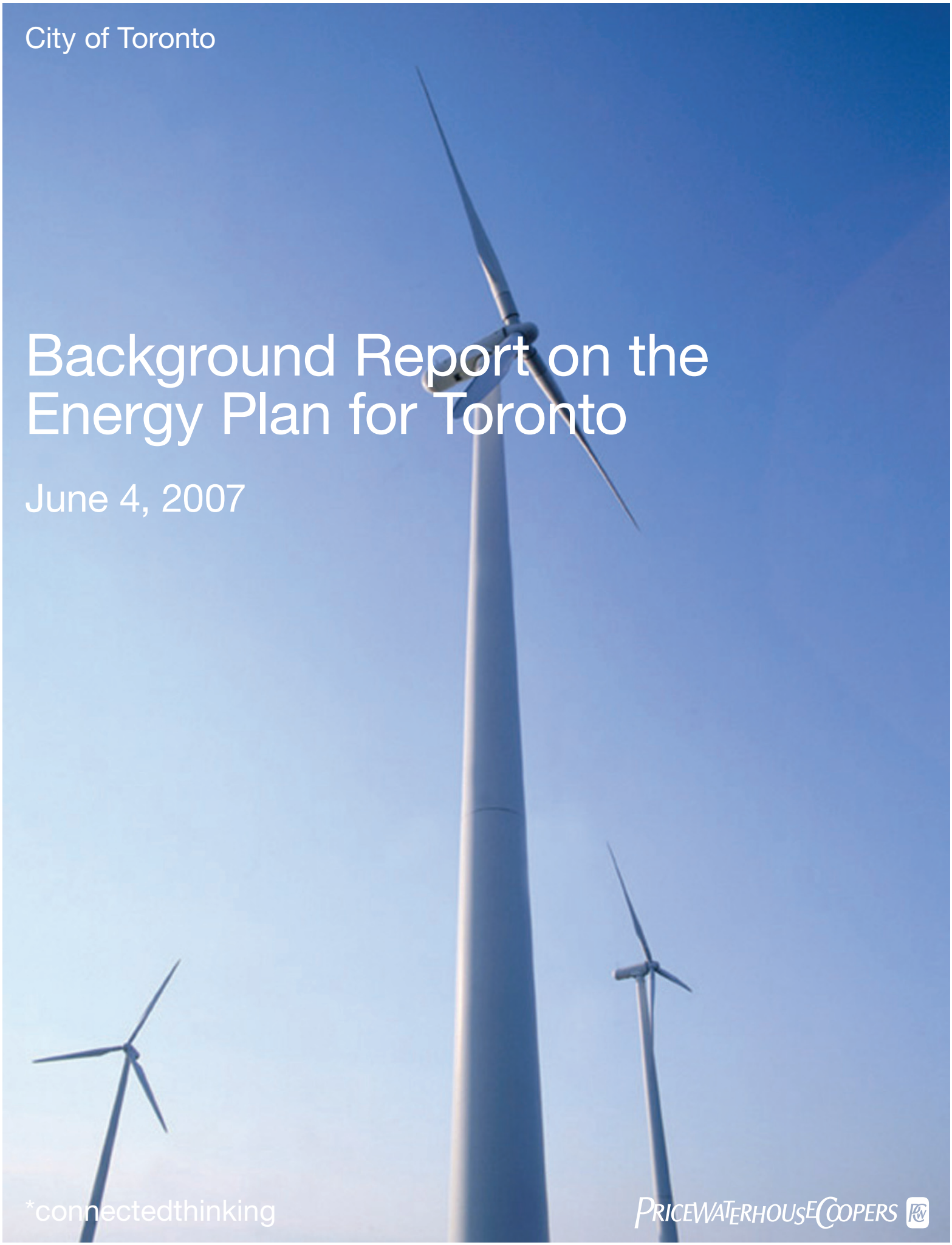
City of Toronto

Background Report on the Energy Plan for Toronto

June 4, 2007



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1 Introduction

1.1 Background

Toronto has a strong history of leadership in addressing energy issues. In 1990, the City of Toronto ("City") established the Energy Efficiency Office ("EEO") with a mandate to improve and influence energy use within Toronto. The EEO is a municipal agency unique to Toronto, which has undertaken a number of projects and partnerships in order to carry out its mandate. In the late 1990s, the City began examining energy issues in a detailed way and, in 1999, commissioned the development of a Sustainable Energy Plan for Toronto. In 2000, the Environmental Plan set out a number of recommendations outlining how the City should deal with energy issues. In 2002, the City's Sustainable Energy Business Plan for the City of Toronto's Energy Efficiency Office was created.

In March 2006, Government of Ontario Bill 21, *The Energy Conservation Leadership Act,* was proclaimed, requiring all public sector agencies, including municipalities, to prepare a detailed energy plan and file it with the province. In response to this new legislation, the City began the development of an Energy Plan for Toronto. In May 2006, the City released the "Terms of Reference for an Energy Plan for the City of Toronto" which identified the initial rationale for an Energy Plan (the "Plan"), and set out the high level goals, objectives, and strategies necessary for meeting those goals. It also outlined key updates that were considered essential for the development of the Plan.

In June 2006, Council adopted the recommendations contained in the "Report on the Development of the Energy Plan for Toronto,"[1] a report which documented work completed on the Energy Plan as of that date and provided a basis for discussion on the further development of the Plan.

On November 21, 2006, the EEO issued a request for proposal seeking technical support services for the development of the Energy Plan for Toronto. In January 2007, PricewaterhouseCoopers LLP ("PwC") was selected to provide these services to the City.

This report is intended to build on previous work conducted by the City, by providing a review of energy demand forecast scenarios; identifying existing energy efficiency, renewable generation, and other initiatives; analyzing best practices from other jurisdictions; and providing a portfolio of preferred options, along with a feasibility assessment for the short to medium term and program development and plan design templates.

1.2 Objectives

More specifically, the purpose of this report is to provide a framework to identify opportunities to support the City in advancing from its current state of energy use to an identified preferred state of energy sustainability. The development of this report should identify options for increasing energy efficiency within Toronto. This report should also provide the City with a plan that can be implemented over the next twenty four years, which addresses both the City Government's own energy needs and Toronto's wider community energy needs.

[1] IndEco, June 2006.

The objectives for this report are to:

- Examine energy use in Toronto and match it with the implementation of sustainable energy practices;
- Achieve a sustainable approach to energy, with an emphasis on energy conservation, demand management, and low-impact renewable energy sources. Sustainable energy can include environmentally sound energy production, affordable energy sources, and adoption of energy efficiency technologies and activities; and
- Coordinate with other existing and relevant work (e.g., the Report of the Development of the Energy Plan for Toronto dated June 2006), existing energy studies in Toronto and Ontario (e.g., the OPA's Conservation and Demand Management ("CDM") Study) other projects that the OPA is funding, and programs that are currently being offered by Toronto Hydro, Enbridge, and others.

1.3 Scope

The Energy Plan for Toronto is designed to meet Toronto's energy needs, including the City Government's own corporate energy needs, the energy needs of the City's Agencies, Boards, and Commissions, along with the energy needs of the community within the boundaries of the City.

PwC has been engaged to develop a report to support the development of the Energy Plan for Toronto by providing detailed background information relating to specific energy efficiency issues in Toronto. An important element in the development of this report has been to understand the characteristics of current energy use (e.g., sector, type, purpose) in both the community at large and in corporate operations within Toronto.

A detailed analysis has been conducted for the following key sectors: Office; Retail; Multi-Unit Residential; Low-Rise Residential; Industrial; Schools; Colleges and Universities; Health Care; and Municipal.

Council has directed that any short term efforts identified in this report be focused on supporting the City's 90 MW electricity conservation pledge to meeting the OPA's 300 Megawatt ("MW") Toronto Directive.

A strong effort was made to develop this report in consideration of and in coordination with other related City of Toronto initiatives, including the Climate Change and Air Quality Action Plan, Renewable Energy Action Plan, Toronto Environmental Plan Update 2006, the Toronto Green Development Standard 2006, Water Efficiency Program, Green Economic Development Strategy, and the Toronto Waterfront Revitalization Corporation's Sustainability Framework.

There are also a number of ongoing related initiatives at the divisional and Agency, Board and Commission level, including the Green Fleets Transition Plan, the Energy Self-Sufficiency Plan for Exhibition Place, cogeneration at wastewater treatment plants, and landfill gas utilization projects at several landfill sites serving Toronto.

1.4 Methodology Used

The approach and methodology used in developing this report involved the following tasks:

- Develop a baseline for energy use in Toronto, and develop an energy load forecast that will be used as a baseline to measure the cost-benefits of the different initiatives and to monitor the success of energy efficiency programs;

- Identify existing and developing energy efficiency and renewable energy initiatives available in and to Toronto;
- Conduct a jurisdictional scan to identify best practices in energy efficiency and renewable energy;
- Develop a sector analysis, including program design templates that outline program parameters, metrics, administrative guidelines, roles and responsibilities and cost-benefit comparisons; and
- Identify common themes and priorities on which the City can focus its Energy Plan efforts over the short term, medium term, and long term in order to meet its energy efficiency and renewable energy objectives.

1.5 Consultations and Sources of Data

Both an internal and external stakeholder consultation process was conducted on the Energy Plan for Toronto to obtain feedback on energy issues facing City stakeholders. We have made every effort to incorporate feedback received from these consultations into the development of this report.

Meetings were also held with representatives from Toronto Hydro, Enbridge, Enwave, the Ontario Power Authority ("OPA"), and relevant City departments to confirm forecasts and obtain data that has informed the development of this report. We have also worked closely with the Energy Efficiency Office in developing this report.

1.6 Definitions

For the purposes of this report, the following definitions have been used. For a complete set of definitions, please refer to Appendix A.

Toronto (or the "City") refers to the entire community of Toronto within the City's geographic boundaries, including:

- The City Government, which includes all of the City Divisions and City-owned buildings;
- The City's Agencies, Boards and Commissions ("ABC"); and
- The community within the boundaries of the City.

Energy within Toronto refers to the following principal types and sources:

- Electricity, from Toronto Hydro Electric System Ltd. ("THESL" or "Toronto Hydro");
- Natural Gas, from Enbridge Gas Distribution ("Enbridge");
- District Energy Systems operated by Enwave District Energy ("Enwave"), which provide heat from natural gas and cooling from deep lake water cooling, electricity and natural gas;
- Fuel oil for heating, from a variety of local fuel oil distributors; and
- Renewable energy from a variety of sources throughout the City.

Timeframes considered in this report are as follows:

- Short term is defined as up to 2010;
- Medium term is defined as up to 2015; and
- Long term is defined as up to 2030.

