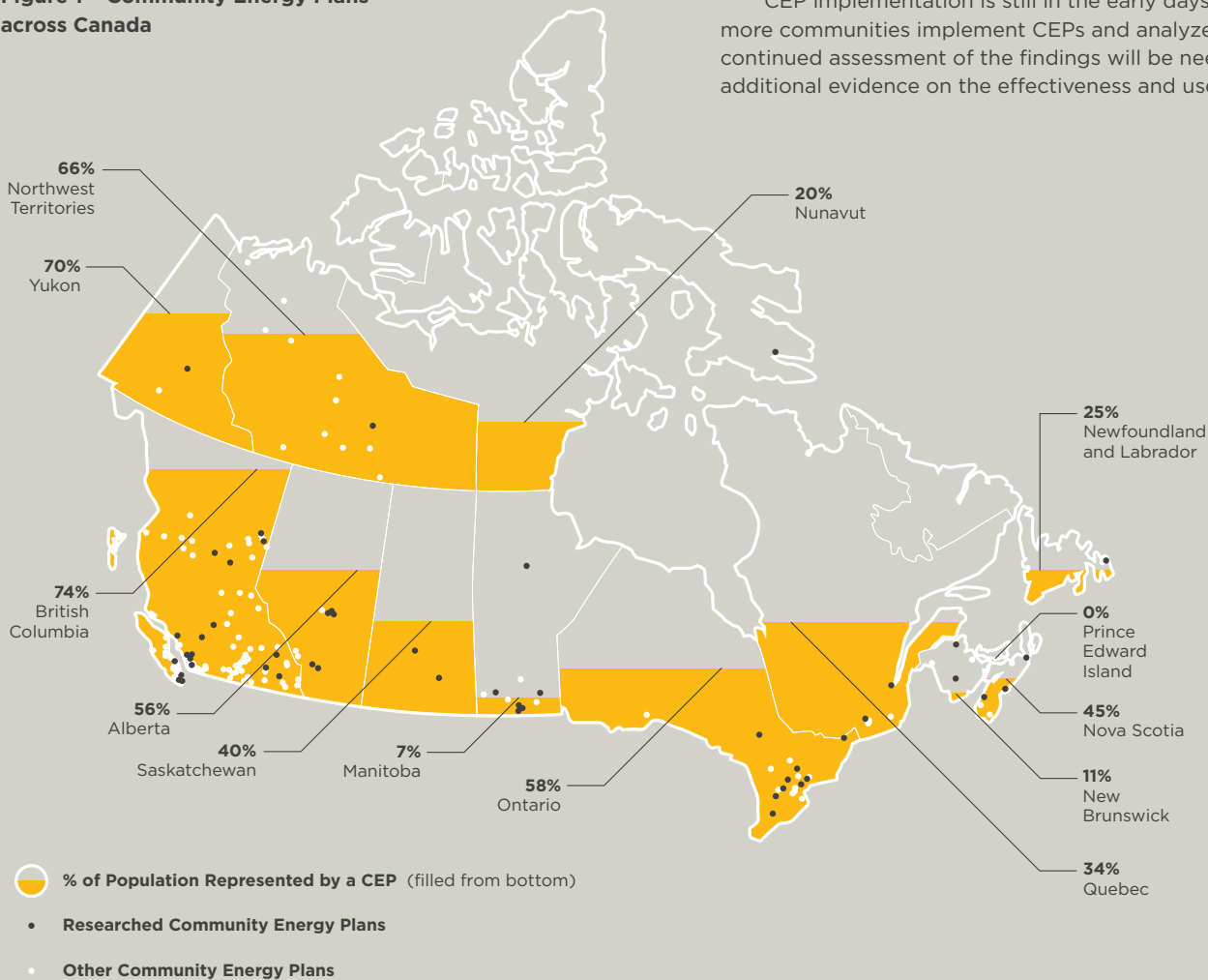


Figure 2 - Economic Benefits of Community Energy Planning Using the Example of a District Energy System

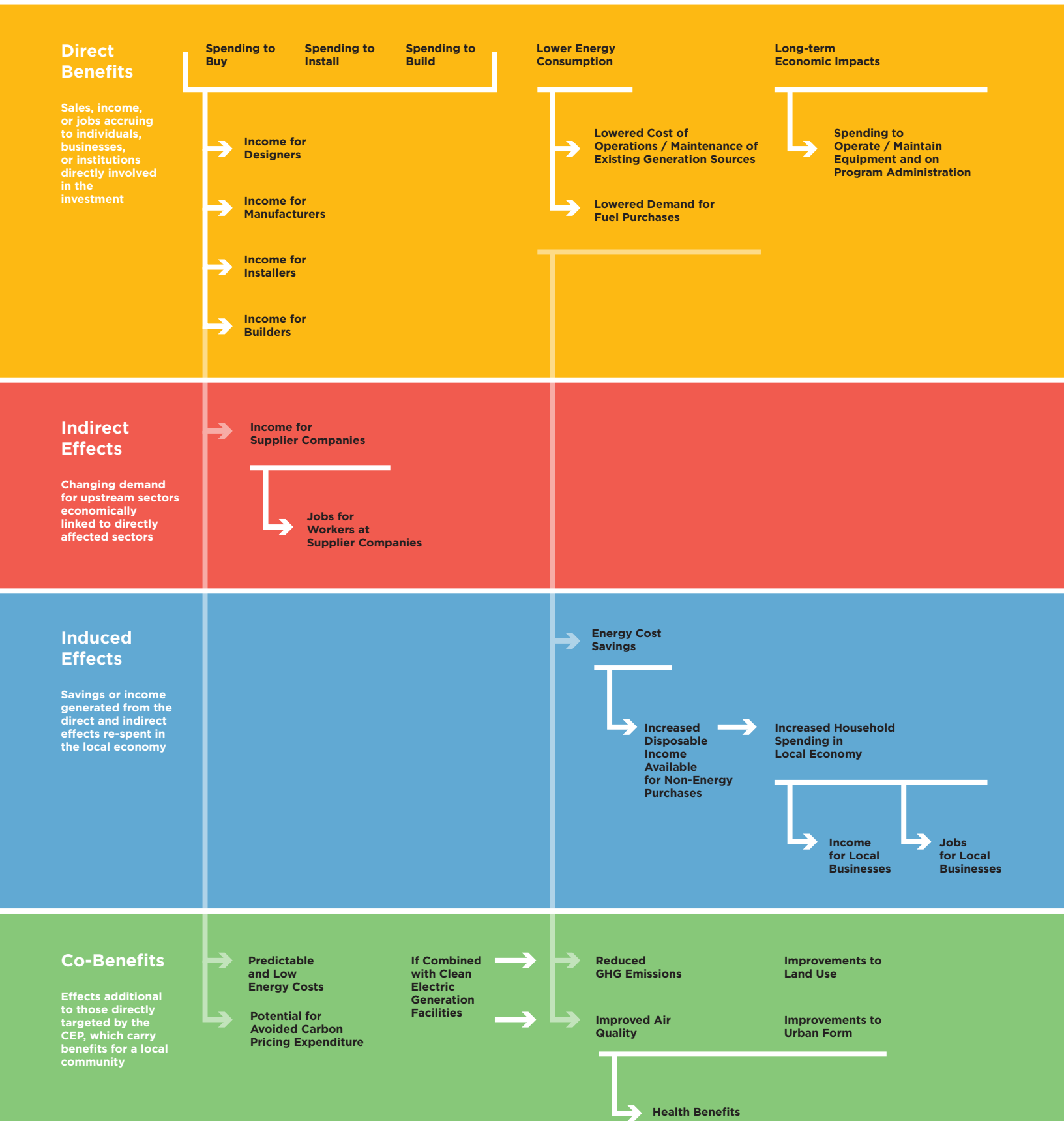


Table 2

| Community Energy Planning: The Value Proposition | Report Section |
|--|-----------------------|
| CEPs help achieve both environmental and community health goals, as well as economic ones | 1 |
| Example: An evaluation of various scenarios for expanding light rail and bus rapid transit in the Region of Waterloo, Ontario, found that the project could lead to air quality improvements that could prevent from 31-61 hospital admissions and reduce costs of health care by \$8.7 million - \$16.6 million over 30 years. | |
| CEPs help recirculate money spent on energy within a community and its region | 3 |
| Example: In London, Ontario, of the \$1.6 billion spent on energy in 2014, only 12 percent stayed in London's economy, and 59 percent total stayed in the province. When energy use is reduced by 1 percent annually, an additional \$14 million is kept within the local London economy. ⁶ | |
| CEPs contribute to achieving local economic development goals | 4 |
| Example: Analysis of Edmonton, Alberta's recently released CEP examines the economic effects of a total investment of \$237 million in low carbon projects such as renewable energy, energy efficiency, and electric transport initiatives over the 2018-2021 period. It found a potential net present value from energy savings of \$3.4 billion by 2035 if a social cost for carbon of \$51/tonne carbon were included. These estimates do not include associated benefits, such as a diversifying labour market with an increase in renewable-related jobs. | |
| CEPs create opportunities for local energy cost savings and job creation | 4 |
| Example: The cities of Barrie and Hamilton, Ontario evaluated the long-term effects (over a period from 2008-2031) of maximizing cost-effective building energy efficiency retrofits and technologies and found that for every \$1 million invested in building energy efficiency retrofits, over 9 person-years of permanent employment would be created within the province of Ontario. | |
| CEPs help to mitigate financial risks from future carbon pricing and energy price volatility | 5 |
| Example: Dawson Creek, British Columbia, imposed a \$100 per tonne levy on its own municipal GHG emissions in 2011. The levy rises at a rate of \$5 per year and is currently \$115 per tonne. This levy is transferred into the Dawson Creek Carbon Fund, which the city uses to fund corporate and community green initiatives. These initiatives have reduced the city's liability in terms of reaching BC's legislated carbon-neutral goal for municipal corporate operations. ⁷ | |
| CEPs contribute to strong and resilient local economies | All Sections |
| CEPs can help to keep more money in a local economy, generate opportunities for local savings and jobs, and help to manage risk from volatile energy prices and future climate policy by using energy more efficiently and producing more energy locally. In addition to this, there is a wide range of broader—and often harder to quantify—economic impacts that smart community energy planning can bring about. | |
| Impact 1 – Improving Residents' Health (Page 15) | |
| Impact 2 – Retaining Local Business (Page 17) | |
| Impact 3 – Smart Urban Renewal (Page 19) | |
| Impact 4 – Attracting New, High Tech Investment (Page 23) | |
| Impact 5 – Employee Productivity (Page 25) | |
| Impact 6 – Energy Affordability and Resilience in Remote, Off-grid and On-grid Communities (Page 27) | |
| Impact 7 – Market Differentiation (Page 29) | |
| Impact 8 – Housing Affordability (Page 31) | |

⁶ See an overview of how communities can replicate London's approach to accounting for the destination of energy spending at the following link: <https://vimeo.com/120112918>

⁷ (BC Climate Action Toolkit, 2015)

Communities have a key role to play in energy. While many communities in Canada are advancing plans to define priorities around energy, all communities need help getting from plans and ideas to implementation.

Community Energy Planning: Getting to Implementation in Canada is a collaborative initiative spearheaded by the Community Energy Association, QUEST – Quality Urban Energy Systems of Tomorrow, and Sustainable Prosperity.

The initiative aims to help communities implement their Community Energy Plans (CEP) in order to improve efficiency, cut emissions, and drive economic development.

Objectives of this Initiative

- Identify barriers for integrated approaches to community energy planning
- Define business models for local governments, provincial and federal governments, utilities, the real estate sector and other stakeholders
- Develop tools for an integrated approach to community energy planning
- Increase awareness of integrated approaches to community energy planning across Canada
- Enhance the capacity of CEP practitioners to implement CEPs

Key Outcomes

- The National Report on Community Energy Plan Implementation
- The National Report on Policies Supporting Community Energy Plan Implementation
- Community Energy Planning: The Value Proposition
- A series of national workshops and an Innovation Symposium
- A Community Energy Implementation Framework
- The pilot application of the Framework to three test communities
- Training modules to support the delivery of the Framework



Project Supporters

THE J.W. MCCONNELL
FAMILY FOUNDATION
LA FONDATION DE LA
FAMILLE J.W. MCCONNELL

SUNCOR
ENERGY | SUNCOR
ENERGY
FOUNDATION

ALBERTA
REAL ESTATE
FOUNDATION

real estate
foundation
BRITISH COLUMBIA

CONSEIL DE LA
COOPERATION DE LA
SASKATCHEWAN
CCS

CDÉM

COEA conseil de
développement
économique
de l'alberta

SDE
Columbia-Britannique

Fondation **ECHO** Foundation

Project Partners

**Community Energy
Association**

QUEST | Quality Urban Energy
Systems of Tomorrow

SP | Sustainable
Prosperity

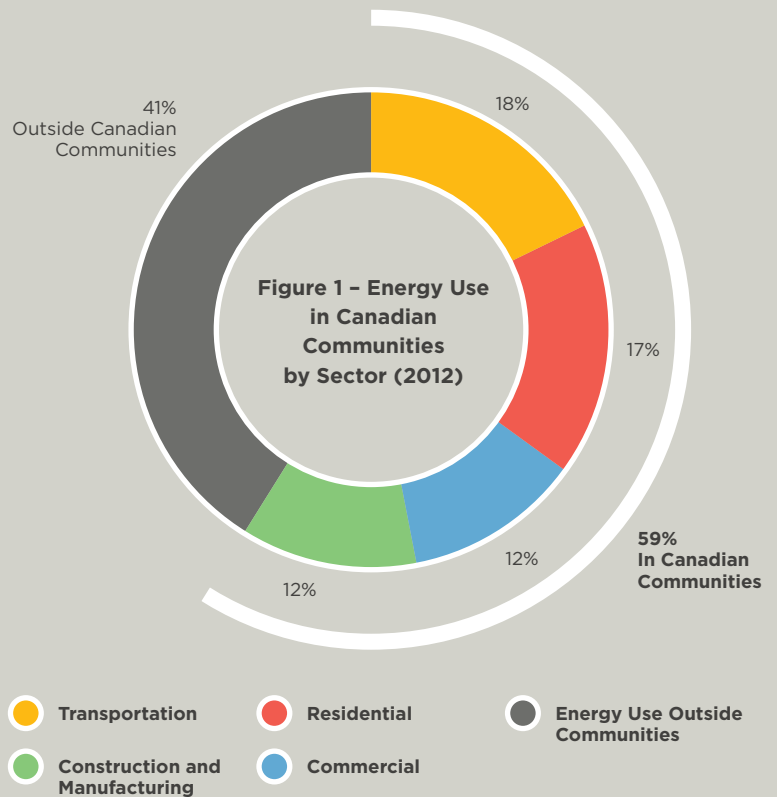
Introduction: The Value Proposition

Canadian communities have untapped opportunities to strengthen local economies, reduce current and future energy costs and greenhouse gas (GHG) emissions, and create jobs by investing in smarter and more integrated approaches to energy use at the local level.