Energy Terminology

- Peak electricity demand is measured in kilowatts (kW), or multiples thereof, e.g. megawatts (MW);
- Electrical energy (electricity) is measured in kilowatt-hours (kWh), or multiples thereof, e.g. megawatt-hours (MWh);
- Natural gas is measured in cubic metres (m^3). One cubic metre of natural gas is equivalent to 10.35 kWh
- Fuel oil is measured in litres (L). One litre of No. 2 fuel oil is equivalent to 10.54 kWh;
- Cooling demand is measured in tons, defined as the amount of heat that would be absorbed by a ton of ice changing to water over a twenty-four hour period. One ton of cooling capacity is equal to 12,000 Btu/hr; and
- Energy refers to all forms of energy, including electricity natural gas, oil, etc.

1.7 Limitations

The following limitations must be considered when reading this report:

- **Publicly available information used.** The information gathered and relied upon in the development of this report was obtained from publicly available information. As a result, PwC cannot attest to the accuracy of the information as at the date of the issuance of this report as energy related information is very dynamic.
- **Reliance on forecasts.** Forecasts and assumptions relied upon in this report may have changed. Actual results will vary from those presented, and the variations may be material. The outputs of our analysis are provided only for planning purposes. No assurances are provided that the results indicated in the various analysis discussed in this report will be borne in practice. These forecasts may change based on additional analysis and data.
- **Provision of data**. No investigation was conducted as to the completeness or accuracy of statements made by stakeholders during consultations, or of information provided by the City of Toronto, Toronto Hydro, Enbridge, Enwave or any other stakeholder.
- **Unaudited information**. PwC has not audited or otherwise verified the information supplied to us in connection with this report, from whatever source, and the procedures we have performed do not constitute an audit in accordance with generally accepted auditing standards. In particular, we have not completed any independent audit or verification of the information contained in any of the material provided to us, nor do we express any opinion on such information or analysis contained in any source documents provided by the City of Toronto or by other stakeholders such as Toronto Hydro, Enbridge, the OPA, et cetera.
- **Focus on reduction of energy demand and consumption in Toronto.** There are a number of associated initiatives and reports currently underway within the City of Toronto. This report focuses on opportunities to reduce overall energy demand and consumption in Toronto. These opportunities will have climate change impacts, which will be discussed in detail within the City's Climate Change Plan.

2 Energy Efficiency and Renewable Energy

2.1 Background

Energy efficiency and renewable energy can act as key contributors to offset both energy supply needs and meet climate change targets. The benefits of energy efficiency and renewable energy for the City are well documented, and include:

- **Addressing climate change and improving air quality** – Energy efficiency programs can support the Government of Ontario's objective to close coal-fired generators, which are a major source of emissions and detrimental to the health of Torontonians. Natural gas and heating oil use also generate pollutants. As a result, reductions in energy use of all forms will assist in both meeting the City's Climate Change targets and improving air quality.
- **Retaining energy dollars in the city** – the City is a net importer of energy and reducing energy costs could act to stimulate the reinvestment of savings in the local economy.
- **Saving our energy resources** – Energy resources are not infinite. Reducing energy consumption can serve to ensure that the energy resource pool is available for future generations.
- **Creating jobs in the new renewable and energy efficiency economy** – Investment in energy efficiency and renewable energy technology and projects can act to stimulate jobs and offer second order impacts in a highly capital intensive sector.

The City has a history of being at the forefront on energy-related issues and is widely recognized as an innovator in North America in the area of sustainable energy use. As such, the City recognizes both the opportunities and challenges presented by its increasingly fragile energy situation. It is with this understanding that the City commissioned this report.

2.2 Recent Actions in Canada

Recent Municipal Actions

As of 2006, the economic impact of the Better Buildings Partnership ("BBP") has been approximately $161 million, with a 194,500 tonnes reduction in CO_2 levels, and a total operations savings of $19 million per year. The BBP was initiated in 1996, as a City program which provides funding for comprehensive energy efficiency retrofits and building renewal initiatives for all private and public sector buildings in Toronto. These initiatives include a mix of short and long term payback measures, where energy and water technologies are bundled with other building renewal activities in order to increase project flexibility.

The City has also set into motion the Better Buildings New Construction Program, which aims to improve energy efficiency in the construction of new buildings. This program was designed by the City's Energy Efficiency Office in cooperation with Toronto Hydro, and provides incentive payments when it can be proven that a new building will use less electricity during peak hours than a comparable building designed to meet the basic requirements of the Model National Energy Code for Buildings; this is done through the use of approved energy modelling simulation.

Upon acceptance of the initial documentation, the BBNCP provides the building owner with $500/peak W/m2 Gross Floor Area of the Building reduction in the building's energy demand as compared to the forecasted demand if designed to the Model National Energy Code, with a cap of $50/peak kW. At completion, the building owner can receive a further incentive of $500/peak W/M2 GFA reduction in energy demand as compared to the projected demand based on the code.

The City has also made advances on efficiency initiatives for other areas within its mandate, including water usage. In 2001, the City developed a Water Efficiency Plan in order to reduce water use to accommodate population and employment growth for 1/3 of the price for infrastructure expansion. The plan identified seven water efficiency measures (e.g., System Leak Detection, Watering Restrictions, Toilet Replacement, Outdoor Water Audits, etc.) which could be applied to one or all of the water use categories (i.e., municipal; single family residential; multi-unit residential; and industrial, commercial, and institutional). The Plan also offered a detailed implementation schedule up until the year 2011. At present, incentives for community residents and business owners range from $60-75 for a single-unit residential toilet replacement to $0.30 per litre of water saves as part of the WaterSaver Program: Water Buy Back Program for Industrial, Commercial, and Institutional organizations.

Recent Provincial Actions

In February 2006, the Ontario Ministry of Energy issued a directive to the Ontario Power Authority ("OPA") to achieve 300 MW of peak electricity savings in Toronto by 2010. In September 2006, the City of Toronto and Toronto Hydro each agreed to undertake to develop programs to achieve 90 MW of those of savings, while the Building Owners' and Managers' Association ("BOMA") agreed to reduce electricity consumption in Toronto's commercial buildings by 150 MW, for a total of 330 MW of conservation by 2010. This represents a 30 MW increase over the original directive. The OPA is also providing incentive payments (based on $400 per kW) of up to $150 million to help realize these targeted savings.

In April 2007, the provincial government announced The Home Energy Audit Program, a $24 million, four-year energy conservation initiative that will subsidize home energy audits in Ontario.[2] Residents of Toronto can take advantage of this program. Each energy audit evaluates the energy efficiency of a home and outlines improvements to the heating, cooling, hot water heating, and other uses of energy in the house that could result in energy savings.

The OPA has been mandated to deliver 6,300 MW of demand reduction through energy efficiency initiatives. In response, the OPA has developed and launched a series of conservation and demand management ("CDM") programs. These represent the first steps and more programs are coming. The two natural gas utilities, Union Gas Ltd and Enbridge Gas Distribution have a long history of delivering demand-side management ("DSM") programs in the province.

On the supply side, the province launched the Renewable Energy Standard Offer Program ("SOP") in 2006.[3] The program offers a guaranteed price for electricity generated by small renewable power installations, such as solar photovoltaic and wind. In February 2007, the OPA increased the amount of clean, green energy used to power Ontario's electricity grid

[2] Source: http://www.energy.gov.on.ca/index.cfm?fuseaction=english.news&body=yes&news_id=150
[3] Source: http://www.powerauthority.on.ca/sop/

with twenty-two new renewable energy projects awarded through this program.[4] It is expected that the OPA will soon announce a similar program for "clean" energy (i.e., high-efficiency natural gas installations, such as the new tri-generation facility in the Direct Energy Centre at Exhibition Place).

The Portlands Energy Centre ("PEC") has also commenced construction of its gas-fired electrical generation facility, which will eventually have a capacity of 550 MW.[5] The first phase of the PEC is expected to come into full operation in 2008.

Recent Federal Actions

The federal Minister of Natural Resources recently announced the creation of the ecoENERGY Efficiency Initiative[6], a $300 million, four-year plan to increase the number of energy-efficient homes and small commercial and industrial buildings across the country, through retrofits and higher standards for new construction. This is similar to the mandate of Toronto's Energy Efficiency Office's Better Buildings Partnership. The length of the program is almost identical to that of the City of Toronto's 90 MW Program.

The ecoENERGY for Renewable Power program[7] is managed by Natural Resources Canada ("NRCan") and will invest $1.48 billion to increase Canada's supply of clean electricity from renewable sources, including wind, biomass, low-impact hydro, geothermal, solar photovoltaic, and ocean energy. It will encourage the production of 14.3 terawatt hours of new electricity from renewable energy sources, enough electricity to power approximately one million homes.

Businesses, municipalities, institutions and organizations are eligible to participate in this program. ecoENERGY for Renewable Power will provide an incentive of one cent per kilowatt-hour of generation for up to ten years to eligible low-impact, renewable electricity projects constructed between April 1, 2007 and March 31, 2011.

In its 2007 Budget, the Federal Government also announced a $1.5 billion ecoTrust. This trust will provide support to those provinces and territories that identify major projects that will result in real reductions in greenhouse gas emissions and air pollutants. Ontario's share of the ecoTrust, $586 million[8] could result in increased movement to reduce the dependence on coal and to promote renewable forms of generation.

2.3 Review of Existing Energy Efficiency and Renewable Energy Programs

Jurisdictional Scan: Programs Available in Toronto

In the following section, the term program is used to describe any market intervention or market initiative intended to encourage the uptake of energy efficiency or renewable energy

[4] Source: http://www.powerauthority.on.ca/Page.asp?PageID=376&ContentID=5183
[5] Source: http://www.powerauthority.on.ca/Page.asp?PageID=924&ContentID=5144
[6] Source: http://www.nrcan.gc.ca/media/newsreleases/2007/200704a_e.htm
[7] Source: http://ecoaction.gc.ca/ecoenergy-ecoenergie/power-electricite/index-eng.cfm
[8] Source: http://www.ontariobudget.ca/english/bk11.html

activity. Some of these activities may not be direct interventions (i.e., incentive based programs), while others are more indirect (i.e., the use of information or “suasion” programs).

Energy efficiency and renewable energy focused programming efforts are not new concepts; there are already a number of initiatives and programs in place within the City. As a part of the analysis of the current energy state in Toronto a review was conducted to identify the majority of energy efficiency and renewable energy programs currently available in the City. By design, the review was intended to be comprehensive, covering all aspects of the various types of programs, including:

- Incentives (e.g. utility or government initiatives);
- Tax Rebates;
- Information and Education;
- Codes and Legislation; and
- “In-house” programs focusing on City buildings and properties.

This review relied chiefly on Internet based research, augmented by information and/or publicly available reports provided by Enbridge, Toronto Hydro, and the City. It included a review of activities at all three levels of government, in addition to an examination of specific initiatives sponsored or operated by a variety of non-government organizations (“NGOs”) and member-supported organizations.