Communities that have analyzed these opportunities have consistently identified a strong value proposition for these approaches, with solid economic returns on investments, environmental gains, health benefits, and improved quality of life for local residents.

Energy is a significant, and growing, cost in Canadian communities. Each year, many millions of dollars leave local economies to pay energy bills for heating and cooling, lighting, transportation, manufacturing, industrial production, and the many conveniences of modern living. Decisions within the community context regarding urban form, buildings, transportation, waste, and distributed energy resources⁸ can reduce those costs and recirculate some of those dollars into the local economy. Equally, they can drive economic development, make communities more resilient to disruptions or changes in energy supply, and support key strategies for reducing greenhouse gas (GHG) and air pollution emissions.

Canadian cities, towns and villages have influence over approximately 60 percent of energy consumption and over half of all GHG emissions in Canada, as illustrated in Figure 1. Consequently, communities have the potential to make significant contributions to addressing Canada's current and future energy and climate challenges.

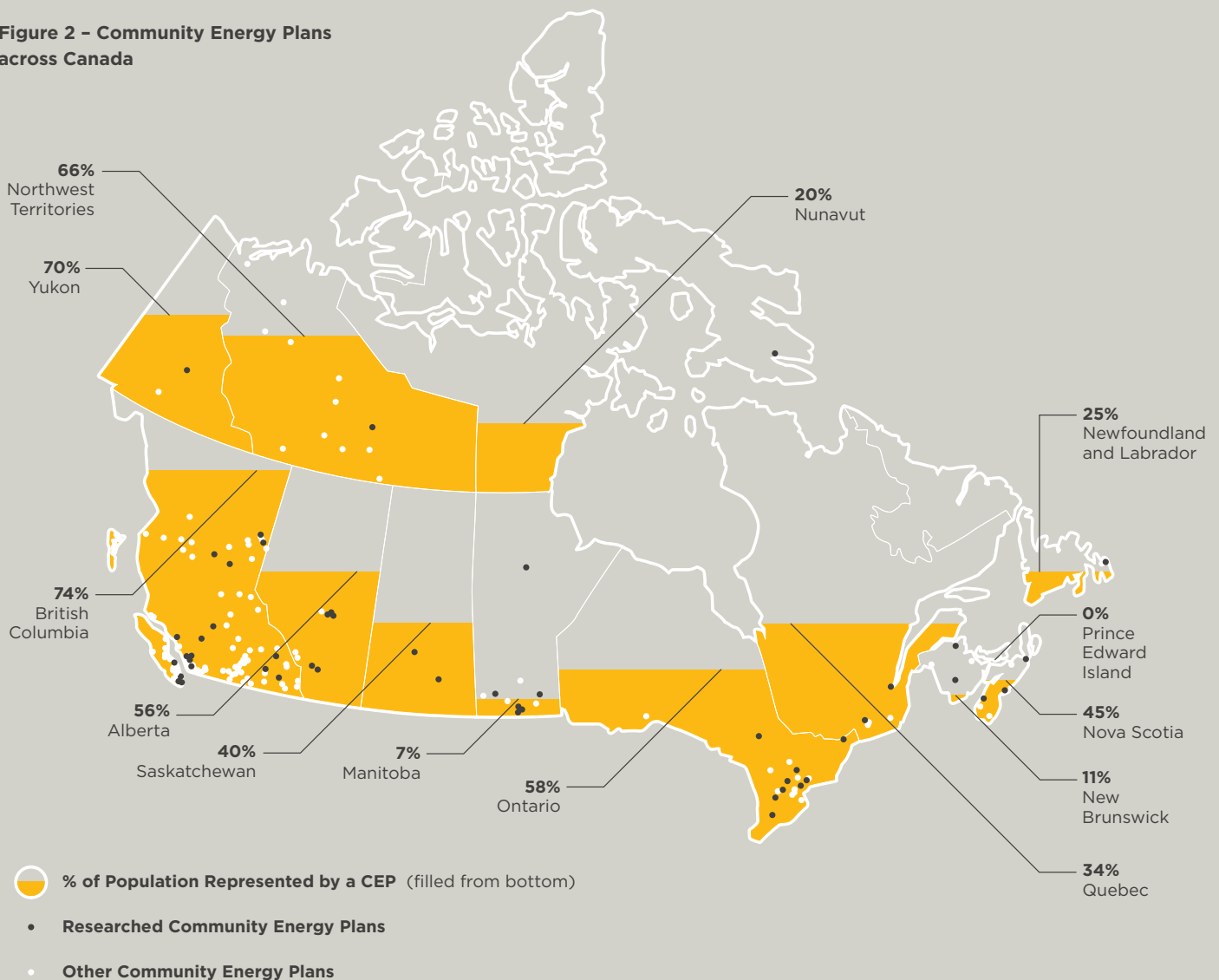


Source: (Natural Resources Canada, 2012)

⁸ Distributed energy resources include renewable energy, district energy and combined heat and power, and storage.

A Community Energy Plan (CEP) is a tool that drives community priorities around energy with a view to increasing efficiency, reducing emissions and driving economic development.

Figure 2 - Community Energy Plans across Canada



Over 180 communities, representing 50 percent of the Canadian population, have developed a CEP, as illustrated in Figure 2.⁹

While there is no standard approach to developing a CEP, it often contains community-wide:

- Energy inventories including energy from buildings, transportation, land use, waste, and distributed energy resources
- Energy and GHG emissions reduction targets
- Sector-specific actions¹⁰
- Economic, health and other co-benefit considerations

Around half of the CEPs in effect include economic analyses of the economic impacts of CEP implementation. Some of the approaches they use include:

- Calculation of total current energy expenditure in the community
- Economic assessment of specific actions to assist with screening and prioritization:
 - Internal rates of return on investments and payback periods
 - Net present value of investments across 15-25 year horizons
 - Net present value as above, incorporating shadow prices for carbon
 - Marginal abatement cost curves when GHG emission reduction is a CEP goal
- Economic modeling of the potential economy-wide impacts of implementation of the CEP in full, including
 - Total investment required
 - Total future energy savings from CEP implementation, including avoided costs
 - Local jobs created (including direct, indirect, and induced jobs)
- Co-benefits, such as GHG emission reductions, reduced congestion, improved air quality, improved population health, and increased social capital

CEPs that contain economic analyses consistently find a strong value proposition from the successful implementation of a CEP: impressive community savings, solid returns on investment, and attractive local job creation.¹¹

As CEP communities begin or continue to implement their energy plans, a growing body of experience is also supporting these findings.

Economic Analysis in CEPs in Canada

There are many approaches to conducting economic analyses to assess the economic value proposition of implementing a CEP. A survey of 50 CEPs across Canada found that while half included economic analysis of several or more actions, half analyzed only one action or none at all (see Appendix I for economic analysis approaches used).

⁹ See the National Report on Community Energy Plan Implementation at www.gettingtoimplementation.ca. Community Energy Plans are also commonly referred to as Local Action Plans, Municipal Energy Plans, Community Energy and Emissions Plans, Energy and Greenhouse Gas Management Plans and Integrated Community Energy Plans. Generally, each of these are very similar and contain much of the same content, and aim to achieve similar objectives of a CEP.

¹⁰ CEPs vary in the degree of detail provided for these actions, but many include active transport and public transit measures, combined heat and power projects, renewable energy projects, energy efficiency retrofits, and land use planning measures.

¹¹ CEP implementation can enable communities to become Smart Energy Communities: communities with improved energy efficiency, enhanced energy reliability, lower energy costs, and reduced GHG. Such communities will often integrate conventional energy networks (electricity, natural gas, district energy, and transportation fuel) to better match energy needs with the most efficient energy source; integrate land use; and harness local energy opportunities. Such communities can be characterized by 6 technical principles and 6 policy principles. Read the principles at <http://www.questcanada.org/principles-smart-energy-communities>

This report draws primarily on the findings of six comprehensive economic analyses of CEP actions and programs, and case studies to illustrate the value proposition of CEP implementation to communities across Canada.

CEPs vary in the types of economic analyses conducted, the methods used, and the goals they are trying to achieve. As a result, it is not possible to compare and contrast the forecasted economic benefits between the various CEPs. The purpose of this report is to provide examples of the findings from CEP analyses, and evidence of the wide range of direct and indirect benefits being reported from CEP implementation. It aims to inform, motivate, and build the political, staff and stakeholder support needed for CEP implementations. To do this, the report is organized into the following sections:

Section 1 describes in detail what a CEP is and how it can help communities achieve both economic and environmental goals

Section 2 discusses how energy is a significant and growing cost to communities

Section 3 focuses on how a CEP can help recirculate money spent on energy within a community and its region

Section 4 explains how CEP implementation can contribute to achieving local economic development goals and can create opportunities for local savings and local jobs, showcasing specific municipal examples from across Canada

Section 5 considers how a CEP can help to mitigate financial risks from future carbon pricing and uncertain energy prices

A Note on Methodology

Quantifying the value proposition of CEP implementation is challenging due to uncertainty over future growth, energy prices, and technology, as well as shifting energy, environmental and economic policies at all levels of government. Community energy planning is also a relatively new practice. This means that data on the implementation success of a CEP is limited. The majority of information available on the economic benefits of a CEP relies on economic forecasting produced through the application of economic models. All economic models, by definition, are attempts to represent the real world, but due to the inherent uncertainty and variability in the real world, models will never be perfect representations. Models are therefore primarily used for comparing alternative policy scenarios and for simulating likely future scenarios. Scenarios for co-benefits, and indirect and induced effects are particularly difficult to capture with accuracy since these depend on complex interactions in a given region's economy.

The data cited in this report indicate the forecasted economic effects of various energy efficiency projects, distributed energy resources, transportation and integrated land use options, but they draw from studies containing a wide variety of goals, assumptions and contexts, and using different economic analysis methodologies and standards. Due to this variability, the findings highlighted in this report cannot be directly transferred to other communities. However, the range of findings and experiences described provide insights and practical examples for communities of all sizes, at various stages of planning, and in locations throughout Canada, who are seeking to implement a CEP.

Impacts

CEPs can help to keep more money in a local economy, generate opportunities for local savings and jobs, and help to manage risk from volatile energy prices and future climate policy by using energy more efficiently and producing more energy locally. In addition to this, there is a wide range of broader—and often harder to quantify—economic impacts that smart community energy planning can bring about. These impacts are described throughout the report.

Impact 1

Improving Residents' Health

Impact 2

Retaining Local Business

Impact 3

Smart Urban Renewal

Impact 4

Attracting New, High Tech Investment

Impact 5

Employee Productivity

Impact 6

Energy Affordability and Resilience in Remote, Off-grid and On-grid Communities

Impact 7

Market Differentiation

Impact 8

Housing Affordability

CEPs: A Smart Approach to Achieving Environmental and Community Health Goals, as Well as Economic Ones

CEP implementation can bring a community substantial economic benefits, as will be discussed in the following sections, but it can also support environmental goals at the local, national, and global levels, and improve community health. Environmental goals are mainly related to supporting global GHG emissions reductions, and reducing local and regional air pollution.¹² Community health benefits arise from reduced air pollution, and the health and social connectivity benefits associated with less car-dependent neighbourhood design and transport systems.¹³

1.1 – Environmental Goals

Canadian communities play a particularly important role in national and global efforts to address climate change as they have direct or indirect control of 60 percent of Canada's total GHG emissions.¹⁴ Municipal or regional level policies, including CEPs, can consequently drive significant emissions reductions and are critical to nation-wide efforts to address climate change. A 2015 report from the prestigious New Climate Economy project notes the enormous opportunity that exists, on a global scale, for cities all over the world to accelerate low-carbon development.

Low carbon actions at the local level, with annual investment of roughly \$1 trillion could pay for themselves and yield savings from now until 2050 with a net present value of USD\$16.6 trillion, accompanied by a reduction in annual emission of 8 gigatonnes of GHGs by 2050 (greater than total 2013 U.S. emissions).¹⁵ Although the contribution of each community may feel small in contrast to the global challenge of mitigating climate change, these contributions, combined, can make a large difference.

A growing number of municipal networks are supporting climate leadership through peer exchange of technical, planning and policy knowledge. These include, among others, the Federation of Canadian Municipalities' Partners for Climate Protection, the Carbon Neutral Cities Alliance, the C40 Climate Leadership Group, the International Council for Local Environmental Initiatives, the QUEST Caucus Municipal Working Groups, the Community Energy Association's BC Mayors Climate Leadership Council and the Renewable Cities network. A CEP can help a community incorporate the technical and policy knowledge it receives through these partnerships and set a clear course of action for achieving environmental goals, based on its own unique energy and GHG inventory baseline, targets, and capacity.

1.2 – Community Health Goals

In a sampling of communities in Canada with CEPs, 59 percent indicated that health benefits were among the reasons for developing a CEP.¹⁶

Smart land use and transportation infrastructure can help reduce health care costs. Mixed-use neighbourhoods designed to enhance walkability, active transport, and access to public transit have positive population health effects, such as reduced obesity and improved mental health and social cohesion, by increasing movement and exercise.¹⁷

Health impacts and costs are also linked to how communities use energy: cities in Canada have a large influence on sources of air pollution related to land use, transportation and other energy production.¹⁸ One-third of Canadians live near highways or other major roads, where they are exposed to hazardous tailpipe emissions such as nitrogen oxides and particulate matter, associated with medical conditions including high blood pressure, asthma and stress.¹⁹ The health impacts associated with transport in Canada are estimated to have an economic impact of between \$4 and 7 billion (2000 dollars).²⁰ The health benefits of reduced air pollution from decreasing fossil fuel power generation through actions such as energy efficiency, conservation, and distributed energy resources, are also significant. For example, a 2013 study focusing on air pollution from coal plants in Alberta notes that the total economic damages from associated health impacts are in the order of \$300 million each year.²¹

Impact 1 Improving Residents' Health

There are direct—and economically significant—health costs associated with energy use in communities, as previously noted. Improvements to local energy use and production are often conducive to healthier neighbourhood design, transportation systems, natural environments, and housing.