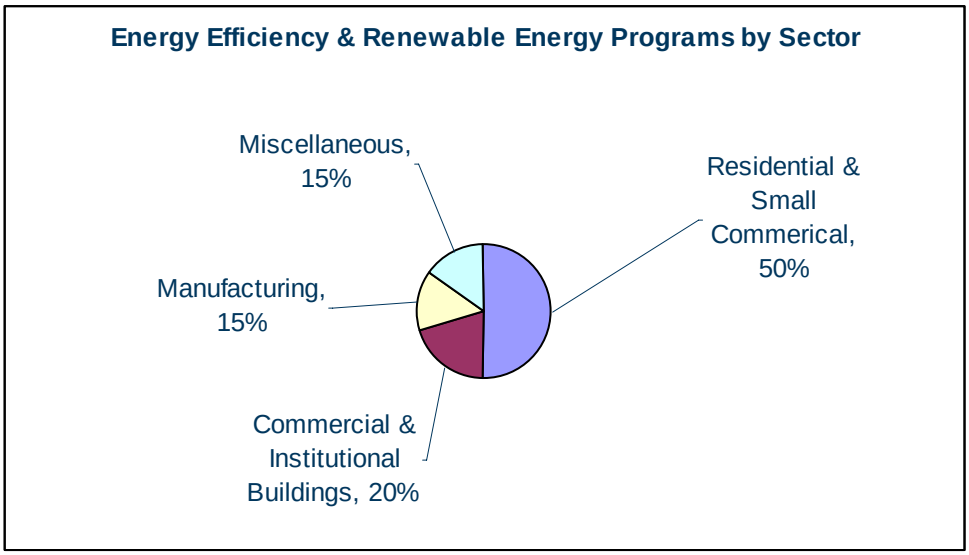
Over 80 programs were reviewed and filtered. Appendix D contains additional information on the methodology used to conduct the review, along with specific details relating to the programs reviewed. Consistent with the jurisdictional scan presented in the next section, the programs were also assigned an effectiveness rank. This ranking served to inform the sector discussion in Section 6.

Analysis

The list of energy efficiency and renewable energy programs available in Toronto is substantial, with the vast majority primarily focused on energy efficiency. Water reduction focused programs are included in this list of programs as they can also bring energy reduction co-benefits. The programs are offered by different levels of governments, and cover the entire range of possible energy efficiency and renewable energy programs, including education, incentives, tax based, and codes/legislation. Many programs use hybrid approaches to the marketplace. For instance, there are a number of programs that combine education and financial incentives, a hybrid model which appears popular.

Energy efficiency and renewable energy programs are available to all sectors of the economy. Of the programs reviewed, approximately 50 percent were operating in the residential and small commercial markets, 20 percent in commercial and institutional buildings directed programs, 15 percent in the manufacturing sector, and 15 percent in a “miscellaneous” category.

Figure 2-1: Energy Efficiency and Renewable Energy Programs by Sector



Primary program sponsors included:

- Toronto Hydro Electric System Ltd.;
- Enbridge Gas Distribution;
- The City of Toronto Energy Efficiency Office;
- The City of Toronto, Toronto Water;
- The Ontario Power Authority;
- The Ontario Ministries of Energy and Municipal Affairs and Housing; and
- Natural Resources Canada, Office of Energy Efficiency and Renewable Energy Technologies.

There are also a number of associations promoting specific technologies, applications or approaches to the marketplace, typically through the use of education, training, workshops, etc. Examples of these include: the Green Roofs Association, Net Zero Energy Coalition, the Canadian GeoExchange Coalition, Canadian Solar Industries Association, Sustainable Buildings Canada, Federation of Canadian Municipalities, and others. A number of these organizations act as delivery agents for programs, and may also offer financial or other support.

There are a variety of delivery agents and partners actively delivering the various programs identified in the scan. These include NGOs, member organizations, and private program delivery specialists.

The provincial government's primary areas of activity relate to the specification of building and energy codes and energy efficiency directives aimed at provincial buildings or provincially funded buildings. Energy codes in particular can be an effective way of increasing energy efficiency; recently, the Ontario government has set higher minimum energy code requirements, both for appliances and for new buildings.

The federal government promotes energy efficiency and renewable energy through a broad continuum of programs and activities including: research and development, incentive programs, tax incentives, educational efforts and codes.

Key Findings

Given the number and breadth of energy efficiency and renewable energy programs operating in the City, the overlap of program offerings, and the myriad of players, there is potential for some confusion in the market, in addition to a danger of information overload. Multiple messaging is now common, particularly at the homeowner level. There can also changes in program design and program responsibility, which may lead to program offering changes or, in the worst case, cancelled or revoked programs. This can also lead to stakeholder confusion.

Identification of City Stakeholders

The City has a complex mix of stakeholders with differing, interests and representation which must be managed on a City wide scale. Many of these stakeholders can be viewed as either partner stakeholders who have shared interests with those of the City, or as organizations whose capabilities can be leveraged to meet the City's energy efficiency goals.

The City faces major challenges with respect to its stakeholders. These relate primarily to the City's ability to leverage and manage such a diverse range of stakeholders, and to communicate to and with these stakeholders using media that reaches them in a meaningful and informative way. Above all the City must be able to engage and encourage each group of stakeholders to take action and to contribute to the City's overall energy goals.

Fortunately, there are a number of opportunities for the City to leverage as it moves forward. Table 2-1 provides a framework for defining the communication potential of the City.

Table 2-1: Illustrative Communication Framework for City Stakeholders

Sector	Segment	Type	Capability	Points of Leverage
Government	**Municipal**	Political	Mayor and Councilors	Leadership; communication with constituents
		Administrative	City services	Some mass market communication potential, e.g. City Water
			Agencies, Boards and Commissions	Leadership and demonstration potential, e.g. TCHC, ExPlace
	Provincial and Federal	Programmatic	Existing EE Programs	Leverage their initiatives, especially for funding
		Internal	Existing EE Programs	Some internal programs; City has limited impact on their buildings
Business	**Large Commercial**	Representative associations	Most businesses are members	Can demonstrate leadership, communicate, and organize, e.g. BOMA

Sector	Segment	Type	Capability	Points of Leverage
	Small Commercial	Representative associations	Limited communication capability; some existing programs	More difficult segment to reach. Smaller market penetration; more cross sectoral associations
		Community approach	Appropriate for small retail communication	Combines business and community interests
	Industrial	Representative associations	Leadership & communication	Federal government and energy utilities have some communication capability
		National & international ownership	Leadership; Internal programs	Desire recognition
Institutional	**Schools, Colleges & Universities, and Hospitals**	Provincially funded; small number of organizations	Leadership; Internal programs	Respond to provincial direction, but desire recognition
Residential	**Large Multi Unit Rental**	Representative association; strong regulation	Leadership; communication	Difficult sector with significant barriers; more responsive when occupancy rates are lower
	Large Condominium	Representative associations	Strong self-interest; needs leadership	Large property management firms provide communication, want to lead
	Low-Rise	Multiple independent stakeholders	City and utility contact through bill stuffers	Need to separate and emphasize the EE message
		Community approach	Leadership and demonstration projects	Use local organizations to demonstrate leadership
Local Distribution Companies	**Electricity**	Municipally owned	Communication pipeline to every building; program delivery agent	Leadership; communication
	Natural Gas; Fuel Oil	Investor owned	Communication pipeline to every customer; existing/potential program delivery agent	Leadership; communication

Sector	Segment	Type	Capability	Points of Leverage
	District Energy	Public/private ownership	Communication pipeline to every customer; potential program delivery agent	Leadership; communication

A multi-pronged approach should be followed to reach these varied stakeholder groups. In the past, the City has demonstrated its capability to work with many stakeholders, to show leadership, and to reach consensus through prior consultation processes and through outreach with the community and stakeholders. To persuade all organizational and individual stakeholders to take action on energy efficiency the City will need to play a strong leadership role, leverage existing and new relationships, and communicate effectively and in a manner that challenges and motivates these stakeholders.

Opportunities Available

The opportunities presented below were drawn from the review of existing programs in Toronto. From this analysis, it is clear that there are some notable opportunities for the City to participate in energy efficiency and renewable energy program design, delivery or enhancement.

The opportunities outlined in this section have been used as a basis for the identification of preferred program options.

Taking into account the scan of City programs and the diversity of City stakeholders, we believe that a central repository of program offerings could be a helpful tool in reducing potential marketplace confusion. This repository should act as a single point of contact, or "portal," to the programs, wherein any interested party could quickly and easily access relevant program information. The responsibility for creating and maintaining this capability would appear to logically reside with the City. Such a repository could also serve as a focal point for all energy efficiency and renewable energy activities that the City wishes to undertake, and could be expanded to be the primary program agent for most of these initiatives. In this respect, the City could take on a coordinating role for all the various organizations offering programs within the city, and thereby streamline efforts to achieve the overall objectives of its Energy Plan.

In addition, the review of the existing initiatives also identified key sectors that could provide the City with the best opportunities to achieve its energy efficiency potential, including:

- Large commercial and institutional;
- Small to medium size enterprises, particularly retail;
- Residential sector, including community based efforts;
- Multi-unit residential buildings ("MURBs"); and
- City-owned properties and buildings.

The potential overlap between these sectors presents a compelling case for the development of specific programming activities in a few key areas, specifically:

- In-house Energy Efficiency and Renewable Energy;
- Community Based Initiatives, focusing on residential, MURBs and small retail;
- Commercial/Institutional Building Retrofits;

- Commercial New Building Construction Program; and
- Residential New Building Construction Program.[9]

Building retrofits generally offer the greatest potential, and the institutional sector, including municipal buildings, schools, hospitals and universities (i.e., the MUSH sector) presents a large opportunity for the City, likely requiring specific programming activities directed at each sector.

The jurisdictional scan of City programs indicates that there is a variety of effort already underway that target these sectors. In particular:

- The OPA Building Owners and Managers Association ("BOMA") program targeting large commercial (>25,000 ft^2) for energy efficiency retrofits and using a $400/kW incentive.
- The Enbridge Gas Distribution, Toronto Hydro and City of Toronto Design Assistance/New Building Construction programs.
- A variety of Toronto Hydro, OPA, and NGO residential programs including Peak Saver, Refrigerator Exchange, Residential 10/10 and Green$aver that could be important offerings in a community based initiative.
- The City's Energy Management Plan which directs the City to undertake a variety of efforts aimed at reducing energy use in City facilities (note that this 5-year plan expires in 2007).[10]

There appears to be an opportunity to combine, amplify, organize and integrate these efforts in a more holistic approach in order to achieve greater activity. Similar to the development of the programs portal, this integration could be conducted under the sponsorship of a central coordinating entity within the City.

Additionally, there may be an opportunity to enhance a number of the standalone offerings of the OPA, Toronto Hydro, and Enbridge Gas Distribution by co-marketing with them or by offering greater incentives. Potential programs that the City should consider supporting are described below:

a) In-house Energy Efficiency and Renewable Energy Opportunities

The in-house program could focus on City owned or operated buildings and facilities incorporating multiple components including:

- Employee awareness to instil a "culture of conservation;"
- Incentives for operations staff and managers to implement energy efficiency or renewable energy programs; and
- Financing that might be available through a special fund available to City owned or operated buildings.

[9] "Energy Management Program for City of Toronto Facilities and Operations", Approved February, 2003. Note that this 5-year plan expires in 2007.
[10] "Energy Management Program for City of Toronto Facilities and Operations", Approved February, 2003

In developing this program, the City could bring all in-house energy efficiency and renewable energy activities under a single area of responsibility to deliver a comprehensive program. In addition, the program could be be a model for replication that might be adopted for all government owned or operated buildings, including those that are the responsibility of the provincial or federal governments. As a result, City leadership in this area could offer significant leveraging potential and a further opportunity to showcase the City's achievements.

b) Community Based Energy Efficiency and Renewable Energy Retrofits

This program could represent a continuation and amplification of the home renovation forums that the City currently operates. It would target the residential and the small retail sectors, and would be designed to be delivered and operated at the community level. Additionally, it would include educational and incentive components, and could be offered in partnership with Toronto Hydro or Enbridge. It would also give energy suppliers, including retailers, a potential contact point to the marketplace. The program would cover a wide spectrum of potential activities, ranging from do-it-yourself upgrades to appliance replacements and major renovations. As a community based initiative, this program would attempt to leverage existing infrastructure including local businesses and economic development organizations.

c) Commercial/Institutional Building Retrofits

This program would aim to engage those owners of those buildings that are not included in the current BOMA program or those that might be targeted through the In-house (or expanded In-house) program. This program would offer a combination of prescriptive and custom incentives, supported by educational and marketing efforts aimed at encouraging comprehensive retrofits of equipment and systems.

d) Residential New Construction Program

The implementation of the new Ontario Building Code should result in greater energy efficiency in new homes. This program would aim to increase efficiency beyond what is inherent in the Code, through the adoption of an EnerGuide 80 or ENERGY STAR program and brand. This program would target builders, focusing primarily on equipment and appliance choices by offering incentives to select ENERGY STAR or better appliance packages, hard wired compact fluorescents, advanced programmable thermostats, heat recovery ventilators, and other prescriptive measures. This program would also encourage builders to offer “solar ready” homes with appropriate conduits for easy retrofitting of solar thermal and photovoltaic systems.

e) Commercial/Institutional New Construction

This program would build on the Enbridge, Toronto Hydro, and City Energy Efficiency Office Design Assistance and New Building Construction Programs, using their fundamental approaches, but offering greater incentives and support. More focus on smaller buildings would be a feature. Additionally, this program would include an advocacy component aimed at changing City planning and approvals processes in a manner that favours green and energy efficient projects.

These programming recommendations support the discussion of the sector analysis provided in Section 6.

Jurisdictional Scan: Programs in Other Jurisdictions

The objective of the jurisdictional scan of other jurisdictions was to identify best practices around the world and to select potential energy conservation programs that could be implemented in the City of Toronto as part of its Energy Plan. The jurisdictional scan was conducted in three phases:

1. **City selection**

   Twenty-one cities were selected for the jurisdictional scan. The selection was based on information obtained from global sustainability rankings, publications, and feedback from subject matter experts and staff from the City of Toronto's Energy Efficiency Office.

2. **Jurisdictional research**

   The jurisdictional research consisted of gathering the following information from public sources for each of the 21 selected cities:

   - General city description, including population, area and climate;
   - Energy plans and policies, if applicable;
   - Information on energy agencies or other organizations such as utilities or private-public partnerships, if applicable; and
   - Information on energy conservation initiatives at the municipal level as well as provincial or national level, if applicable.

   A total of 188 initiatives were identified within the 21 cities researched.

3. **Selection of initiatives**

   The objective of this phase was to select best-in-class initiatives that were relevant to the City of Toronto and that could be completely or partially considered for the selection of program options as part of the development of the Energy Plan.

   The 188 initiatives identified during the jurisdictional research were ranked based on City Criteria and Initiative Criteria. City Criteria refers to how the selected city compares to Toronto, in terms of characteristics such as area, population and climate. Initiative Criteria refers to the initiative's potential success in achieving energy conservation if implemented in Toronto. Based on these criteria, each initiative was ranked and awarded a low, medium, or high grade.

   A total of 55 initiatives were awarded a high grade.

A more detailed description of the methodology in addition to a complete list of initiatives can be found in Appendix B.

Analysis

Programs identified in the jurisdictional scan were grouped by type. The following three types of programs accounted for almost 70 percent of the top 55 initiatives identified:

- Green building and conservation programs;
- Rebates and grants; and
- Solar and other renewable energy sources.

In general, the cities identified relied on provincial and national initiatives to support their energy conservation initiatives. For example, the California Solar Initiative applies to cities across California including San Francisco and Los Angeles, which also have their own energy conservation activities in place. The California Solar Initiative offers photovoltaic incentives, funds for solar installations for existing and new low-income and affordable housing, and a pay-for-performance incentive structure to reward high-performing solar projects.[11]

Many cities included their energy conservation plans and initiatives under the climate change umbrella. In these cases, energy conservation is one of a number of actions aimed at reducing greenhouse gas emissions. An example of this is Melbourne's "Zero Net Emissions by 2020 Strategy." Among other mechanisms, the Melbourne strategy's vision is for commercial, industrial and residential investment in superior energy-efficient design and the greening of the power supply.[12]

Key Findings

From the 21 cities researched, the following cities stood out as progressive examples due to their energy efficiency and conservation commitment or their program offerings:

- The City of London, because of its Energy Plan;
- The State of California, because of its solar energy programs;
- The City of Copenhagen, because of its Main District Heating Network initiative; and
- The City of Portland, because of its energy conservation and renewable energy initiatives for City Government.

Best Practices

Below are six examples of best practices identified during the jurisdictional scan which are relevant for Toronto. Each has been selected because it addresses specific areas of need for the City, because it potentially offers a unique approach for Toronto to consider, or because it had a particularly compelling outcome.

[11] Go Solar California!, http://www.gosolarcalifornia.ca.gov/csi/index.html, Accessed May 31, 2007

[12] Zero Net Emissions by 2020 Strategy, http://www.melbourne.vic.gov.au/info.cfm?top=218&pa=1612&pg=1618, Accessed May 31, 2007

Residential Energy Assessment Program	
Initiative type	Assessment Tool
City	Chicago, IL, USA
Description	An online home efficiency assessment tool which provides homeowners with the ability to assess the energy efficiency of their homes and provides tips for conserving energy. The REAP online questionnaire takes most people 10-15 minutes to complete. Many of the questions include instructions for how to answer the questionnaire. Once the survey is completed, an automated and personalized home energy audit report will be generated on-line. Several documents on energy saving technologies and tips are also available to download and printout to help realize the energy conservation recommendations in the audit report. The energy assessment program has the following sections: Registration Building Information Utility Bills Roof & Walls Windows & Doors Basement, Foundations & Crawlspaces Heating System Cooling System Water Heater Lighting Appliances
Delivery Agent	Department of Environment City of Chicago DOE - Energy Management and Air Quality 30 N. Lasalle Suite 2500 Chicago, IL 60602 Phone: 312-744-7606 environment@cityofchicago.org
Target sector	Residential City community
Website link	http://webapps.cityofchicago.org/ERC/

Consumer Energy Centre of the California Energy Commission	
Initiative type	Education
City	San Francisco, CA, USA
Description	The Consumer Energy Center went on line in 1995 to offer the public a one-stop site on the Internet for the latest information about energy resources and how to use them wisely in the home, work and vehicles. The major topic areas addressed on this website are: Choices at home - information on Appliances, Construction and Remodeling, Consumer Tips to Save Energy, Heating and Cooling, Inside Your Home, Lighting, Outside Your Home, Tighten Up Your Home!, Windows and Energy Bill Choices at work - information on Cool Roof Program, Energy Bills & Commercial Programs, Enhanced Automation, High Performance Buildings, Lighting, Green Buildings and Transportation Choices Choices at school - information on Bright Schools Program, Cool Roof Program, High Performance School and Solar Schools Renewable energy - information on Biomass, Fuel Cells, Geothermal, Hydro-electric, Solar, Solar Thermal and Wind Transportation - information on Consumer Tips, Incentives, Information About Buying a New or Used Car, Alternative Fuel Vehicles, Hybrid Vehicles, Bicycling, Walking, Telecommuting, Urban Options, Vehicle "Urban Myths," etc. There are also links to sections offering seasonal consumer tips, "how-to" videos for the consumer and energy professional, and information about incentives and rebates.
Delivery Agent	California Energy Commission Media and Public Communications Office 1516 Ninth Street, MS-29 Sacramento, CA 95814-5504 U S A Phone: 916-654-4287 E-mail: mediaoffice@energy.state.ca.us
Target sector	Residential, commercial and industrial City community and City Government
Website link	http://www.consumerenergycenter.org/index.html

Seattle's Energy Code	
Initiative type	Green building and conservation programs
City	Seattle, WA, USA
Description	2004 Seattle Energy Code (i.e., the 2004 Washington State Energy Code with Seattle amendments) requirements are subdivided by occupancy type. Chapters 1-10 of the Energy Code contain the requirements for Group R occupancy (single family, multi-family, hotel and motel guest rooms, both low-rise and high-rise) and are referred to as the Residential Energy Code. Chapters 11-15 contain the requirements for all other occupancies and are referred to as the Nonresidential Energy Code. Reference Standard (RS) 29 contains requirements that are only applicable to detailed computer analysis.
Delivery Agent	Department of Design, Construction and Land Use (DPD) Phone: 206-684-7846
Target sector	Residential, commercial and industrial City community and City Government
Website link	http://www.seattle.gov/DPD/Codes/Energy_Code/Overview/default.asp

Solar Roof Exchange	
Initiative type	Solar energy and other renewable energy sources
City	Berlin, Germany
Description	Solar panel installed in public buildings by the private sector. The initiative is part of the PV – Dach Initiative Berlin (PV-Roof Initiative Berlin).
Delivery Agent	Senatsverwaltung für Gesundheit, Umwelt und Verbraucherschutz Referat Klimaschutz Brückenstraße 6 10179 Berlin Wolfram Müller Tel.: 030-9025-2148 E-Mail: wolfram.mueller@senguv.verwalt-berlin.de
Target sector	Commercial City community and City Government
Website link	http://www.berlin.de/sen/umwelt/klimaschutz/solardachboerse/