For example, transportation system fuel switching and land use changes that promote active transportation can help to reduce the prevalence of obesity and cardiovascular issues through improved air quality—in particular, from reduced ozone and PM2.5 (fine particulate matter that can interfere profoundly with lung function).²²

Evaluation of Rapid Transit in Waterloo Region, Ontario

An evaluation of the benefits from improved public transit in the Waterloo region found a variety of health benefits in addition to a wide range of economic, direct transportation cost, and travel time benefits. The study considered the possibility of two light rail corridors, and two bus rapid transit corridors, and two distinct staging scenarios, evaluating potential impacts of each against a reference case. In particular, the study considered public health benefits in terms of air quality (hospital visits avoided and economic impacts) as well as active transportation (qualitative evaluations of project impacts).

The study found that the Waterloo rapid transit project could lead to air quality improvements that could prevent, under the various scenarios, from 31-61 hospital admissions and reduce costs of health care by \$8.7 million - \$16.6 million (2003 dollars) in net present value over 30 years, from 2009-2038. These figures do not include additional health benefits that arise from improvements to community liveability and active transportation.²³



Copyright Queen's Printer for Ontario, photo source: Ontario Growth Secretariat, Ministry of Municipal Affairs and Housing.

¹² (Jaccard et al., 1997)

¹³ (Provincial Health Services Authority, 2014)

¹⁴ (M. K. Jaccard and Associates, 2010) (New Climate Economy, 2015) (Natural Resources Canada, 2012)

¹⁵ (New Climate Economy, 2015)

¹⁶ (QUEST, 2015a)

¹⁷ (Provincial Health Services Authority, (2014).

¹⁸ (Canadian Environmental Grantmakers' Network, 2005).

¹⁹ (Brauer et al., 2013)

²⁰ (Sawyer et al., 2007)

²¹ (Pembina Institute, 2013)

²² (Provincial Health Services Authority, 2014)

²³ (Canadian Urban Transit Association, 2010) (Region of Waterloo, 2009)

Section 2

Energy: A Significant Cost to Communities, Businesses, and Households

CEP implementation offers a systematic approach for a community to lower energy costs by using energy more efficiently, better matching energy needs with the most efficient energy source, integrating energy considerations into land use and transportation decisions, and harnessing local energy opportunities.

Energy is a significant, and growing, cost in Canadian communities with millions to billions of dollars being spent on energy each year. Table 1 outlines the range of average community-wide energy spending across communities of different sizes. On a per capita basis, this ranges from \$2,000 to \$4,000 per year.²⁴ These total cost figures include the costs of energy used and produced by buildings, transportation, land use, waste and distributed energy resources. Table 1 profiles average energy spending in Canada by community size.

Table 1 - Energy Spending in Small, Mid-sized and Large Communities

| Community Size | Average Spending on Energy in the Community |
|--|---|
| Small Communities (less than 20,000 people) | Up to \$80 million |
| Mid-sized Communities (20,000 to 100,000 people) | \$60 million to \$400 million |
| Large Communities (100,000 people to 2.5 million people) | \$200 million to \$10 billion |

Source: QUEST, 2015b

Energy is also a major operating cost for many businesses. In some Canadian manufacturing industries, energy, water and fuel costs are on par with production wage expenditures.²⁵ In a 2015 report, the Ontario Board of Trade identified rising energy costs as a critical concern, noting that member businesses are finding that increasing energy costs are impeding their growth and ability to hire additional workers.²⁶ In a national survey of Canadian executives, 86 percent cited energy costs as a high or moderate concern to their business. The highest rates of concern were expressed by small businesses in the retail, accommodation, food and arts sectors.²⁷

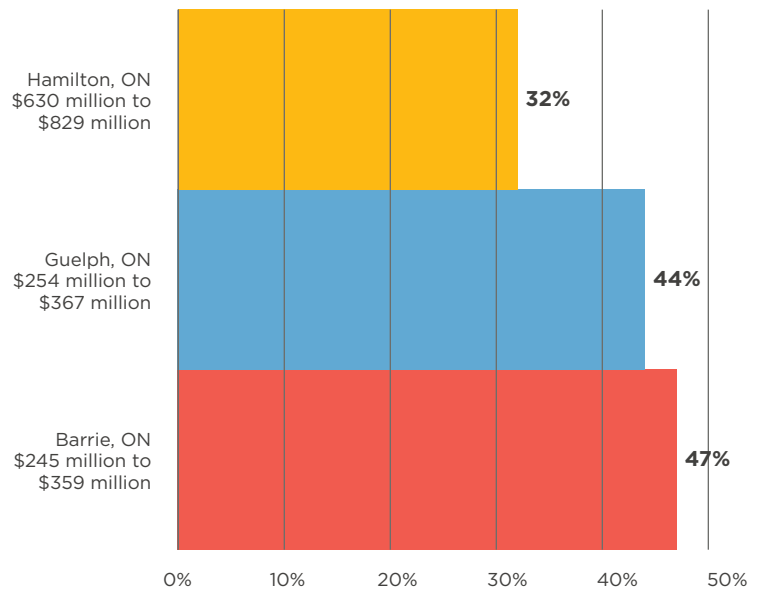
Currently, energy for transportation, heating, and electricity accounts for approximately 7 percent of Canadian household expenditures.²⁸ This expense is disproportionately burdensome for low-income households, where tough choices must

sometimes be made between paying energy bills and paying for rent, food, clothing, medicine and other necessities.²⁹

As outlined above, the cost of energy plays a significant role in the financial well-being of communities, businesses, and people. The total cost of energy in Canadian communities, and to the businesses and households in these communities, is expected to grow over time if no alternative actions are taken. This is a result of a variety of factors, including growth in local population, employment, and transportation, as well as rising costs of energy, particularly for electricity in many jurisdictions. The introduction of carbon pricing in a growing number of Canadian provinces will also result in further energy cost increases.

Figure 3 shows the forecast growth in the cost of energy (reflecting increases in population and changing fuel prices) for three communities in Ontario between 2008 and 2031.

Figure 3 - Percentage Increase in Expected Cost of Supplying Energy Community-Wide in Three Ontario Communities Between 2008-2031



Source: Canadian Urban Institute, 2011a-c

CEP implementation can help communities gain a systematic understanding of their current energy baseline and prepare a plan for reducing costs and mitigating the risks of increasing costs over time.

Impact 2 Retaining Local Business

Community energy planning can aid to lower local energy input costs. Energy conservation and energy efficiency, renewable and alternative energy and fuels, district energy, cogeneration, and new approaches to waste management can change the economics of production for the better, and influence a firms' decision to remain in a community.

Polycon Car Parts stays in Guelph

Rising energy costs placed competitive pressures on the Polycon Industries car parts plant in Guelph, Ontario, threatening its closure. To address this, in 2014 Polycon installed a combined heat and power system with 8 megawatts of generating capacity, that captures waste heat, provides water heating, and most of the electrical needs for the facility. The system is saving the plant about \$2 million per year in energy costs, and increasing its long-term competitiveness.³⁰ This project, supported by the provincial utility and the City of Guelph's CEP, led the company to stay in the community.



²⁴ (QUEST, 2015b)

²⁵ (Industry Canada, 2015)

²⁶ (Ontario Chamber of Commerce, 2015)

²⁷ (The Gandalf Group, 2015)

²⁸ (Scotiabank, 2014)

²⁹ See, e.g., Low Income Energy Network at www.lowincomeenergy.ca

³⁰ (CTV Kitchener, 2014; Government of Ontario, 2014; Sturgeon, 2014; City of Guelph, 2014)

Section 3

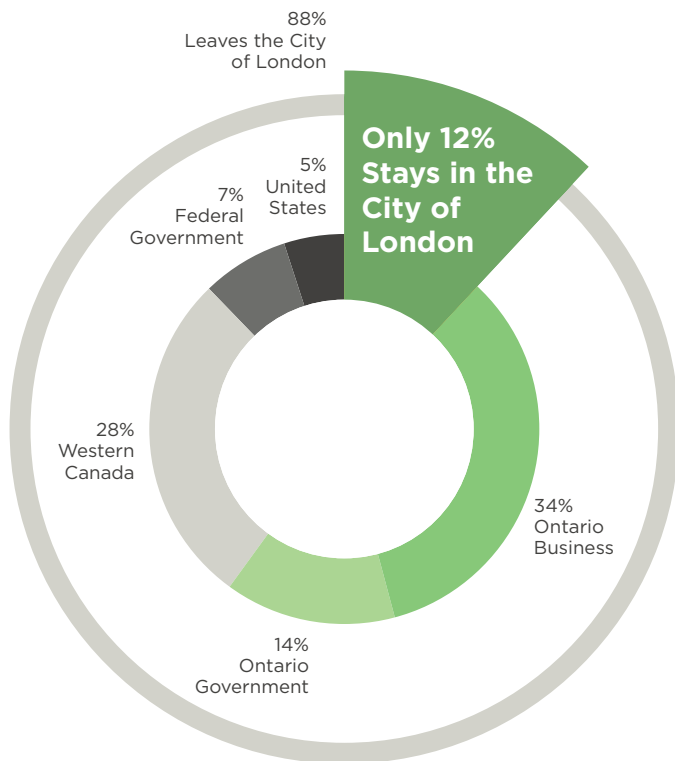
Keeping More Energy Dollars in the Local Economy

While a significant portion of money is directed to paying energy costs in a community, few of the energy dollars spent by residents and businesses actually remain within that community. For example, in London, Ontario, as shown in Figure 4, only 12 percent of the \$1.6 billion spent on energy in 2014 stayed in London's economy, and only 59 percent total stayed in the province.³¹ The dollars staying in the London economy greatly varied by fuel type and Figure 5 illustrates that the choice of fuel used can be a key factor in how much money spent on energy actually stays in the local economy.

A similar analysis from Duncan, British Columbia, which has a population of approximately 5,000, indicates that the majority of their roughly \$15 million spent on energy costs per year, equal to \$3,000 per resident, left the community in 2010.³²

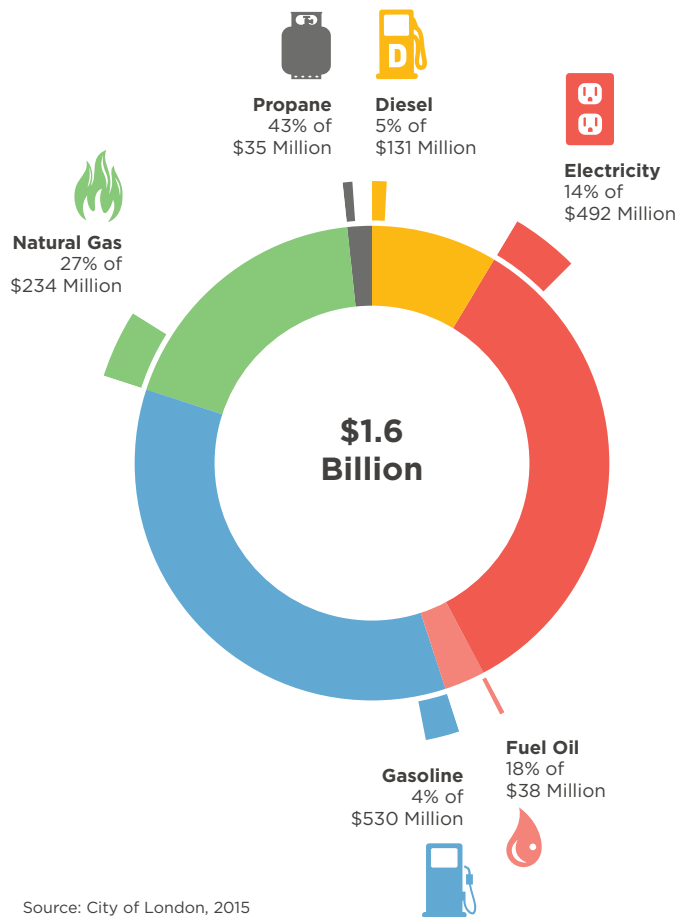
A community can use a CEP to identify opportunities to keep money within the local economy. In the London, Ontario example shown in Figure 5, a change in the type of fuel used could achieve this. Other opportunities can come through the use of conservation, efficiency, and distributed energy resources such as renewable energy, district energy or combined heat and power. Using London, Ontario as an example again, it is estimated that for every 1 percent reduction in energy use by London residents and businesses, about \$14 million dollars will be retained in the local economy.³³

Figure 4 - Destination of City of London Energy Expenditures as Percentage of \$1.6 Billion Total



Source: City of London, 2015

Figure 5 - Energy Dollars Staying in City of London Ontario Economy by Fuel Type



Source: City of London, 2015

Impact 3 Smart Urban Renewal

Redevelopment or renewal of a neighbourhood provides a unique opportunity to better integrate energy and land use, and can result in significant energy savings. Revitalization projects are increasingly aiming to create sustainable, liveable communities, designed for smarter energy management. Features include improved public transit, active transportation infrastructure, building design, integration between land use and transportation, and distributed energy resources.

Innovative financing options can be at the forefront of neighbourhood revitalization. The River District neighbourhood development is in a former industrial area in Southeast Vancouver (also known as the East Fraser Lands). The neighbourhood developer owns and operates its own centralized district energy system, delivering hot water and space heating for all buildings in the development.³⁴ This district energy utility model has not only provided increased autonomy for the development, but also stable financial returns for the developer (while still providing affordable energy to residents).

Regent Park Revitalization Plan (Toronto, Ontario)

The Regent Park Revitalization Plan is a large, multi-phase, 20-year neighbourhood redevelopment plan that began in 2005. It is transforming an area that had a large stock of aging infrastructure into a mixed-income, mixed-use neighbourhood with an emphasis on liveability and sustainable design.³⁵ The Daniel Corporation is a partner on the redevelopment, and Daniels Spectrum—an arts and cultural centre—is a focal point within the redevelopment.