Green Power Initiative	
Initiative type	Green Power
City	Calgary, AB, Canada
Description	The City of Calgary made a commitment to increase its green electricity consumption to 75percent of total use by January 2007 through an agreement with ENMAX Energy Corporation, making it the first municipality in North America to do so. As a direct result of The City of Calgary's commitment, ENMAX will develop a 37 turbine wind farm in southern Alberta. The **light rail transit initiative** supports this commitment. Calgary Transit's Ride the Wind program made Calgary's C-Train (LRT) the first "wind powered" public transit system in North America. Through the purchase of zero-emissions wind energy, 'Ride the Wind' has helped financially support the development of 12 windmills in southern Alberta. Annually, the program is responsible for avoiding the production of 26,000 tonnes of greenhouse gas emissions from other fuel sources.
Delivery Agent	City of Calgary 800 Macleod Trail SE P.O. Box 2100, Stn. M. Calgary, AB Canada T2P 2M5 Mail Code #230 Phone : (403) 268-2489
Target sector	City Government
Website link	http://www.calgary.ca/portal/server.pt/gateway/PTARGS_0_2_771_203_0_43/http;/content.calgary.ca/CCA/Citypercent20Living/Thepercent20Environment/Climatepercent20Changepercent20andpercent20Airpercent20Quality/Climatepercent20Change/Whatpercent20Thepercent20Citypercent20ispercent20Doingpercent20aboutpercent20Climatepercent20Change/Majorpercent20Citypercent20Accomplishmentspercent20topercent20Date.htm

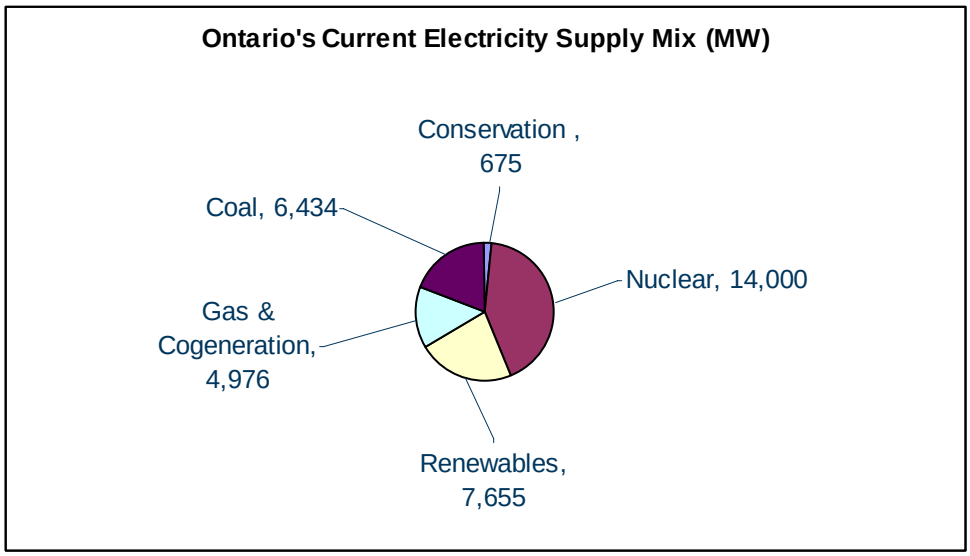
Energy Conservation and Renewable Energy for City Government	
Initiative type	Solar energy and other renewable energy sources
City	Portland, OR, USA
Description	City actions to use energy more sustainable: **City Energy Challenge Program** - In 1991, the City created the City Energy Challenge Program to cut energy use - and save money - in City operations. The program is a response to the City Energy Policy, which was adopted in August 1979 and updated in April 1990. The policy's goal is to: "Promote a sustainable energy future by increasing energy efficiency in all sectors by ten percent by the year 2010." The City already has exceeded that goal. Between July 1991 and December 2001, the program saved $9.46 million. Currently, the savings equal $2 million per year - more than 15 percent our energy bills. * **100percent Renewable by 2010** - In 2005 the Office of Sustainable Development issued a Request for Proposals for a 100percent renewable electricity product for all City accounts. The City is in negotiations with the successful proposer for the construction of new wind power facilities in Eastern Oregon to meet this need. **Waste Methane Used for Fuel and Power Generation** - As part of the sewage treatment process at the Columbia Boulevard Wastewater Treatment Plant, a significant amount of waste methane, known as biogas, is produced. Since 1998, the Bureau of Environmental Services has sold this waste methane to a local roof materials manufacturer, Malarkey Roofing. The current value is more than $120,000 a year. **Energy Efficient Traffic Signals** - All red and green traffic signals now use LED technology. By installing 14,000 LED lamps, the City saves approximately 5.25 million kWh each year – enough to power over 400 homes. **Powered by the Sun and Wind!** - Parking meters, trucks and more use solar and wind energy.
Delivery Agent	Office of Sustainable Development City of Portland 21 NW 9th Ave, Suite 350 Portland OR 97209 Phone: 503-823-7222
Target sector	City Government
Website link	http://www.portlandonline.com/osd/index.cfm?c=42399

3 Overview of Current Energy State in Toronto

3.1 Ontario Energy Context

Toronto's energy use and demand is a microcosm of the Ontario context. In Ontario, three end use energy forms are dominant: electricity, natural gas and oil. The majority of electricity is generated by Ontario Power Generation using primarily a mix of nuclear, coal, hydro and natural gas generation assets. There is also a small amount of electricity generated in the province from renewable energy other than hydraulic – mainly from wind power.

Figure 3-1: Ontario's Current Electricity Supply Mix[13]



The Ontario Power Authority has estimated that by 2014, demand will begin to exceed supply and by 2025, that gap will be approximately 10,000 MW. As the largest single user of electricity, Toronto Hydro, and by extension, the City of Toronto is paramount to any solutions that might be achieved to resolve this "demand gap." The Minister of Energy has directed the OPA to achieve 6,300 MW of demand reduction in the immediate short-term. This can only be achieved with the full participation of the City.

There are two main suppliers of natural gas in Ontario – Union Gas Ltd. which serves customers in northern and southwest Ontario and Enbridge Gas Distribution which serves customers in Toronto, Ottawa and the St. Catharines area. Natural gas is used primarily for space and water heating and for a variety of process loads in the industrial sector. Demand for natural gas in the province is relatively stable with increases due to new additional loads

[13] Backgrounder: Ontario's Electricity Supply Mix, Ontario Power Authority, 2005. Note that hydro generation is considered a renewable asset

being largely off-set by increases in efficiency. No shortages of natural gas are projected for the immediate future.

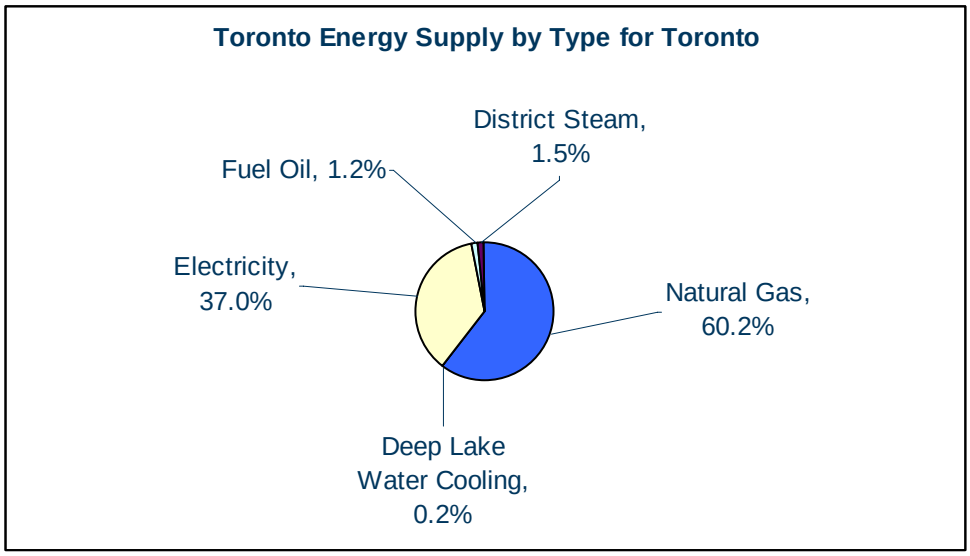
Fuel oil is the third fuel source in the province with a relatively significant share of space and water heating, particularly in rural areas where natural gas is not available. Where natural gas is available, the use of oil is relatively small.

Other end use fuels include propane and wood, which are anticipated to remain as small alternative fuels used mainly in rural areas.

3.2 Energy Supply in Toronto

Five key types of energy are used to meet the supply needs of the City of Toronto. The percentage breakdown of these types is illustrated in Figure 3-2.

Figure 3-2: Total Energy Supply – By Type for Toronto[14]



The main source of Toronto's energy is natural gas, followed by electricity. Although, it is important to note that electricity is an energy carrier, not an actual energy source. If the source energy used to generate the electricity was included in the chart (e.g., coal used in thermal generation), the combined energy source would represent the largest component of the energy used in Toronto.

[14] The amount for DLWC has been calculated based on an equivalent replacement of the electricity that would have to be supplied to a conventional cooling plant. For Enwave steam, an equivalent amount of natural gas has been deducted from the Industrial rate class for Enbridge natural gas.

Electricity

Toronto's electricity is supplied by Hydro One to Toronto Hydro from generators around the province and from outside Ontario. It enters the City through a number of connection points. These transmission lines have been in place for a number of years; a major new transmission line has not been constructed in Ontario since the 1980s, although several applications have recently been submitted to the Ontario Energy Board ("OEB").

Toronto Hydro transforms the voltage down for the distribution of electricity at the street level, and delivers it to Toronto Hydro owned meters located on customers' premises.

In the 1990s, the Toronto Hydro system changed from winter peaking to summer peaking. This has resulted in a significant reduction in distribution capacity as transformers and conductors have decreased capacity as the ambient temperature rises. Since the peak demand is coincident with the hottest summer cooling load (i.e., a combination of high temperature and humidity, fully occupied buildings, and maximum solar radiation), the distribution system is also at its lowest capacity during this peak time.

In 1994, Ontario Hydro and Toronto Hydro undertook a major study, entitled the Toronto Integrated Electricity Study ("TIES").[15] The objectives of this study were:

- Meet the supply reliability and power quality requirements of the electricity consumers in the City of Toronto;
- Ensure the electrical supply system can be operated and maintained in a manner which is safe to the public, and utility operations and maintenance staff;
- Minimize Total Resource Costs to society;
- Reduce environmental impacts; and
- Increase socio-economic benefits.

The conclusions of this report can be summarized as follows:

- The three downtown transformer stations, John TS, Esplanade TS, and Terauley TS, and the Ontario Hydro high voltage facilities at Leaside TS, Hearn TS and Manby TS are expected to experience the highest annual growth in electrical load, estimated to be between 1.1 percent and 2.2 percent in the peak summer months.
- If this load growth is realized, some parts of the system will not be capable of reliably supplying customer needs by 2000.
- Demand-side management programs will be the most cost effective near term option for the downtown core, with an estimated potential of 40 MW between 1996 and 2015.
- Supply-side plans must be implemented, including an expansion of Esplanade TS by 2000, new high voltage cables from John TS to Esplanade TS and uprating high voltage lines from Manby TS to Riverside Junction by 2005.

[15] Note that the reference to the City of Toronto was to the former City, and that each of the other five municipalities comprising Metropolitan Toronto had their own electric utility:

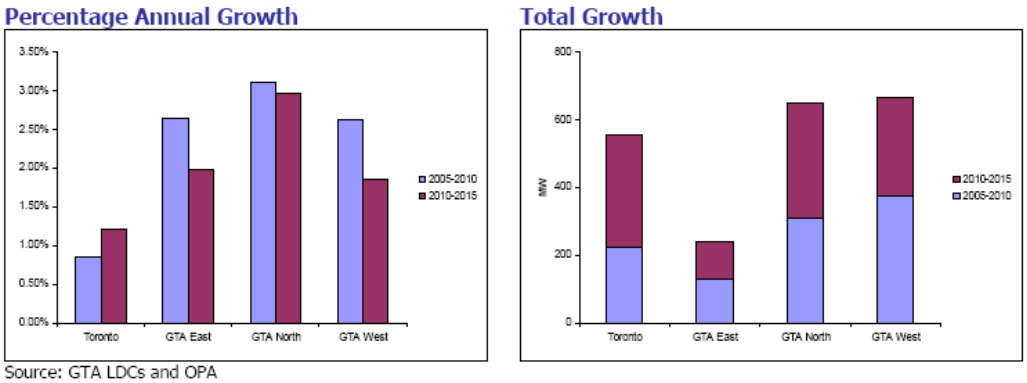
- Beyond 2008, local generation will cost about the same as transmission and distribution upgrades.
- The only building energy retrofit measures that can directly affect summer peak demand are cooling plant efficiency upgrades and energy efficient lighting.

Reviewing the TIES study illustrates the extent of divergence and/or clairvoyance of predictions made in 1994 and provides valuable insights to our current forecasting process. Notably many of the technical challenges to deliver a stable and reliable electricity supply to downtown Toronto in 1994 are still relevant today.

In the absence of any information on peak demand by transformer station from Toronto Hydro, the TIES report has been used as the key source for system growth in demand and consumption at those transformer stations. In reviewing actual demand and consumption data for the system as a whole, the projections prepared under the TIES project appear to have been accurate for the first few years, however, the rate of increase in peak demand appears to have slowed or potentially halted by 2003.

The OPA's Integrated Power System Plan ("IPSP") Discussion Paper # 5 identified forecast growth in peak demand for the Greater Toronto Area ("GTA"), including Toronto and three other GTA areas, as shown in Figure 3.3. These forecasts are based on LDC forecasts of station loadings, coincident with the sub-area peaks. The overall GTA average annual growth is expected to be about 1.8 percent per year over the next ten years. At this rate, the GTA load would increase by 2,000 MW and effectively absorb the new generation provided by the Goreway Station, Portlands Energy Centre and GTA West developments. Within Toronto however, the Portlands Energy Centre capacity of 550 MW will just meet the 2005 to 2015 load growth forecast of the OPA.

Figure 3-3: GTA Forecast Load Growth by Area



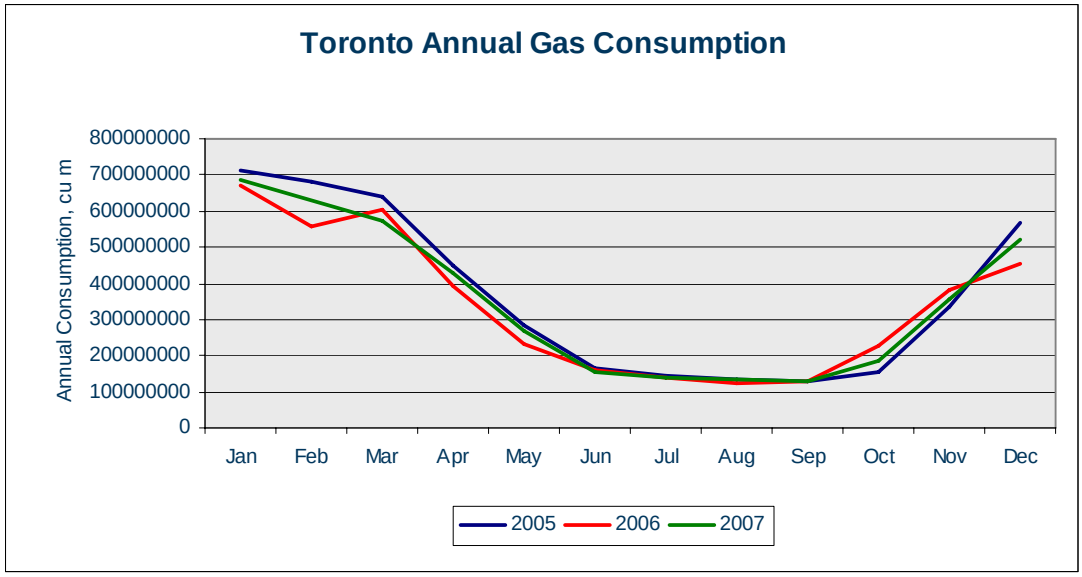
Source: GTA LDCs and OPA

Natural Gas

Enbridge is responsible for the distribution of natural gas in Toronto and other parts of the province. This gas is transported from Western Canada mainly by Trans-Canada Pipelines. As Enbridge is the default supplier, selling gas to customers who choose not to enter into an agreement with a retailer or wholesaler, it purchases gas from western producers and resells it at no profit.

The Enbridge system has a strong winter peak for its sales in Toronto, as shown in Figure 3-4. Note that the figures for 2007 are a projection provided by Enbridge.

Figure 3-4: Toronto Annual Gas Consumption



Enbridge deals with this peak through a combination of storage, mainly in underground caverns in south-western Ontario leased from Union Gas, and interruptible contracts in the industrial sector. Under an interruptible contract, an industrial customer undertakes to stop using natural gas and change to another fuel source when advised by Enbridge to curtail their usage. In return, these organizations can purchase natural gas at a lower price.

In November 2006, Enbridge made a presentation to the Ontario Energy Board that showed that its overall deliveries for Low-Rise Residential, Commercial, and Multi-Unit Residential customers were declining significantly. The explanations provided by Enbridge for this decline were:

- More efficient gas appliances;
- Better home insulation;
- Customer response to higher natural gas prices; and
- Unlike electricity, there are few low demand uses for natural gas (e.g., gas powered computers, cell phones and MP3 players/IPods, etc.)

On the basis of this presentation, there is not likely to be a constraint on the supply of natural gas for the Enbridge Gas Distribution system. However, a possible exception to this conclusion could arise from a significant increase in new gas powered generation in central and decentralised locations within Toronto.

Fuel Oil

Almost all of the fuel oil provided for space heating and hot water heating in the City is No. 2 fuel oil. This is a refined product very similar to diesel fuel.

Fuel oil is delivered by transport from the refiners to distribution points both in the City and nearby. From there, it is delivered to customers by smaller trucks, equipped to deliver the fuel oil to storage tanks on customers' premises.

Fuel oil lost significant market share during the 1970s and 1980s, mainly due to natural gas and government programs encouraging consumer to move "off-oil." However, industry

sources suggest that the market is now fairly stable at about eight to nine percent of the residential market in Toronto.

While supply of fuel oil has generally been adequate, two recent events demonstrate how closely matched supply is to demand.

1. The power system failure in August 2003 caused standby diesel generators in commercial buildings to be operated for a number of days. Commercial buildings are only required to keep a two-hour supply stored on site, and fuel oil suppliers were unable to meet the unexpected increase in demand.
2. The shutdown of a refinery in south-western Ontario in the winter of 2007 also demonstrated how constrained the market is for refined petroleum products. If fuel oil supplies tightened in winter, a decision would have had to be made about where supplies would be delivered: to transportation users; commercial buildings; or residential homes.

District Heating and Cooling

District heating in Toronto is provided to a number of downtown buildings by Enwave, which generates steam by burning natural gas in boilers at three locations in the downtown area. Enwave is on an interruptible contract with Enbridge, but is only called on to curtail gas consumption by changing to fuel oil on rare occasions.

Enwave also produces district cooling through the use of Deep Lake Water Cooling ("DLWC"), which is a renewable energy source. The original size of this system was 52,000 tons; this has since been expanded to 75,000 tons through the use of polishing chillers which operate at periods of peak load. This is the limit of the Enwave system and almost all of that capacity has now been sold to building customers. Any further additions will require either more pipes to be installed to take water from the bottom of Lake Ontario and more distribution piping to be installed under the streets of Toronto or some investment for daily storage or booster chiller capacity by Enwave customers. One estimate of the total cooling load in the downtown core prepared approximately ten years ago was 250,000 tons; it is likely that this number has grown since that time. The cooling load of 250,000 tons is equivalent to about 250 MW of electricity demand given the efficiency of cooling systems in Toronto buildings.

Several smaller municipalities in Ontario, including Sudbury and Markham, have installed district energy systems for heating based on Combined Heat and Power ("CHP") and using high pressure water for distribution. A system of similar size could be developed in a Toronto neighbourhood or ICI region, provided that all stakeholders could agree on such a plan, and the capital cost could be provided.

3.3 Energy Use in Toronto

The total energy consumed by Torontonians in their homes, buildings, and industrial facilities in 2006 was 69,000 GWh/yr.

As can be seen from the chart in section 3.2, energy is supplied to Toronto from five main sources:[16]

- Electricity, from Toronto Hydro;
- Natural Gas, from Enbridge;
- Steam and Deep Lake Water Cooling for heating and cooling downtown buildings respectively, from Enwave; and
- Fuel oil for heating, from a variety of local fuel oil distributors.

In the next section, energy use for each of these sources of energy is examined. As steam and Deep Lake Water Cooling are both supplied by Enwave, they are examined together.

Electricity

Information relating to the electricity provided by Toronto Hydro in Toronto was obtained from publicly available sources. This information includes information on consumption (as measured at the customers' meters), demand, rate classifications, and number of customers, and is the source of data for the figures and tables within this section.

The Toronto Hydro rate classifications are as follows:

- **Residential:** for individually metered residential premises;
- **General Service:** for non-residential customers having a monthly demand on any single property of 4,999 kW or less; and
- **Large User:** for customers having a monthly demand on any single property of 5,000 kW or greater.