The revitalization of Regent Park shows how changes to community energy systems can be an important part of modern urban renewal. The Regent Park Community Energy System started operations in 2009,³⁶ and at build-out will be connected to all buildings in the redevelopment to provide a share of their required heating and cooling. In addition to the greenhouse gas benefits of district energy systems, the project is estimated to lead to a 15 percent savings in energy costs.³⁷ The redevelopment included requirements for affordable housing. With Daniels Corporation as the primary private sector partner, the energy savings are effectively invested back into supporting more affordable housing and directly helping to address energy poverty.



City of Toronto (2013). City of Toronto: Regent Park.
<https://www.flickr.com/photos/cityoftoronto/10056352874/>

³¹ See an overview of how communities can replicate London's approach to accounting for the destination of energy spending at the following link: <https://vimeo.com/120112918>

³² (City of Duncan, forthcoming)

³³ (City of London, 2015)

³⁴ (River District Vancouver, 2015. See also Windmill Developments (2015))

³⁵ (Toronto Community Housing Corporation, 2015)

³⁶ (FVB Energy Inc., 2015a)

³⁷ (Natural Resources Canada, 2015)

Section 4

Contributing to Savings, Local Economic Development, and Jobs

In addition to retaining money spent on energy within the local economy, there are other direct and indirect economic benefits to the broader community from implementing a CEP:

Direct economic benefits are gained to the businesses or households directly implementing a particular investment to reduce energy costs, through changes in savings or spending, new income to businesses, and new jobs.

Indirect benefits arise in economic sectors that supply the inputs for that investment, such as equipment or technical services. The more a community can provide the goods and services needed for the CEP, the greater the share of indirect benefits that will remain in the community.

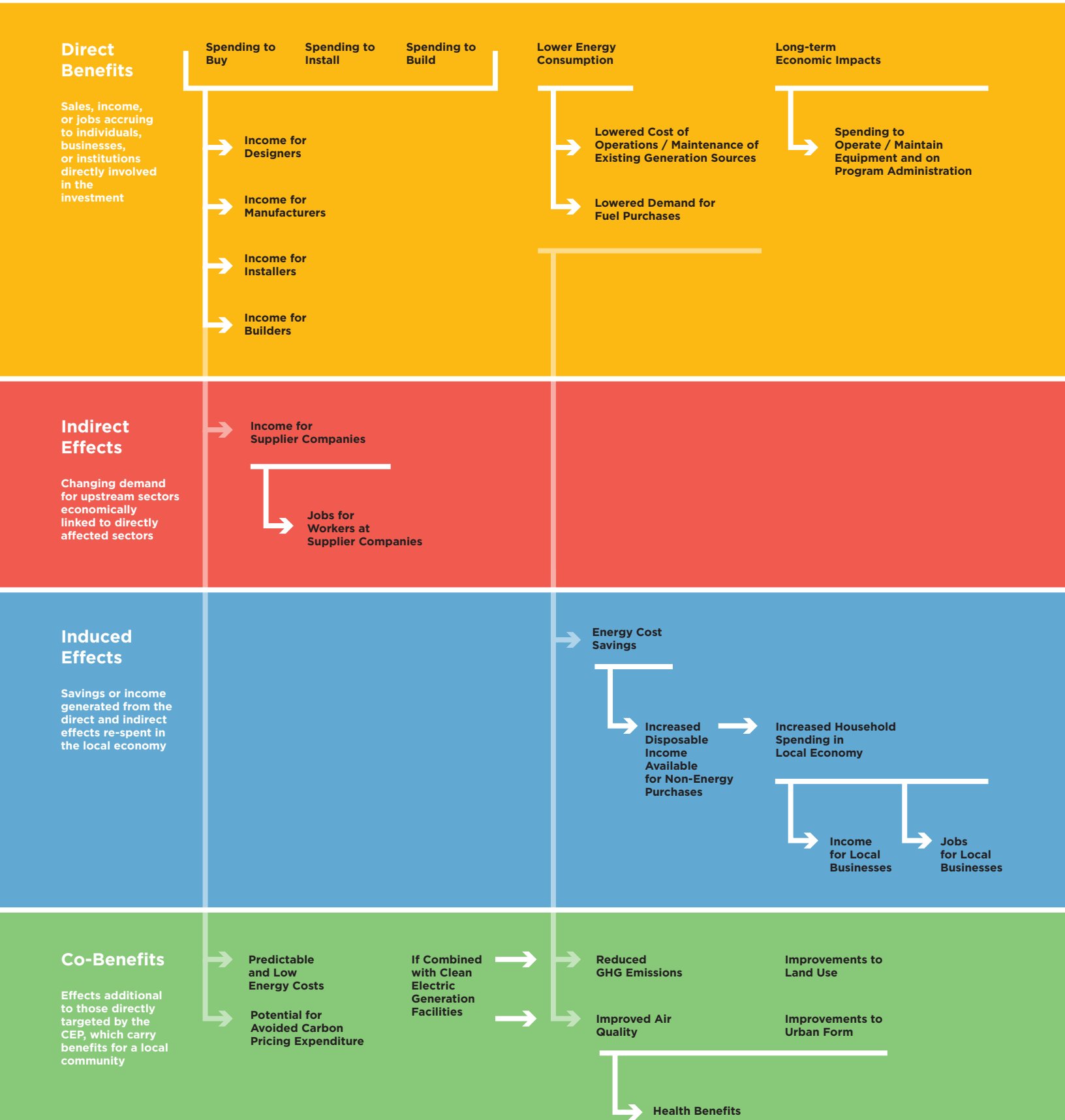
Induced benefits result from a trickledown effect which arises when dollars generated from energy savings or from new local energy-related jobs are re-circulated in the local economy.

Co-benefits are bonus benefits additional to those directly targeted by the CEP. These are often significant, but harder to quantify: for example, reduced congestion, improved air quality, improved community health, and increased community interactions as a result of an active transportation initiative would be indirectly supported by the implementation of a CEP.

Figure 6 outlines examples of the potential cost savings and job creation achievable through CEP implementation using the example of a district energy system.³⁸ These examples are expanded upon in the following sections.

³⁸ District energy systems provide heating and/or cooling needs via a central plant for a given area. Such systems can work in tandem with electric generation facilities (known as combined heat and power systems).

Figure 6 - Economic Benefits of Community Energy Planning Using the Example of a District Energy System



4.1 – Investing for Impressive Long Term Savings and Jobs

The savings from reducing energy demand and energy costs can far exceed the initial capital investment, particularly when considered over longer time horizons.

For example, the Ontario cities of Barrie and Hamilton evaluated the long-term effects (over a period from 2008-2031) of maximizing cost-effective building energy efficiency retrofits and technologies, using an internal rate of return threshold of 6 percent. They found that considerable reductions in annual energy costs would result, and would persist beyond the period considered in the study. Additional indirect economic benefits, not included in the analysis, would also be realized. Table 2 below shows investment, savings, and job estimates from the analyses conducted by the cities of Barrie and Hamilton. For every \$1 million invested in building energy efficiency retrofits in these cities, over 9 person-years of permanent employment would be created within the Province of Ontario.³⁹

Table 2 – Investment, Energy Savings and Job Impacts from Ontario Community Studies

| Implementing all actions within the scenario leads to | Barrie | Hamilton |
|--|---|--|
| Cumulative Capital Investment (2008-2031) | \$2,655,000,000 | \$7,544,000,000 |
| Annual energy savings (based on base year energy prices) | \$67,300,000 (19% of BAU energy costs) | \$233,000,000 (28% of BAU energy costs) |
| Jobs created in Ontario | 1,200 | 2,400 |
| Jobs/million invested | 9.1 person-years | 9.35 person-years |

Source: Canadian Urban Institute, 2011b-c

A similar CEP analysis was prepared for the city of Edmonton, Alberta. A total investment of \$237 million in low carbon projects such as renewable energy, energy efficiency, and electric transport initiatives over the 2018-2021 period promises a potential net present value from energy savings of \$3.4 billion by 2035 if a social cost for carbon of \$51/tonne carbon were included. If the social cost of carbon were omitted, the cumulative cost savings are expected to be still significant but lower, at \$2.5 billion.⁴⁰ Annual per capita spending on energy would drop from \$1,550 in 2010 to \$770 per capita by 2044.⁴¹ These estimates do not include associated benefits, such as a diversifying labour market with an increase in renewables-related jobs.⁴²

Impact 4 Attracting New, High Tech Investment

Communities that can provide clean, reliable and affordable energy can attract those businesses—and large high technology companies in particular—who desire to shrink their environmental footprint. Many of these companies will also work with local utilities to establish long-term clean power purchase agreements. These businesses are considering multiple characteristics of local energy supply in choosing a business site location:

- Affordable energy is important to all businesses⁴³, but particularly to businesses for whom energy constitutes a relatively large share of production inputs— 87 percent of Canadian business executives identify improving energy efficiency as a high or moderate priority for their business;⁴⁴
- Reliable and stable energy supply is vital for companies that are big energy users, and for whom any interruption in energy supply is particularly costly (for example, industrial and manufacturing facilities); and
- Reducing emissions—energy with relatively low pollution impacts—is a key factor for firms that want to lower their environmental footprint, often in consideration of corporate environmental stewardship initiatives.

Companies use a variety of approaches to procure clean energy. These include on-site generation, links with district energy systems, renewable energy certificates, which certify that electricity provided is from renewable sources; and renewable power purchase agreements.⁴⁵

IBM moved their entire corporate headquarters and labs to Markham, Ontario in 2000, a move credited to the development of a local district energy system that provides clean, reliable, and affordable energy from multiple sources.⁴⁶

Google locates its energy-intensive operations partly based on local energy characteristics. The company seeks to procure additional renewable electric generation (that would avoid reshuffling the outputs of existing projects), and focus on scalable technologies that advance the renewables industry. In 2013 it proposed “renewable energy tariffs” as an improved procurement approach, and in 2015 announced the first solar energy project enrolled under such an approach. Under this approach, companies can secure clean energy supply by paying a renewable energy tariff to utilities, which passes on any additional costs that come from using renewable sources to the company, without impact on other ratepayers. An added benefit of this approach is accelerating growth of renewable supply in a given region.⁴⁷

Data Centers

Data centers or “server farms” support the internet’s massive telecommunications and storage requirements. The cost of a server’s electricity over four years can be equal to the cost of the server itself, with the bulk of the energy used for cooling the air and powering the computer servers.⁴⁸

Clean, affordable and reliable power is of primary importance for data centers⁴⁹ as they are large energy users, can incur large costs from power interruptions, and in many cases have corporate commitments on GHG emissions. Data centers are likely to show the fastest future growth in demand amongst components of information and communication technology systems, with emissions slated to triple by 2020 based on 2002 levels.⁵⁰

The RackForce GigaCenter is a large data center that opened in Kelowna, British Columbia in 2009, which benefits from the clean, affordable, and stable energy available—a result of past choices British Columbia made regarding clean energy.⁵¹

For small and medium sized data centers (such as university data centers), relocating facilities to communities with low-carbon electricity sources and with opportunities to source electricity generated from renewable sources can be a cost competitive, and scalable approach to reducing corporate GHG footprints.⁵² The changing economics of climate change, and in particular expanding carbon pricing systems, may increasingly make it economically favourable for companies to locate data centers in communities that have the lowest carbon intensity in their electrical systems.⁵³



Source: Schroeder, Dennis and NREL (2013).
<http://images.nrel.gov/viewphoto.php?imageld=7723501>

³⁹ (Canadian Urban Institute, 2011b-c)

⁴⁰ (City of Edmonton, 2015a)

⁴¹ (City of Edmonton, 2012)

⁴² (See Navius Research Inc., 2013 for more on labour impacts)

⁴³ (KPMG, 2014)

⁴⁴ (The Gandalf Group, 2015)

⁴⁵ (Google, 2013)

⁴⁶ (Markham District Energy, 2015)

⁴⁷ (Google, 2013; Google 2015)

⁴⁸ (Rath, 2011)

⁴⁹ Ibid.

⁵⁰ (The Climate Group, 2008)

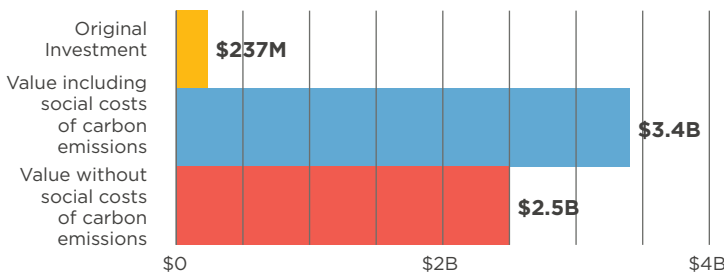
⁵¹ (MacNaull, 2009)

⁵² (Welch, 2011)

⁵³ (Lévesque et al., 2010)

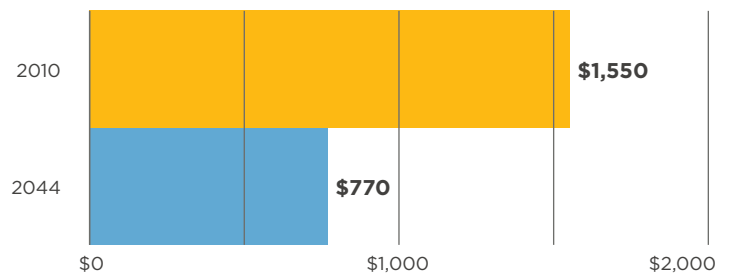
Under a low-carbon scenario, a total investment of \$237 million from 2018-2021 in Edmonton could generate big value from energy savings through to 2035 and reduce the costs of energy per person significantly by 2044, as illustrated in Figures 7 and 8.