The General Service rate classification is further broken down in to less than 50 kW; 50kW up to 999 kW; 1,000 kW to 4,999 kW, and for the middle category (50kW to 999kW), it is further broken down by whether the customer has an interval meter or not. All accounts with electric demand greater than 1000kW have an interval meter installed to measure electricity use. Unfortunately, there is no consumption or demand data provided in publicly available sources for these additional categories. Requests to Toronto Hydro for these types of data were not fulfilled.

Table 3-1 summarizes the consumption and summer peak demand for Toronto Hydro from 2003 to 2006.

[16] In addition, there is a small amount of renewable energy. Appendix C contains additional information on energy use in Toronto.

Table 3-1: Toronto Hydro Consumption and Peak Demand

Year	Consumption, MWh/yr			Peak Demand,
Rate	Residential	General Service	Large User	MW
2002	5,625,643	17,696,376	2,855,001	4,864
2003	5,407,809	17,626,782	2,569,929	4,914
2004	5,412,022	17,502,460	2,593,568	4,521
2005	5,724,299	18,084,770	2,563,100	5,005
2006	5,351,747	17,583,280	2,592,278	5,000

Table 3-2 shows the number of accounts within each rate class. The number of accounts in each rate category rose over the timeframe reviewed. It should be noted that an account is equivalent to a meter, except for those few cases where a single building has more than one meter, or where there is more than one building on a single property. Each of these cases is treated as a single account by agreement between the customer and Toronto Hydro.

Table 3-2: Toronto Hydro Accounts by Rate Classification

Year	No. of Accounts		
Rate	Residential	General Service	Large User
2002	586,714	78,177	46
2003	590,109	78,517	47
2004	594,976	78,150	47
2005	597,469	79,163	47
2006	599,080	78,980	49

Note that Table 3-3 shows the consumption per account by rate classification, in MWh/year for residential and general service, and GWh/year for large users. It is interesting to note that the trend is towards lower consumption per account in all rate classifications, although 2005 reversed that trend for one year.

Table 3-3: Toronto Hydro Consumption per Account

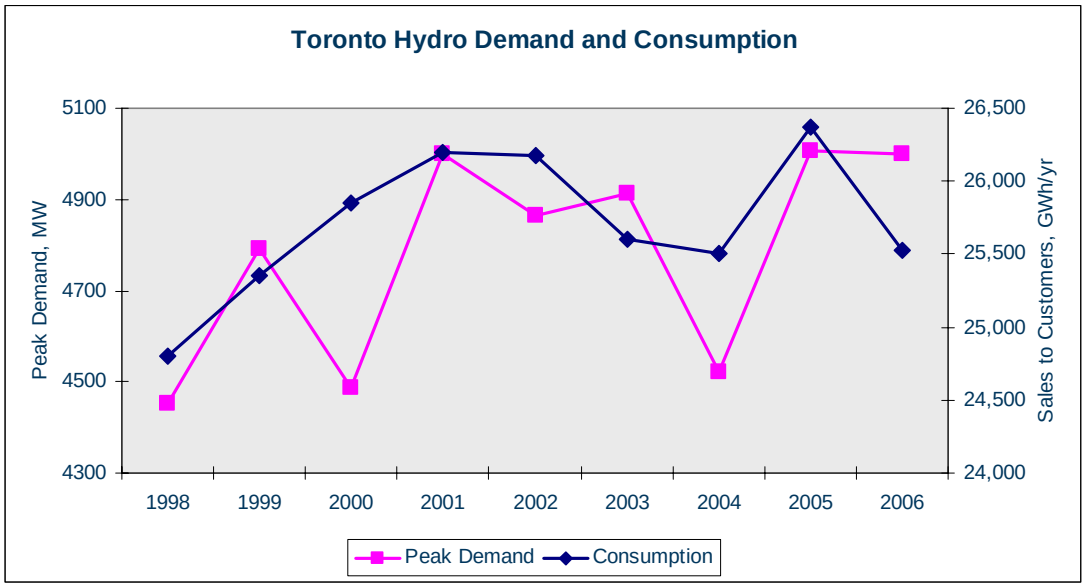
Year	Consumption per Account		
Rate	Residential	General Service	Large User
2002	9.59	226.36	22.64
2003	9.16	224.50	22.45
2004	9.10	223.96	22.40
2005	9.58	228.45	22.84
2006	8.93	222.63	22.26

Electricity consumption for Toronto Hydro is the sum of all the electricity delivered to its account holders throughout the year.[17] Peak demand, on the other hand, is measured during only one hour throughout the year, and almost always occurs in July. Both consumption and peak demand are presented in Figure 3-5. Note there is not a direct relationship between the peak demand and consumption. Peak demand is very dependent on the summer weather,

[17] Note that there are other loads that are not included in the totals, such as street lighting.

due mainly to the cooling load, which is often linked to a large extent, with the summer peak for the system, and therefore a significant contributor to the size of the peak.

Figure 3-5: Annual Consumption and Peak Demand



Natural Gas

Enbridge provided actual natural gas consumption by rate category within the City of Toronto for 2005 and 2006, and projected consumption for 2007[18]. This is summarized below in Table 3-4. Note that the forecast suggests lower consumption than in 2005 in all categories, although the consumption is still expected to be greater than 2006.

Table 3-4: Natural Gas Consumption in Toronto

Year	Consumption, m^3/yr					Consumption, GWh/yr
Rate	Low-Rise Residential	Apartment	Commercial	Industrial	Total	Total
2005	1,457,065,204	867,781,332	1,324,987,350	748,639,125	4,398,473,011	45,502
2006	1,322,326,792	829,040,476	1,234,880,300	688,541,544	4,074,789,112	42,154
2007	1,352,572,109	850,525,207	1,266,272,324	735,164,585	4,204,534,225	43,496

Information on the number of accounts was not provided by Enbridge.

Steam and Deep Lake Water Cooling

Enwave supplies steam and chilled water to buildings in downtown Toronto, but not necessarily both energy types to the same buildings.

[18] This information is the source of data for the figures and tables within this section.

The steam is derived from natural gas-fired boilers, although their interruptible gas contract requires that they change to fuel oil whenever there is a request from Enbridge to curtail their natural gas use. This has occurred for less than twenty four hours during recent winters. Within the Enbridge rate categories, Enwave is classed as Industrial.

The chilled water, described as DLWC, is derived mainly from the bottom of Lake Ontario. This water passes through a heat exchanger before it is passed to the City water system, where it absorbs heat from the Enwave system. It is further cooled by mechanical chillers to reduce the delivery temperature, before being distributed to the Enwave cooling customers. The mechanical chillers include 2 - 4700 ton steam turbine driven centrifugal chillers and 2 – 2000 ton electric centrifugal chillers. This combination provides maximum flexibility, permitting Enwave to use the lowest cost energy source for their cooling plant. For this and other reasons, the electric chillers are never operated during peak periods. The overall impact on electrical summer peak demand of the DWLC system, including all pumps and auxiliaries, is 0.12 kW/ton. This compares to a conventional chiller plant including heat rejection that operates in the range of 0.8 to 1.0 kW/ton.

Table 3-5[19] shows a summary of Enwave's supply by customer type. The heating energy is based on 2006, and the DLWC is based on projected full capacity when the system is fully operational.

Table 3-5: Enwave Energy Supply by Customer Type

Sector	Heating Output, MWh/yr	Cooling (Equivalent Energy Input), MWh/yr
Office	450,396	82,977
Institutional	258,424	10,372
Multi-unit Residential	29,534	
Accommodation		10,372

Note that the energy presented for deep lake water cooling is equivalent to the amount of electricity that would have been required to provide the same amount of cooling effect if it had been provided by a cooling plant powered by electricity.

Fuel Oil

Fuel oil is distributed in Toronto by fuel oil distributors who are either divisions of major oil companies or independents. Based on an industry estimate, total fuel oil deliveries are approximately 80,000,000 L/yr (89,100 MWh/yr). This is mainly for the Low-Rise Residential market.

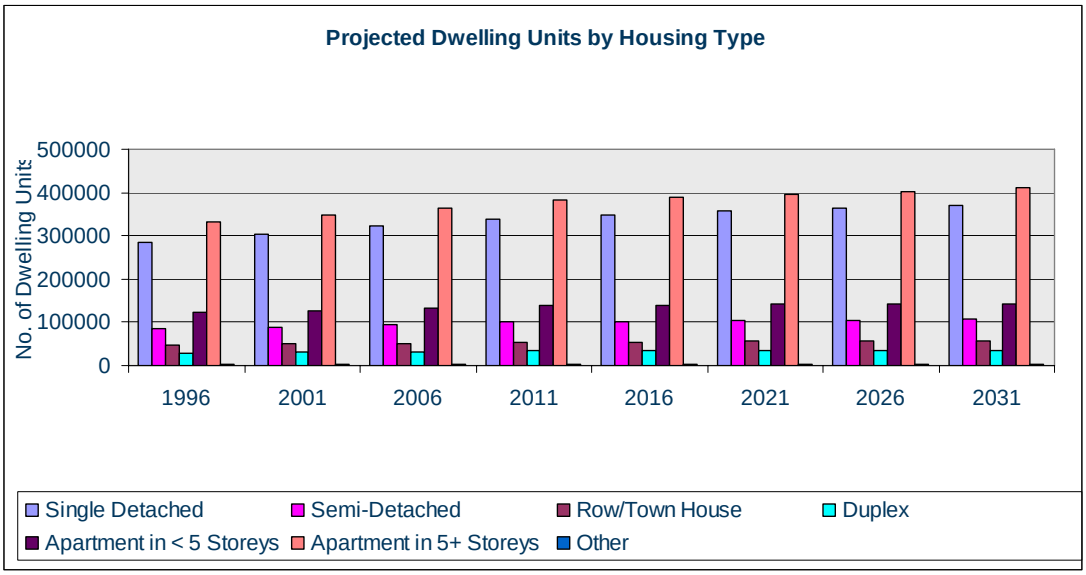
[19] Information has been obtained from Enwave and is publicly available.

3.4 Impact of Growth in Toronto

Dwelling Unit Projections[20]

The City of Toronto Economic Development Department has provided a forecast of growth in dwelling units by housing type. The forecast is presented in Figure 3-6.