Figure 7 - Value from Energy Savings in Edmonton between 2018-2035



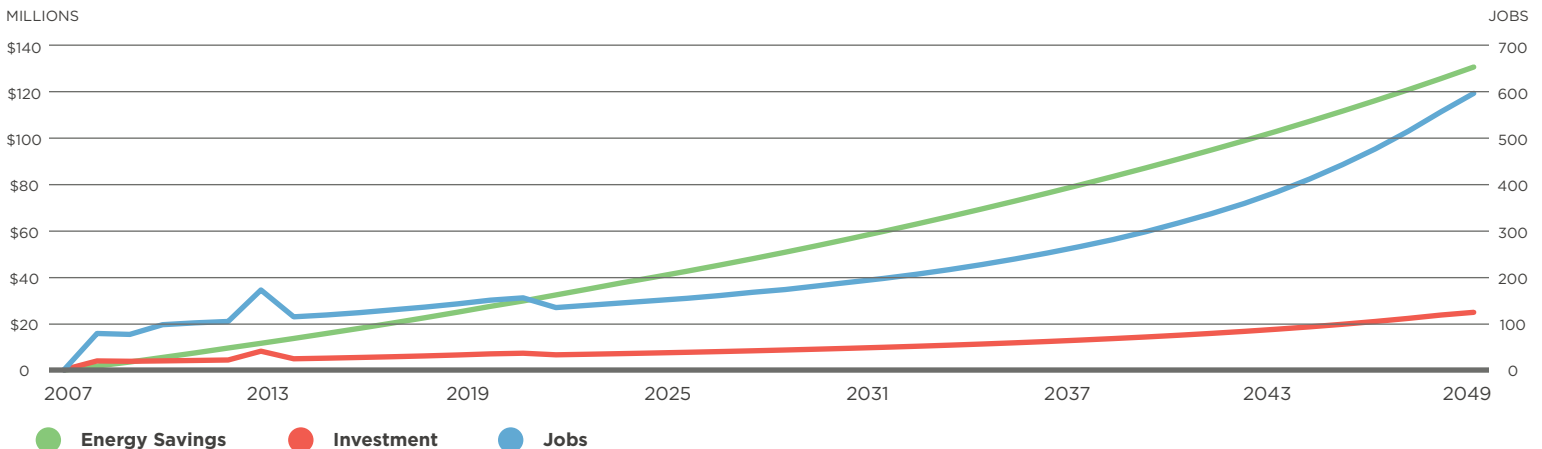
Source: City of Edmonton, 2015a; City of Edmonton, 2012

Figure 8 - Energy Cost Reductions Per Capita in Edmonton between 2010 and 2044



In North Cowichan, British Columbia (population 28,800), the municipality examined the long-term benefits of alternate scenarios for meeting a 33 percent reduction in GHG emissions by 2020 or 2025 (depending on scenario) compared with 2007 levels.⁵⁴ A business as usual scenario forecast community energy spending at \$285 million/year by 2050. One scenario focused on urban densification around mixed-use nodes and new transportation fuels. It identified potential savings from reduced energy costs at \$130 million annually by 2050, or \$4,000 per household, with investments starting at \$7 million/year in 2020 and reaching \$25.5 million/year by 2050. The total investment by 2050 would be \$470 million and an estimated 598 new jobs would be created. Figure 9 provides an overview of the forecasted savings, investment and employment outcomes under North Cowichan's mixed-use nodes scenario.⁵⁵

Figure 9 - Savings, Investment and Employment under the North Cowichan's Mixed-Use Node 33% Emissions Reduction Scenario



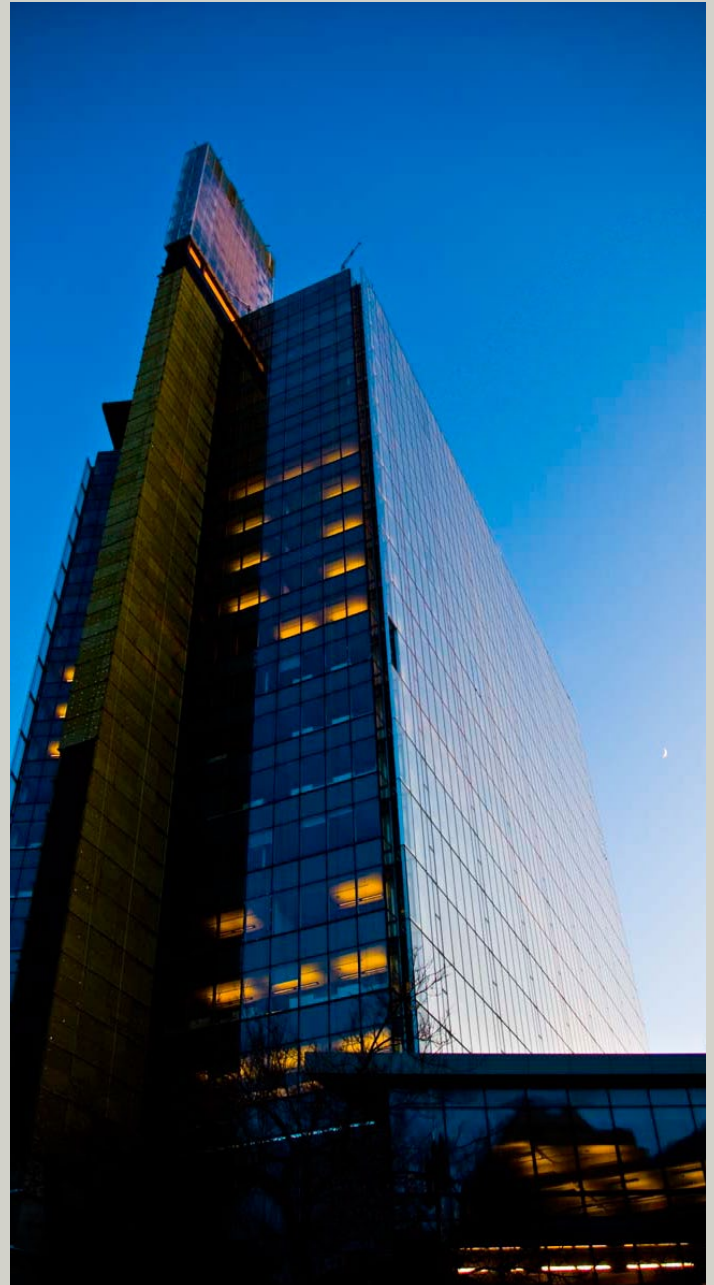
Impact 5 Employee Productivity

Energy efficient workplaces appear to boost employee productivity. Measures to increase energy efficiency, such as improvements to lighting, HVAC systems, and building design can lead to a more comfortable—and therefore productive—workplace, and reduce absenteeism.⁵⁶ Even a 1 percent increase in productivity can save a business more than the cost of energy efficiency investment.⁵⁷ A U.S. study that looked at such productivity impacts found for example that a \$300,000 post office retrofit in improved lighting and ceiling construction led to energy savings of \$22,400 per year, and to a 6 percent increase in processing rate—a one year payback on the investment. Similarly, the same study found that a \$2 million lighting and energy efficiency investment at a new build Lockheed plant led to \$500,000 in annual energy savings, a 15 percent rise in production, and a 15 percent decrease in absenteeism. In other examples, the study found improved retail sales, and reduced manufacturing defects tied to energy-efficiency improvements.⁵⁸

Manitoba Hydro Place

Manitoba Hydro opened a new Winnipeg head office hosting approximately 2,000 employees in 2009. The building has been recognized for its exceptionally sustainable design, which includes innovative energy efficiency measures and passive energy technologies. The building was designated LEED Platinum in 2012.⁵⁹ Improved lighting and air circulation has led to a healthier and more comfortable workplace.

Eight hundred Manitoba Hydro employees moved into the former headquarters from other facilities, allowing for comparison of employee absenteeism between the former headquarters and the new LEED facility. Employees in the new building averaged 1.25-1.5 fewer absentee days per employee in the first year compared to those remaining in the older building. This is attributed to improved indoor environment (air quality, daylighting, views) and improved office ergonomics. The decrease in absenteeism in the new building was equivalent to roughly 3,000 extra days of work, or to having an additional 20 employees – roughly a 1 percent boost to productivity. In the case of Manitoba Hydro, this corresponds to a labour cost gain of approximately \$700,000, more than twice the roughly \$300,000 in energy savings achieved from the building's improved energy efficiency. There was also a marked decline in service calls related to thermal comfort.⁶⁰



Source: https://en.wikipedia.org/wiki/File:1ajs_january_2009.jpg

⁵⁴ (Municipality of North Cowichan, 2013)

⁵⁵ Ibid.

⁵⁶ (Rocky Mountain Institute, 2013)

⁵⁷ (Romm and Browning, 1998)

⁵⁸ Ibid.

⁵⁹ (Manitoba Hydro, 2015)

⁶⁰ (Personal communication, Mark Pauls, Manitoba Hydro Building Energy Management Engineer 2015)

4.2 – Cost Effective Investments Are Community Specific

The most cost-effective investments will vary by community and will be influenced by local factors such as urban form, cost of current energy supply, age of building stock, and growth trends. For example, when the southern Ontario cities of London, Hamilton and Barrie assessed the best candidates for energy efficiency investments in new and existing buildings, using similar assumptions, each city found cost-effective programs, but quite different priorities, as shown in Figure 10.

Figure 10 – Financial Feasibility and Acceptability of Energy Efficiency Improvements across Three Ontario Municipalities

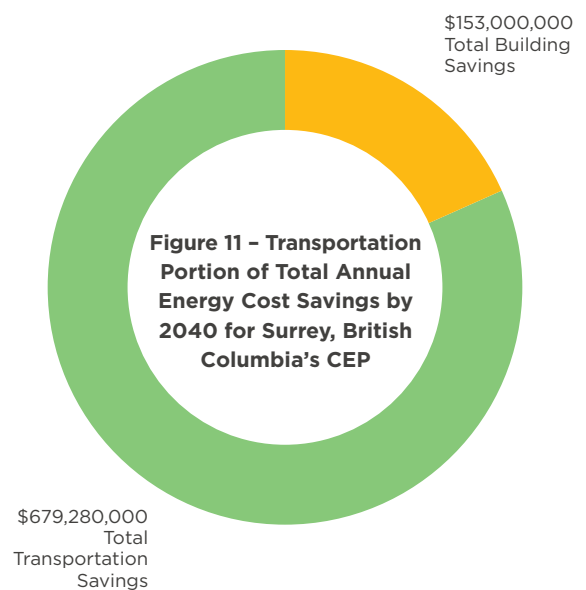
| Financial Performance of Improvements | High Efficiency Scenario | | |
|---------------------------------------|--------------------------|----------|--------|
| | London | Hamilton | Barrie |
| Office - New | ● ● | ● ● | ● ● |
| Office - Retrofit | | ● | |
| Retail - New | | ● | |
| Retail - Retrofit | ● | | ● |
| Institutional Low Density - New | ● ● | ● | ● |
| Institutional High Density - New | ● | ● | ● |
| Institutional Low Density - Retrofit | | | ● |
| Residential Low Density - Retrofit | | ● ● | |
| Residential Medium Density - New | | | |
| Residential High Density - New | | | ● |
| Industrial - New | ● | ● ● | |
| Industrial - Retrofit | ● | ● ● | |

● Feasible (or likely feasible), with IRR of at least 4 percent

● Acceptable, with payback period of 7 years or less

Source: Canadian Urban Institute, 2011 a-c

Surrey, British Columbia’s CEP⁶¹ shows how compact land use and proximity to public transit can have substantial local economic benefits. The land use and transportation goals of the plan are highly linked, notably aiming to increase the share of residents within a 5 minute walk of frequent public transit by 21 percent by 2040, increase bicycle routes by 148 percent, and reduce personal vehicle driving distances by 9 percent. Implementation of Surrey’s CEP could deliver community-wide energy savings of \$832 million annually by 2040, corresponding to a 31 percent saving relative to business as usual. In Surrey’s plan, over 80 percent, \$679 million annually, of these savings are concentrated in the transportation sector as shown in Figure 11. This represents a community-wide reduction in transportation costs of 47 percent relative to business as usual.



Source: City of Surrey, 2014

Impact 6 Energy Affordability and Resilience in Remote, Off-grid and On-grid Communities

Energy resilience is critical for communities across Canada. It is a particular priority for the over two hundred remote and off-grid communities in Canada that rely on diesel fuel for electricity and thermal production. This is expensive: the electricity rate paid by customers in off-grid communities is three times more, on average, than paid by on-grid customers in other parts of Canada, placing a burden on households and boosting operating costs for businesses.⁶²

Fossil-fuel-reliant remote communities are also vulnerable to interruptions to fuel supply and, in some cases, fossil fuel forms of energy may also be the most cost-effective for thermal and/or electrical power needs in off grid communities.⁶³ In others, renewable generation such as biomass and small hydro can lead to cost-savings, and also offer benefits such as economic development, job creation, skill development, and increased community self-reliance.⁶⁴ The Governments of Manitoba, Québec, Newfoundland and Labrador, The Northwest Territories, Yukon, and Ontario recently announced that they are establishing a pan-Canadian taskforce aimed at reducing the use of diesel to produce electricity in remote communities. An accompanying news release notes that the taskforce comes in response to requests from communities for “cleaner and more economical energy solutions”.⁶⁵

Resilient energy systems are also important in on-grid communities. The interruption or loss of energy supply from major natural disasters can leave wide areas without power for extended periods of time, including critical services such as hospitals, water pumping stations, and transit providers. This can create long term, negative economic impacts, as well as serious public health and safety risks.

- In Calgary’s 2013 flood, 35,000 customers were without power for up to 8 days following the flooding due to extensive damage to the city’s electrical network. The flooding throughout Southern Alberta led to an estimated \$4.7 billion in damages.⁶⁶
- The Ontario ice storm in 2013, as with the Québec and Ontario ice storm in 1998, left millions without power for days in winter weather.

Distributed energy resources, such as combined heat and power, can provide standby power for critical services and emergency reception shelters.

Biomass Energy Systems in Northern Alberta and Northern Québec

Biomass (as well as other renewable based) energy systems can improve energy resilience to communities with a reliable source of biomass. For communities that otherwise rely on trucked-in diesel or expensive grid connections, unused biomass materials from a sawmill or residue from agricultural harvesting can be used to produce electricity or provide heating, and save costs.

The Cree Nation of Ouje-Bougamou, located in Québec, has had a local biomass based district energy system in place since 1993. Using wood waste from a nearby sawmill, the plant produces 75 percent of the energy requirements of the district energy system, relying on fuel oil for the remainder, and provides heating and hot water to the entire community of 135 homes and 16 public buildings.⁶⁷ The system cost \$46 million to build, and benefited from both provincial and federal support.⁶⁸ The system is viewed as an integral part of the socio-economic development of the community, justifying the upfront capital costs.⁶⁹

Similarly, the Driftpile First Nation in Northern Alberta, working with the Pembina Institute and Stantec Consulting, conducted a feasibility study of a biomass energy plant in the community and found that it could be profitable.⁷⁰



Ouje-Bougoumou, Québec. Source: https://commons.wikimedia.org/wiki/File:Ouje_Bougoumou_Philippe_Maurice.jpg

⁶¹ (City of Surrey, 2014)

⁶² (Natural Resources Canada, 2011)

⁶³ (Quality Urban Energy Systems of Tomorrow, 2012b)

⁶⁴ (Natural Resources Canada, 2011; Community Energy Association, 2013)

⁶⁵ (Government of Ontario, 2015)

⁶⁶ (Swiss Re, 2014)

⁶⁷ (FVB Energy, 2015b)

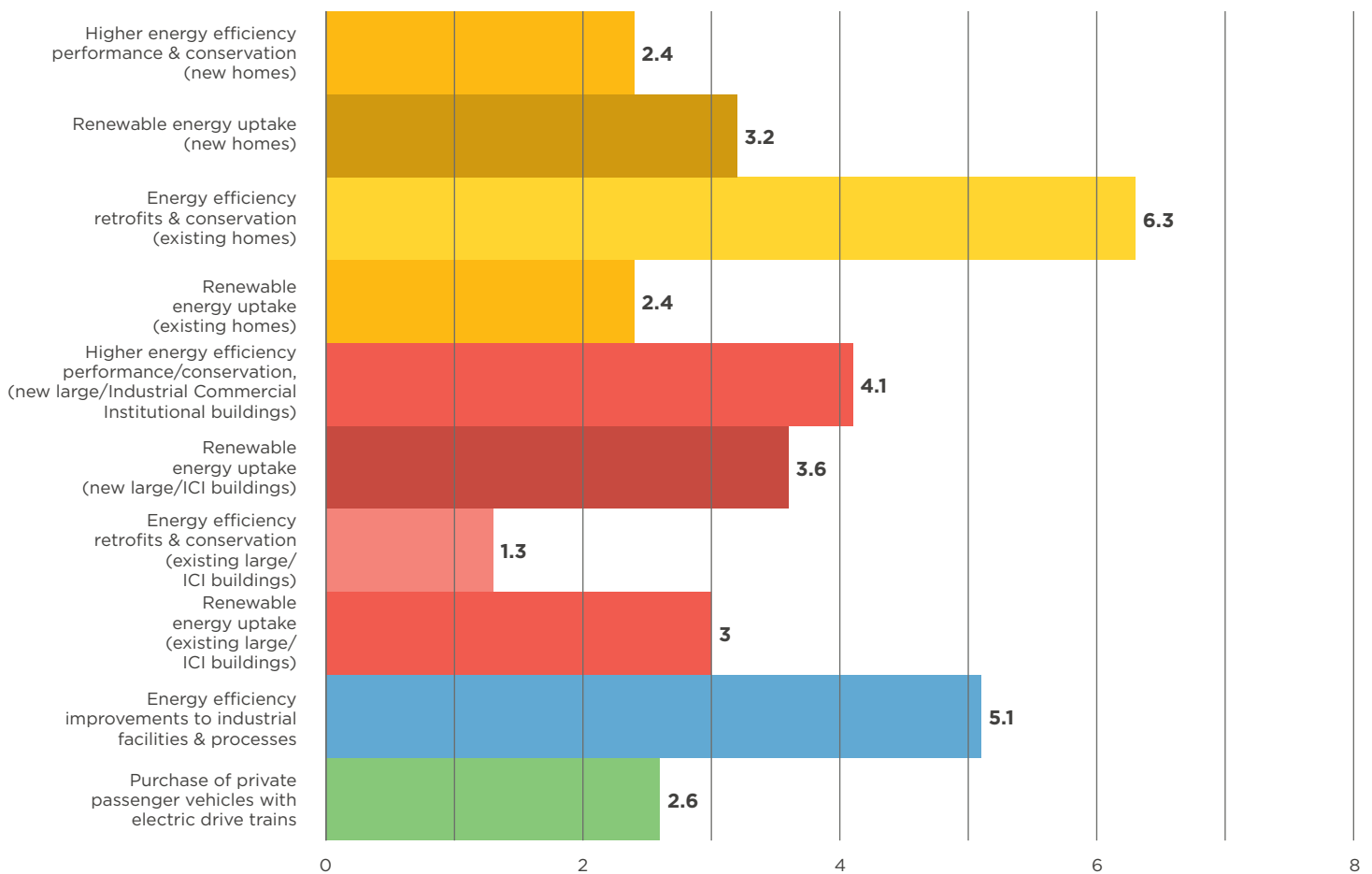
⁶⁸ (Biomass Energy Resource Center, 2009)

⁶⁹ (Cobb and Welk, 2010)

⁷⁰ (Weiss and Cobb, 2008)

Edmonton, Alberta analyzed the benefit/cost ratios of ten discrete community energy programs, incorporating a social cost for carbon emissions at \$51/tonne of GHG emissions. Costs were incurred across a 4-year time period and benefits calculated out to 2035. As seen in Figure 12, all the programs considered had positive benefit/cost ratios, with energy efficiency retrofits and conservation of existing homes, in particular, returning over \$6 in benefits for every dollar invested.

Figure 12 - Benefit/Cost Ratios of 10 potential programs, Edmonton's Energy Transition Strategy



Source: Adapted from City of Edmonton (2015).

Impact 7 Market Differentiation

Market preferences are shifting in favour of sustainability, as consumers are willing to pay more for sustainable goods and services. More energy-efficient spaces and buildings add value to projects that extend beyond energy cost savings. Energy utilities across Canada offer a range of incentive programs for implementing energy efficiency measures, which provide cost savings for project developers. But in addition, the measures in themselves provide considerable cost savings for tenants and owners, which along with other co-benefits of energy efficiency improvements can increase the liveability and desirability of a building.⁷¹

Communities that support such improved building performance, for example through incentives for energy-efficient construction, can differentiate developments to appeal to sustainability-conscious consumers.

The Rocky Mountain Institute recently partnered with the Institute of Real Estate Management in an effort to teach analytical skills for determining value beyond energy savings of building retrofits.⁷² The initiative is based on the principles that deep retrofits can realize benefits for investors in addition to direct impacts of lower energy costs; in particular that they can increase sale price of property, increase rents, reduce operating costs other than simply energy costs, potentially reduce development costs if combined with other necessary renovations, and increase sale and rent prices.⁷³ For example, the Enwave Deep Lake Water Cooling project in Toronto is a district cooling system that draws on Lake Ontario water to cool over three million square metres of office space in the Financial District. In addition to energy cost savings, the system saves cooling system maintenance costs for office and rental building owners.⁷⁴

Resale value of Green condos in Toronto

The market benefits of green condos were analyzed using data from 4,000 anonymous Toronto condo sales transactions in 36 buildings between 2006 and 2014. The green condos were buildings with LEED Gold or Silver certification, indicating enhanced energy and water performance, improved air quality, and reduced environmental impact in construction.

LEED certification was shown to increase sale price by 5.7 to 14.9 percent relative to condos that did not have LEED certification. There was no impact on how long it takes for a condo to sell.⁷⁵



Copyright Queen's Printer for Ontario, Photo Source: Ontario Growth Secretariat, Ministry of Municipal Affairs and Housing

⁷¹ (BC Hydro, 2015)

⁷² (Labrador, 2015)

⁷³ (Rocky Mountain Institute, 2015)

⁷⁴ (Enwave, 2007)

⁷⁵ (TD Economics, 2015)

4.3 – Connecting Savings to Investors

In order to recirculate the savings from CEP implementation to the stakeholders making the investments, funding partnerships and creative investment strategies are key elements of CEP implementation plans.⁷⁶

An example of this is the Toronto Atmospheric Fund's Green Condo Loan, which allows for lowered condo utility costs by providing additional funding to builders to increase energy efficiency measures during construction, and requiring the condo companies to pay back these loans.⁷⁷

Projects in Québec City, Vancouver, Halifax, and Perth-Andover, described below, illustrate attempts to better connect savings to investors.

- Québec City is considering developing a district energy and cogeneration system fuelled by waste steam from the municipal incinerator. Technical and financial studies have supported the development of the system, which, under current plans would provide steam to municipal, industrial, commercial and institutional facilities, including nearby hospitals. The City noted that the project could help to attract businesses to the Estimauville Innovation Zone a new, nearby industrial park. And, in addition to considerable environmental benefits, the project could generate significant revenue for the city, while decreasing its clients' energy costs by an estimated 15 percent and fixing that cost for the next 20 years.⁷⁸ A share of the energy cost savings as a result of the City's investment could increase local spending, strengthening the City's economy.
- In the Southeast False Creek Neighbourhood of Vancouver, a \$21 million share of the capital cost of a local district energy and sewer heat recovery system (which delivers energy cost savings to connected users, in addition to broader environmental benefits) has been financed in part from a City reserve, and will be repaid over the 25 year asset life through a fixed energy rate charged to connected users.⁷⁹
- The Alderney 5 geothermal cooling project in the Halifax Regional Municipality (HRM), Nova Scotia benefitted from a unique financing mechanism.⁸⁰ A 2010 deadline for building owners to eliminate common refrigerants used in cooling systems due to their ozone depleting effects led to this innovative project, an seawater cooling system for a 31,000 m² site with five municipal buildings on the Dartmouth waterfront. The \$3.6 million project, the first of its kind globally, used a public-private partnership model to reduce financial risk. The geothermal cooling retrofit is saving \$350,000 per year in energy costs, \$800,000 in future cooling equipment replacement costs and significantly reduces maintenance expenses, benefitting both the city and the private investor.⁸¹
- In 2008, the Town of Perth-Andover, New Brunswick in partnership with NB Power created a community-wide energy efficiency campaign aimed at reducing energy consumption at the residential level. The savings produced from energy efficiency efforts in over 100 homes across the City were recirculated into recreational activities for the community, offering free skating and swimming programs to residents.⁸²

Impact 8 Housing Affordability

Energy costs are a major component of the operating expenses for a household and can impose a significant burden on low-income households. At the same time, affordable rental housing can be among the least energy-efficient buildings in a city. In Toronto, for example, by 2020, roughly 60 percent of rental apartments will be over 50 years old.⁸³ The higher energy costs created by these aging buildings will likely impact the affordability of the units over the long-term.

Housing affordability can be supported through energy efficiency retrofits or energy efficiency codes in new housing stock. Efficient building envelope, lighting, appliances and heating systems will all lower a households' energy costs over time,⁸⁴ making housing more affordable and reducing energy poverty.

Land use patterns also influence household costs. High-density neighbourhoods with good public transit and active transportation can help to lower transport-related energy (and other living) costs.⁸⁵

St. John's, Newfoundland Affordable Housing Plan

The City of St. John's 2014-2017 affordable housing business plan aims to test new approaches to improving energy efficiency for 100 low-income homes. The program's goal is to reduce energy costs by 30 percent to promote long-term affordability.⁸⁶ The plan promotes energy efficiency measures in both rental and ownership housing (via, for example, retrofit subsidies for low-income households⁸⁷), and aims to apply lessons learned from the smaller scale project throughout the city.

The city itself will not play a capital role in the energy efficiency retrofit projects. It will host events and workshops, and focus on its role as a convener of people and conveyor of information relating to innovative options.



Source: https://commons.wikimedia.org/wiki/File:Saint_John,_NB,_skyline_at_dusk8.jpg

⁷⁶ (Municipality of North Cowichan, 2013)

⁷⁷ (Toronto Atmospheric Fund, 2014)

⁷⁸ (Personal communication, September 2015)

⁷⁹ (Quality Urban Energy Systems of Tomorrow, 2011)

⁸⁰ (Quality Urban Energy Systems of Tomorrow, 2012a)

⁸¹ (Halifax Regional Municipality, 2014)

⁸² (Government of New Brunswick, 2008)

⁸³ (City of Toronto, 2009)

⁸⁴ (Brownlee, 2013)

⁸⁵ (Pitt, 2007)

⁸⁶ (City of St. John's, 2014)

⁸⁷ (Newfoundland and Labrador Housing Corporation, 2015)

Mitigating Risk: Future Carbon Emissions Pricing and Regulation, and Future Energy Costs

CEP implementation can buffer the community from uncertainty over evolving climate pricing and policies, and uncertain energy markets, both of which could impact local economies.

5.1 – Reducing Future Costs of Climate Change Regulation and Pricing

Climate policy in Canada—and in particular carbon pricing—is evolving rapidly.⁸⁸

Québec and British Columbia already have policies in place that put a price on carbon, Alberta is broadening and fortifying its carbon price, and Ontario and Manitoba have begun planning for a cap-and-trade system. New carbon pricing (or increases in existing prices) will increase the costs of carbon-based fuels for individuals and businesses.

Many communities are preparing for this by establishing GHG reduction targets and strategies, either in response to provincial requirements, or proactively as part of city networks. These are often integrated with, and implemented through CEPs.

Some municipalities and businesses are incorporating anticipated (or “shadow”) carbon pricing levels into their forward-looking planning to make major investments resilient to any future pricing of carbon.

A good example of this is the community of Dawson Creek, BC, which imposed a \$100 per tonne levy on its own municipal GHG emissions in 2011. The levy rises at \$5 per year (or more if the BC Carbon Tax increases by a greater amount) and is currently at \$115 per tonne. This levy is transferred into the Dawson Creek Carbon Fund, which the city uses to fund corporate and community green initiatives. These initiatives also reduce the city’s liability in terms of reaching BC’s legislated carbon-neutral goal for municipal corporate operations.⁸⁹ The

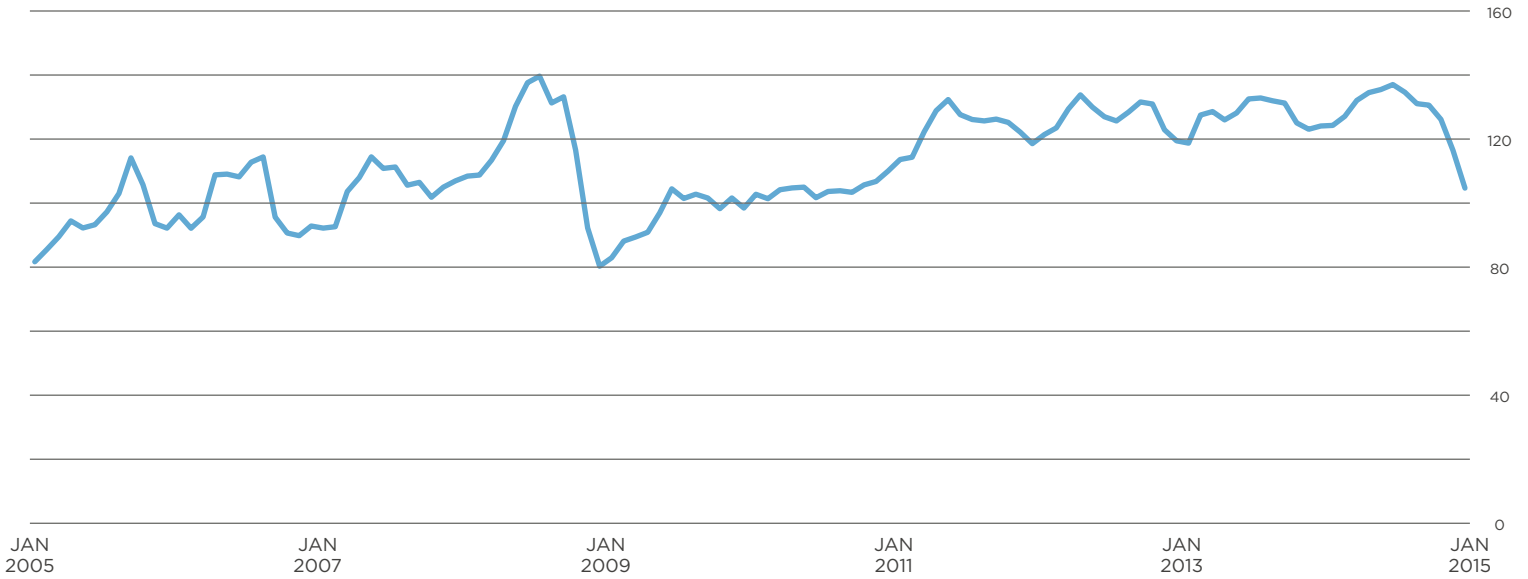
municipal self-imposed levy is partly funded by provincial Climate Action Revenue Incentive Program grants (at \$30/tonne) with the balance paid from the City’s general funds.⁹⁰ Projects that can yield the highest energy and emissions reductions and cost-savings per dollar invested get priority.⁹¹

Another example is at the University of British Columbia, where incorporating the future cost of carbon from the BC Carbon Tax was an important factor in the analysis of energy and operational cost savings on the new Academic District Energy System, helping to make it economically viable.⁹² The system uses a network of underground piping to provide heating and hot water needs for the campus’ northern area. It was converted from an existing steam system to a more efficient hot water system beginning in 2011 with completion slated for 2015.⁹³ It will reduce UBC’s annual operating and energy costs by \$5.5 million (from reduced natural gas consumption, carbon liabilities, maintenance, and personnel requirements), and allow the university to incorporate a variety of clean energy sources into the system.⁹⁴

5.2 – Reducing Risk from Fluctuating Energy Prices

Fluctuating energy prices can be a source of considerable uncertainty for households and businesses at the community level. Communities are vulnerable to changes in the price of energy.⁹⁵ They are price-takers for energy commodities where prices are set by other levels of government (for example, electricity rates) or by global markets (for example, crude oil used to make gasoline). Oil prices in particular are quite volatile in both the short term and long term. Figure 13 shows the fluctuations in monthly average Canadian gasoline and fuel oil prices over the 2005-2014 period.

Figure 13 - Average Canadian Gasoline Prices, 2005-2014
(CPI-adjusted cents/litre)



Note: Figure is based on Statistics Canada (2015) average monthly retail gasoline and fuel oil price, showing average of 18 largest urban centres.⁹⁶

Households, which spend up to 4 percent of average pre-tax income on gasoline,⁹⁷ face similar risks from fluctuating fuel prices. Large consumers and businesses are also vulnerable. This risk can be hedged by reducing energy costs thorough energy conservation and efficiency, and harnessing opportunities for local energy sources.

⁸⁸ (Canada's Ecofiscal Commission, 2015)

⁸⁹ (BC Climate Action Toolkit, 2015)

⁹⁰ (Green Energy Futures, 2012)

⁹¹ (City of Dawson Creek, 2015)

⁹² (University of British Columbia, 2015b)

⁹³ (Compass Resource Management Ltd., 2012)

⁹⁴ (University of British Columbia 2015 a-b)

⁹⁵ e.g. in Town of Bridgewater (2015) where despite reductions in consumption, rising costs have increased energy expenses.

⁹⁶ (Statistics Canada, 2015)

⁹⁷ (2012 average U.S. data. From U.S. Energy Information Administration, 2013)

Conclusion

Communities are balancing a growing emphasis on meeting environmental concerns alongside constrained budgets. Energy, in particular, is a significant, and growing cost in Canadian communities. Every year millions, and in some cases billions, of dollars are spent on energy each year by local government, businesses and households, much of which leaves the local economy. This report drew primarily on the findings of six economic analyses of individual Canadian CEPs, along with case studies, to illustrate the value proposition to communities from the implementation of Community Energy Plans (CEPs).

Based on the analysis and case studies examined, the implementation of CEPs has the potential to provide Canadian communities with a systematic approach for realizing substantial economic savings, new job creation and strengthened local economies, and improved environmental and human health. In particular, this report identified that the implementation of a CEP can help communities:

- achieve environmental, community health, and economic goals;
- recirculate money spent on energy within a community and its region;
- achieve local economic development goals;
- create opportunities for local savings and local jobs;
- mitigate the financial risks from future carbon pricing and uncertain energy prices; and
- contribute to strong and resilient local economies.

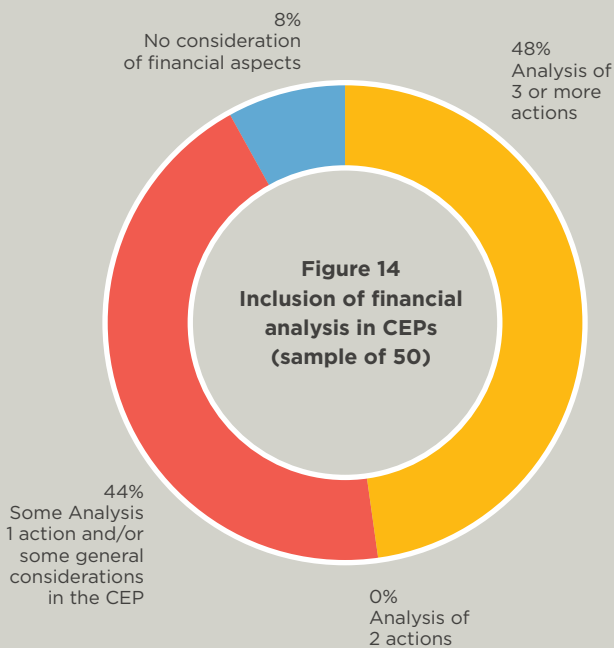
This report also identified that CEP implementation can result in many co-benefits for communities. These co-benefits can influence a company's decisions to remain in a community by lowering energy costs; attract new, high tech investment by offering an affordable, reliable, clean and stable energy supply; improve marketability of a neighbourhood through urban renewal; and, increase energy resilience and affordability in remote and off-grid communities. As more communities implement CEPs and incorporate smarter approaches to energy use, additional benefits are likely to be identified.

Benefits and specific cost-effective actions are very locally determined. Each community needs to carry out independent analysis of its CEP's economic impacts and benefits.

Implementation of CEPs is still in the early days. As more and more communities implement CEPs and analyze their results, continued assessment of the findings will be needed to provide additional evidence on the effectiveness and usefulness of a CEP. The continued ability to demonstrate the value proposition of CEPs will prove critical to securing the required investment and the political, staff, and stakeholder support to implement CEPs, and achieve their economic, environmental, and social promise.

Approaches to Economic Analysis in CEPs

A survey of 50 CEPs across Canada found that while just under half included cost and/or benefits accounting of three or more actions, a slight majority of CEPs analyzed (or considered analysis of) the cost and/or benefit of only one action, or contained no financial analysis at all (Figure 14).



Source: Based on GTI analysis of 50 CEPs selected across Canada. More information on the sample can be found in (QUEST, 2015a).

There are many approaches to conducting economic analyses to assess the economic value proposition of implementing a CEP. Typically, two or more scenarios are analyzed, with variables such as different future prices for energy and carbon, or different suites of actions. Some of the approaches found include:

- Calculation of total current energy expenditure in the community, and proportion flowing to local economy, provincial economy, and beyond.
- Calculation of total future energy savings with full CEP implementation, change in proportions staying in the local economy, and value of savings at a per capita level.
- Economic assessment of specific actions, often for the purpose of prioritization:
 - Calculation of the internal rate of return on investments and the payback period, and green-lighting actions above certain thresholds;
 - Benefit-cost analysis, calculating benefits on a present value across 15-25 year horizons, and green-lighting actions above certain benefit-cost ratios;
 - Benefit cost analysis as above, incorporating one or more shadow prices for carbon; and
 - Marginal abatement cost curves when GHG emission reduction is a CEP goal.
- Economic modeling to forecast the potential economy-wide impacts of implementation of the CEP in full. Impacts typically analyzed include:
 - Cost of investment required;
 - Energy savings from CEP actions, including reduced costs; and
 - Local jobs created (including direct, indirect, and induced jobs).
- Co-benefits, which increase the liveability of communities, and include impacts such as reduced congestion, improved air quality, improved community health, and increased community interactions that result of an active transportation initiative.
- Mapping of proposed actions and local economic sectors to understand opportunities for improvements to sustainability, where value lies, and where gaps exist. Such a 'green economy map' can help to understand a community's range of activities and economic sectors—and the interactions amongst them.

References

- BC Climate Action Toolkit. (2015). Dawson Creek Carbon Fund. Retrieved from <http://www.toolkit.bc.ca/Success-Story/Dawson-Creek-Carbon-Fund>
- BC Hydro (2015). New Construction Program: Featured Projects. Retrieved from <https://www.bchydro.com/powersmart/business/programs/new-construction/projects.html>
- Biomass Energy Resource Center. (2009). Waste Wood Helps Fuel a Native Community's Development. Retrieved from <http://www.biomasscenter.org/images/stories/ouje-bougoumou.pdf>
- Brauer, M., Reynolds, C., & Hystad, P. (2013). Traffic-related air pollution and health in Canada. *Canadian Medical Association Journal*, cmaj-121568.
- Brownlee, M. (2013). Financing Residential Energy Savings: Assessing Key Features of Residential Energy Retrofit Financing Programs. Sustainable Prosperity. Retrieved from <http://www.sustainableprosperity.ca/sites/default/files/publications/files/Financing%20Residential%20Energy%20Savings.pdf>
- Canada's Ecofiscal Commission. (2015). The Way Forward: A Practical Approach to Reducing Canada's Greenhouse Gas Emissions. Retrieved from <http://ecofiscal.ca/reports/wayforward/>
- Canadian Environmental Grantmakers' Network. (2005). Urban Environment Issues. Retrieved from http://www.cegn.org/wp-content/uploads/2013/10/urbanbrief_eng.pdf
- Canadian Urban Institute. (2011a). City of Guelph: Integrated Energy Mapping Strategy (G-IEMS). Part of the Integrated Energy Mapping for Ontario Communities (IEMOC) initiative.
- Canadian Urban Institute. (2011b). City of Barrie: Integrated Energy Mapping Strategy (B-IEMS). Part of the Integrated Energy Mapping for Ontario Communities (IEMOC) initiative.
- Canadian Urban Institute. (2011c). City of Hamilton: Integrated Energy Mapping Strategy (H-IEMS). Part of the Integrated Energy Mapping for Ontario Communities (IEMOC) initiative.
- Canadian Urban Transit Association. (2010). The Economic Impact of Transit Investment: A National Survey. Retrieved from http://www.cutaaact.ca/en/public-transit/publicationsandresearch/resources/Final_CUTA-EconomicBenefitsofTransit-FinalReportESept2010.pdf
- City of Dawson Creek. (2015). Proposed Policy Update – Carbon Fund Policy. Retrieved from <http://www.dawsoncreek.ca/2015/proposed-policy-update-carbon-fund-policy/>
- City of Duncan. (forthcoming Community Energy Plan).
- City of Edmonton. (2012). Edmonton's Energy Transition Discussion Paper. Retrieved from http://www.edmonton.ca/city_government/documents/PDF/EdmontonEnergyTransitionDiscussionPaper-2012-06-20.pdf
- City of Edmonton. (2015a). Edmonton's Community Energy Transition Strategy. Retrieved from http://www.edmonton.ca/city_government/documents/EnergyTransitionStrategy.pdf
- City of Edmonton. (2015b). Population History http://www.edmonton.ca/city_government/facts_figures/population-history.aspx
- City of Guelph (2014). Staff Report - Enterprise Services – Annual Activity Report. Retrieved from <http://guelph.ca/wp-content/uploads/EnterpriseServices2013AnnualActivityReport.pdf>
- City of Kingston. (2011). Kingston Community Energy Consumption and Greenhouse Gas Inventory Update. Retrieved from <https://www.cityofkingston.ca/documents/10180/2304312/Community+GHG+Emissions+2011/6d1b88de-d600-4d7a-a24f-ab655f5c9eca>
- City of London. (2015). 2014 Community Energy & Greenhouse Gas Inventory May. Retrieved from <http://www.london.ca/residents/Environment/Energy/Documents/2014%20Inventory%20Report.pdf>
- City of Richmond. (2014). Community Energy and Emissions Plan. Retrieved from http://www.richmond.ca/__shared/assets/ceep37697.PDF
- City of St John's. (2014). Affordable Housing Business Plan City of St John's 2014-2017. Retrieved from <http://www.stjohns.ca/sites/default/files/files/publication/Housing%20Business%20Plan.pdf>
- City of Surrey. (2014). Community Energy & Emissions Plan. Retrieved from <http://www.surrey.ca/files/ceep-02-02-2014.pdf>
- City of Toronto. (2009). An Affordable Housing Action Plan 2010 – 2020. Housing Opportunities Toronto. Retrieved from https://www1.toronto.ca/city_of_toronto/affordable_housing_office/files/pdf/hot_actionplan.pdf
- Cobb, P., Welk, E. (2010). Cutting Carbon in Small, Rural and Remote Communities Options and successful strategies for achieving significant reductions in greenhouse gas emissions. Pembina Institute. Retrieved from http://www.questrcanada.org/sites/default/files/publications/Emission%20Reduction%20Opportunities%20in%20SRR_Final.pdf
- Community Energy Association. (2013). Green Energy Projects and Utilities: An Investment and Governance Guide for BC Local Governments and First Nations Volume 2: Case Studies in Financing and Ownership of Clean Energy Solutions. Retrieved from <http://communityenergy.bc.ca/download/360/>
- Compass Resource Management Ltd. (2015). Neighbourhood District Energy System for UBC Expansion Areas Business Case Report. Retrieved from http://www.corix.com/docs/default-source/regulatory-affairs/ubc-ndes/appendix-2---compass---ubc-final-ndes-business-case-report_nov2012.pdf?sfvrsn=2
- CTV Kitchener. (2014). <http://kitchener.ctvnews.ca/minister-touts-guelph-company-s-double-duty-hydro-project-1.1770133>
- Environment Protection Agency (EPA). (2011). Assessing the Many Benefits of State and Local Clean Energy Initiatives. Retrieved from http://www.epa.gov/statelocalclimate/documents/pdf/background_paper_8-4-2011.pdf
- Enwave. (2007). Enwave: Deep lake water cooling. Retrieved from <http://www.districtenergy.org/assets/CDEA/Case-Studies/Enwave-case-history-Toronto-7-19-07.pdf>
- FVB Energy Inc. (2015a). Regent Park Community Energy System. Retrieved from <http://www.fvbenergy.com/projects/regent-park-community-energy-system/>
- FVB Energy. (2015b). Ouje-Bougoumou District Energy System. Retrieved from <http://www.fvbenergy.com/projects/ouje-bougoumou-district-energy-system/>
- Google. (2013). Expanding Renewable Energy Options for Companies Through Utility-Offered "Renewable Energy Tariffs". Retrieved from <http://static.googleusercontent.com/green/pdf/renewable-energy-options.pdf>
- Google. (2015). Powering the Internet with renewable energy. Retrieved from <https://googleblog.blogspot.ca/2015/12/powering-internet-with-renewable-energy.html>
- Government of New Brunswick. (2008). News Release – Perth-Andover uses energy savings for free swimming and skating (08/06/06). Retrieved from <http://www.gnb.ca/cnb/news/eec/2008e0859ee.htm>
- Government of Ontario (2014). News Release - Energy Program Supports Agricultural Industry - Combined Heat and Power Program Encourages Investment to Reduce Electricity Costs. Retrieved from <http://news.ontario.ca/mei/en/2014/04/energy-program-supports-agricultural-industry.html>
- Government of Ontario. (2015, July 21). Provincial & Territorial Ministers Working Together to Reduce Use of Diesel for Electricity in Remote Communities. Ministry of Energy. News Release. Retrieved from <http://news.ontario.ca/mei/en/2015/07/provincial-territorial-ministers-working-together-to-reduce-use-of-diesel-for-electricity-in-remote.html>
- Green Energy Futures. (2012). Dawson Creek – A near carbon neutral city in the middle of northeastern B.C.'s shale gas boom. Retrieved from <http://www.greenenergyfutures.ca/blog/dawson-creek-near-carbon-neutral-city-middle-northeastern-bc-s-shale-gas-boom>
- Halifax Regional Municipality. (2014). Alderney 5 Energy Project World's First Geothermal Cold Storage System. Retrieved from <https://www.halifax.ca/facilities/Alderney5.php>
- Industry Canada. (2015). Manufacturing Costs. Retrieved from <https://strategis.ic.gc.ca/app/scr/sbms/sbb/cis/definition.html?code=31-33&lang=eng>
- Jaccard, M., Failing, L., & Berry, T. (1997). From equipment to infrastructure: community energy management and greenhouse gas emission reduction. *Energy Policy*, 25(13), 1065-1074.
- KPMG. (2014). Competitive alternatives: KPMG's guide to international business location, 2014 edition. Retrieved from http://www.competitivealternatives.com/reports/2014_compalt_execsum_en.pdf
- Labrador, D. (2015, July 28). Teaching the Arithmetic of Deep Retrofit Value. Retrieved from http://blog.rmi.org/blog_2015_07_28_the_arithmetic_of_deep_retrofit_value
- Lévesque, J.F., Caners, C., MacLean, D, Vetter, T. (2010). University Data Centres: Policy and business case for reducing greenhouse gas emissions. IISD. Retrieved from <http://www.iisd.org/publications/university-data-centres-policy-and-business-case-reducing-greenhouse-gas-emissions>
- M. K. Jaccard and Associates. (2010). The capacity for integrated community energy solutions policies to reduce urban greenhouse gas emissions. Prepared for: Quality Urban Energy Systems of Tomorrow (QUEST).
- MacNaull, S. (2009, June 27). Gaga over GigaCenter. Kelowna Daily Courier Retrieved from <http://rackforce.com/gaga-over-gigacenter>
- Manitoba Hydro. (2015). Building Features. Retrieved from <https://www.hydro.mb.ca/corporate/mhplace/features.shtml>
- Markham District Energy. (2015). History. Retrieved from <http://www.markhamdistrictenergy.com/who-we-are/history/>
- Municipality of North Cowichan. (2013). Climate Action and Energy Plan. Retrieved from http://www.northcowichan.ca/assets/Departments/Engineering/PDFs/NC%20CAEP%20final%20report%20v5_reduced.pdf
- Natural Resources Canada. (2011). Status of Remote/Off-Grid Communities in Canada. Retrieved from http://www.questrcanada.org/sites/default/files/publications/NCR-3765116-NRCAN_OFF-GRID_REPORT_EN_.pdf
- Natural Resources Canada. (2012). Canada's Secondary Energy Use by Sector, End-Use and Subsector. Retrieved from <http://oe.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=HB§or=aaa&juris=ca&rn=2&page=0>
- Natural Resources Canada. (2015). Canmet Community Energy Case Studies – Regent Park, Toronto, Ontario. Retrieved from [http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/canmetenergy/files/pubs/RegentPark\(ENG\).pdf](http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/canmetenergy/files/pubs/RegentPark(ENG).pdf)
- Navius Research Inc. (2013). How do Industrial GHG Reduction Efforts Affect Demand for Skilled Labour? Retrieved from www.naviusresearch.com

- New Climate Economy. (2015). Seizing the Global Opportunity. Retrieved from <http://2015.newclimateeconomy.report/misc/global-action-plan-at-a-glance/>
- Newfoundland and Labrador Housing Corporation. (2015). Residential Energy Efficiency Program (REEP). Retrieved from <http://www.nlhc.nf.ca/programs/programsReepActive.html>
- Ontario Chamber of Commerce. (2015). Empowering Ontario. Constraining Costs and Staying Competitive in the Electricity Market. Retrieved from <http://www.occ.ca/wp-content/uploads/2013/05/Empowering-Ontario.pdf>
- Pembina Institute. (2013). A Costly Diagnosis: Subsidizing coal power with Albertans' health. Retrieved from <http://www.pembina.org/reports/pi-costly-diagnosis-26032013.pdf>
- Personal Communication (February, 2015). Personal communication, Mark Pauls, Manitoba Hydro Building Energy Management Engineer.
- Personal communication. (September, 2015). Ville de Québec Environment Director and Econoler National Director.
- Pitt, M. (2007). Linking Social Housing and Energy Efficiency. CPRN Research Report. Retrieved from http://www.cprn.org/documents/49551_EN.pdf
- Provincial Health Services Authority. (2014). Healthy built environment linkages a toolkit for design - planning - health. Retrieved from http://www.phsa.ca/Documents/linkagestoolkitrevisedoct16_2014_full.pdf
- Quality Urban Energy Systems of Tomorrow (QUEST). (2011). Integrated Community Energy System Business Case Study Southeast False Creek Neighbourhood Energy Utility. Retrieved from http://www.sauder.ubc.ca/Faculty/Research_Centres/ISIS/Resources/-/media/AEE7D705491345178C4568992FB87658.ashx
- Quality Urban Energy Systems of Tomorrow (QUEST). (2012a). Integrated Community Energy System Business Case Study - Alderney 5 Energy Project. Retrieved from http://www.questcanada.org/sites/default/files/publications/QUESTBusinesscaseNovaScotiaJan2011_FINAL01.pdf
- Quality Urban Energy Systems of Tomorrow. (2012b). ICES Literacy Series - Paper No. 2: Fuels & Technology. Authors: Richard Laszlo and Mike Cleland. Retrieved from <http://www.questcanada.org/sites/default/files/publications/Fuels%20and%20Technologies%20for%20Integrated%20Community%20Energy%20Solutions.pdf>
- Quality Urban Energy Systems of Tomorrow (QUEST). (2015a). National Report on Community Energy Plan Implementation. Retrieved from <http://gettingtoimplementation.ca/wp-content/uploads/2015/02/National-Report-on-CEP-Implementation.pdf>
- Quality Urban Energy Systems of Tomorrow (QUEST). (2015b). National Report on Policies Supporting Community Energy Plan Implementation. Retrieved from <http://gettingtoimplementation.ca/resources>
- Rath, J. (2011). Data center strategies - Simplifying high-stakes, mission critical decisions in a complex industry. Vantage Data Centers. Retrieved from http://www.vantagedatacenters.com/earthday/Pdf/DCK-datacenter_strategies.pdf
- Region of Waterloo. (2009). Multiple Account Evaluation Region of Waterloo Rapid Transit Environmental Assessment. Retrieved from <http://rapidtransit.regionofwaterloo.ca/en/multimedialibrary/resources/maereportjune32009.pdf>
- River District Vancouver. (2015). District Energy Utility. Retrieved from <http://www.riverdistrict.ca/awards/district-energy-utility/>
- Rocky Mountain Institute. (2013). Beyond the Tip of the Energy Iceberg: Why Retrofits Create More Value Than You Think. Retrieved from http://www.rmi.org/summer_2013_esj_beyond_the_tip_of_the_energy_iceberg_main
- Rocky Mountain Institute. (2015). An Investor's Guide to Calculating and Presenting Deep Retrofit Value. Retrieved from http://www.rmi.org/deep_retrofit_value_guide_for_investors
- Romm, J. J., & Browning, W. D. (1998). Greening the building and the bottom line: Increasing productivity through energy-efficient design. Rocky Mountain Institute. Retrieved from http://www.columbia.edu/cu/alliance/EDF-2012-documents/Reading_Fox_3.pdf
- Sawyer, D., Stiebert, S., & Welburn, C. (2007). Evaluation of total cost of air pollution due to transportation in Canada. Marbek Resource Consultants Ltd., and RWDI Ltd. for Transport Canada. Retrieved from http://publications.gc.ca/collections/collection_2008/tc/T22-148-2007E.pdf
- Scotiabank. (2014). Rising Energy Prices Squeeze Household Budgets. Retrieved from http://www.gbm.scotiabank.com/English/bns_econ/spjune6.pdf
- Statistics Canada. (2015). Table 326-0009 Average retail prices for gasoline and fuel oil, by urban centre, monthly (cents per litre). Retrieved from www.statcan.gc.ca
- Sturgeon, J. (2014, May 13). Auto jobs in Canada in 'pretty steep hole right now'. Retrieved from <http://globalnews.ca/news/1327795/auto-jobs-in-canada-in-pretty-steep-hole-right-now/>
- Sustainability Solutions Group. (2015). Plan4DE Scoping Document. Retrieved from http://plan4de.ssg.coop/wp-content/uploads/2015/06/150217_Plan4DE-Scoping-document.pdf
- Swiss Re. (2014). Natural Catastrophes and man-made disasters in 2013. Retrieved from: http://www.swissre.com/media/news_releases/nr_20140326_sigma_insured_losses_in_2013.html
- TD Economics. (2015). The Market Benefits of 'Green' Condos in Toronto. Retrieved from <http://www.td.com/document/PDF/economics/special/GreenCondos.pdf>
- The Climate Group. (2008). Smart 2020: Enabling the low carbon economy in the information age. The Climate Group. London. Retrieved from http://www.smart2020.org/_assets/files/O2_smart2020Report.pdf
- The Gandalf Group. (2015, November 5). View from the Top: The C-Suite's View of Energy and the Environment. Presentation at Green Economy Ontario conference
- Toronto Atmospheric Fund. (2014). First Green Condo Loan Proves Green Buildings are Profitable. Retrieved from <http://taf.ca/wp-content/uploads/2014/05/First-Green-Condo-Loan-Proves-Green-Buildings-are-Profitable-May-28-2014.pdf>
- Toronto Community Housing Corporation. (2015). Regent Park. Retrieved from <http://www.torontohousing.ca/regentpark>
- Town of Bridgewater. (2015). Town of Bridgewater energy management plan 2015-2019. Retrieved from <http://www.bridgewater.ca/document-library/sustainability/sustainable-bridgewater/846-bridgewater-energy-management-plan-2015-2019/file>
- U.S. Energy Information Administration. (2013). U.S. household expenditures for gasoline account for nearly 4% of pretax income. Retrieved from <http://www.eia.gov/todayinenergy/detail.cfm?id=9831>
- University of British Columbia. (2015a). District Energy. Retrieved from <http://energy.ubc.ca/projects/district-energy/>
- University of British Columbia. (2015b). Academic district energy system - steam to hot water conversion. Retrieved from <http://www.projectservices.ubc.ca/portfolio/alternative-energy/academic-district-energy-system.htm>
- Weiss, T., Cobb, P. (2008). Aboriginal Energy Alternatives. Pembina Institute. Retrieved from <https://www.pembina.org/reports/aboriginal-energy-alternatives.pdf>
- Welch, K. (2011). Assessing the business case for data centre relocations. Retrieved from http://www.sauder.ubc.ca/Faculty/Research_Centres/ISIS/Resources/-/media/459465DFAB1241EE8062560F159C5D93.ashx
- Windmill Developments. (2015). Zibi One Planet Action Plan. http://www.zibi.ca/wp-content/uploads/2015/05/Green_Community_2015.pdf



Get engaged in the GTI initiative by visiting www.gettingtoimplementation.ca where you can:

- Learn more by reading the latest project research
- Register and participate in our upcoming National Symposium
- Sign up for our newsletter and receive updates about the initiative