Figure 3-6: Projected Dwelling Units by Housing Type

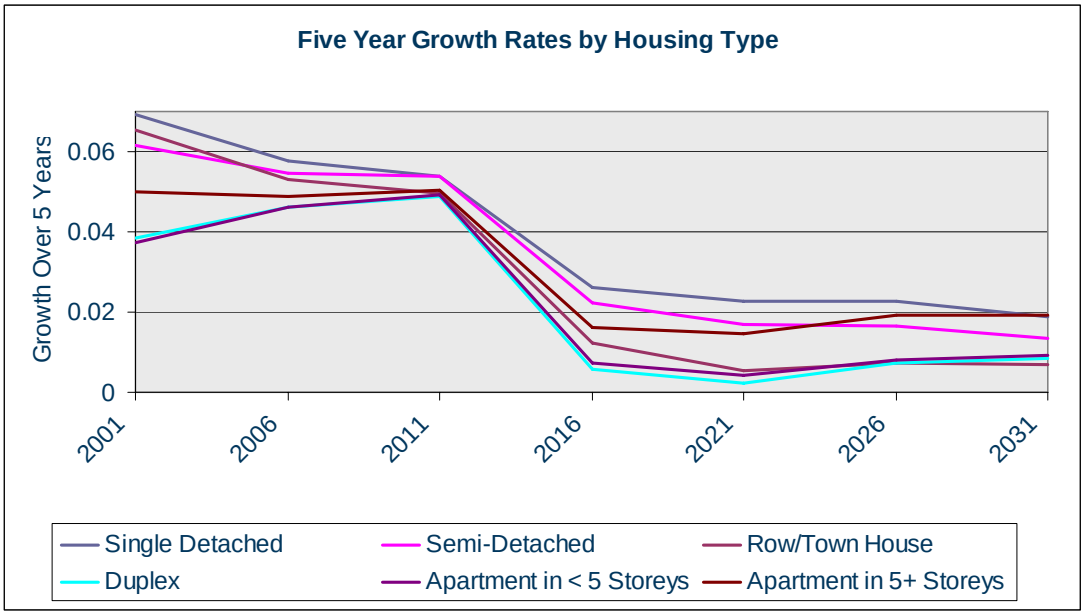


Overall, the number of dwelling units in the City is expected to grow from 903,235 in 1996 to 1,127,843 in 2031, a total increase of 24.8percent over 35 years.

Growth by dwelling unit type for each 5 year period is presented in Figure 3-7. Note that the "Other" category is not included due to its very small size.

[20] *Flashforward: Projecting Population and Employment to 2031 in a Mature Urban Area, Addendum.* July 2006. Toronto City Planning, Policy and Research

Figure 3-7: Growth in Dwelling Units by Housing Type



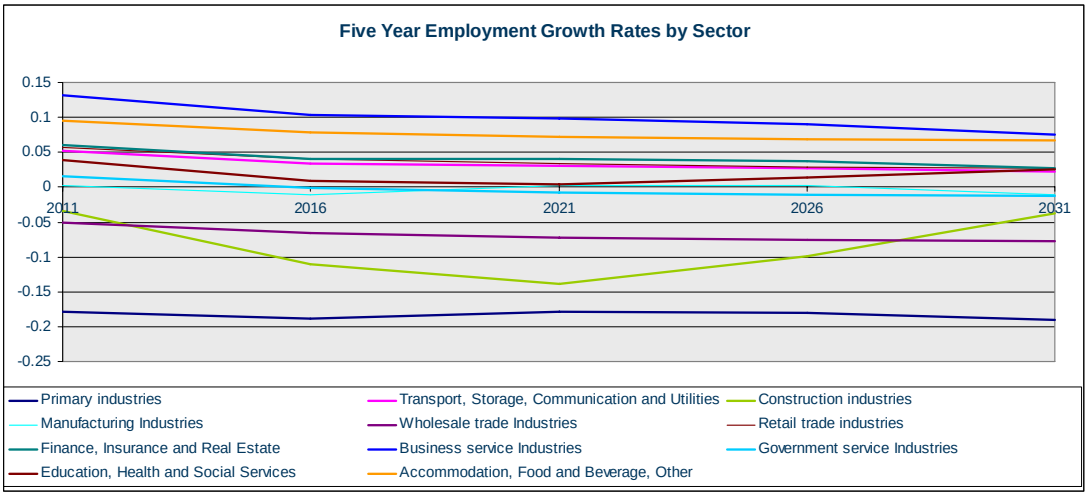
Growth in dwelling units in the single-detached housing sub-sector is expected to exceed all other types throughout the period, while dwelling unit growth in apartment buildings over five stories will start to exceed most other housing types commencing in 2021.

Buildings

The City of Toronto[21] has projected the growth for each five year period in the labour force by economic sector from 2006 up to 2031. This is presented in Figure 3-8.

[21] *Flashforward: Projecting Population and Employment to 2031 in a Mature Urban Area*. 2002

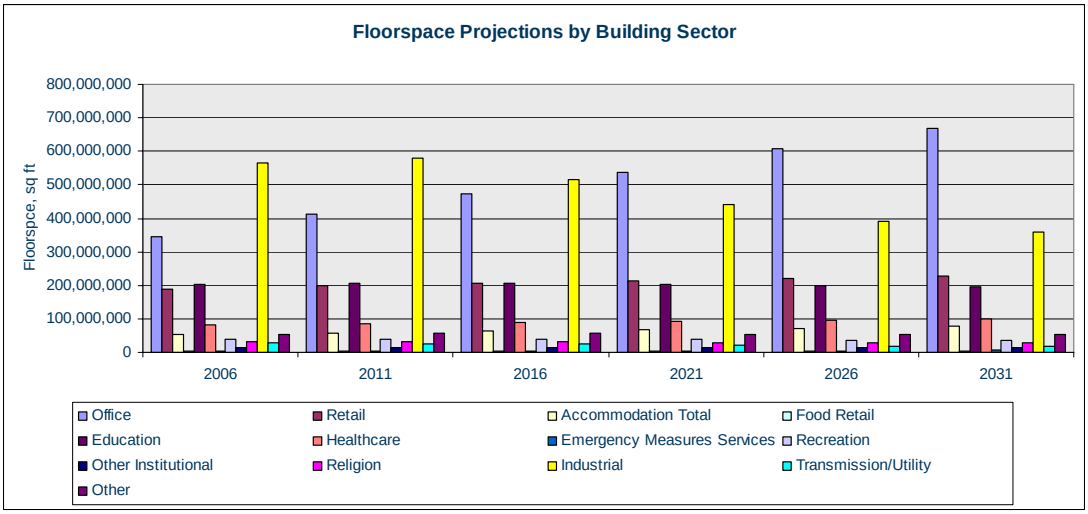
Figure 3-8: Five Year Employment Growth Rates by Economic Sector



Primary Industries and Wholesale Trade Industries are expected to experience negative growth throughout the period, while Construction Industries are expected to experience increasing negative growth until 2021, and a reduced negative growth rate during the decade following. Manufacturing Industries, Government Service Industries and Education, Health and Social Services remain relatively stable, while all others will have a positive growth rate throughout the period.

The City of Toronto has also provided an estimate of building floorspace by building type as of 2005. By combining the building floorspace with the labour force projections, the growth in building floorspace for each building type has been estimated. This is presented in Figure 3-9.

Figure 3-9: Floorspace Projections by Building Type



It is projected that significant growth will occur in the Commercial Office and Accommodation sectors, while the Industrial sector will experience negative growth throughout the period.

3.5 Toronto's Climate

At the end of each decade, Environment Canada publishes information for Toronto and other Canadian locations summarizing and describing the average climatic conditions. The most recent period is 1971 to 2000. This information is summarized in Table 3-6.

Table 3-6: Toronto Climate Averages[22]

Toronto Climate Averages, 1971 - 2000	
Temperature, ^{0}C	
Daily Maximum (July)	26.4
Daily Minimum (January)	-7.3
Extreme Maximum (July, 1938)	40.6
Extreme Minimum (January, 1859)	-32.8
Precipitation, mm	
Annual Rainfall	710
Annual Snowfall	1,331
Degree Days	
Heating Degree-Days, <18^{0}C	3,570
Cooling Degree Days, >18^{0}C	359
Sunshine	
Total Hours	2038
Days with Measurable Sunshine	303
Per Cent of Possible Hours	43.8

The maximum temperature is the highest temperature recorded in a twenty-four hour period ending in the morning of the next day. The minimum values are for a period of the same length, beginning in the evening of the previous day. Precipitation measurements are usually made four times daily at principal stations. Rainfall, snowfall and precipitation amounts represent the average accumulation for a given month or year.

Degree-days for a given day represent the number of Celsius degrees that the mean temperature is above or below a given baseline. Heating degree-days are the number of degrees below 18° C, while values above 18° C are used primarily to estimate the cooling requirements of buildings.

The amount of potential for solar photovoltaic systems using a collector tilted at an angle equal to the latitude (43° 40' N) minus 15° is estimated by NRCan to be 1173 kWh/kW.[23]

[22] http://www.climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html
[23] https://glfc.cfsnet.nfis.org/mapserver/pv/municip.php?n=1752&NEK=e

This is consistent with the projection of 121,000 kWh/year for the 100 kW solar PV array at Exhibition Place.

The Canadian Wind Energy Atlas[24] suggests that the Toronto area may not be a good location for wind turbines, having a mean wind speed over land of 3 to 6 m/s. This is consistent with the experience of the wind turbine at Exhibition Place, which has operated at a load factor of only 20.5 percent, compared to an economic load factor for planning a wind turbine farm of 30 percent. Wind farms out in Lake Ontario would experience significantly higher wind velocities.

Climate Change Impacts

In February 2007, the United Nations Intergovernmental Panel on Climate Change ("IPCC"), Working Group I, "The Physical Science Basis" released a study that included the following statements:[25]

> *"Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years. The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land use change, while those of methane and nitrous oxide are primarily due to agriculture."*
>
> *"For the next two decades, a warming of about 0.2°C per decade is projected for a range of SRES emission scenarios. Even if the concentrations of all greenhouse gases and aerosols had been kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected."*

This was the first time that the IPCC has been able to be more specific in the overall projections of the rate of surface temperature rise, as they were adjusted to match measured temperature change.

In April, 2007, IPCC Working Group II, "Impacts, Adaptation and Vulnerability" released its report, which included the following statements for North American cities:[26]

> *"Cities that currently experience heat waves are expected to be further challenged by an increased number, intensity and duration of heat waves during the course of the century, with potential for adverse health impacts. Elderly populations are most at risk."*

The report showed that temperatures in the Toronto area have risen from 0.2 to 1°C during the period from 1970 to 2004, and that physical systems have also been affected.

At the seventh Conference of the Parties to the United Nations Framework Convention on Climate Change ("UNFCCC"), a map was presented that provided a projection of temperature rise throughout the world from 1990 to the period between 2071 and 2100. In particular, the projected temperature rise for Toronto was shown as between 4° and 6°C.

[24] http://www.windatlas.ca/en/maps.php
[25] http://www.ipcc.ch/
[26] Source: http://www.ipcc.ch/SPM13apr07.pdf

In May 2007, Working Group III, "Mitigation of Climate Change," released its report, which included the following statement:[27]

> *"Both bottom-up and top-down studies indicate that there is substantial economic potential for the mitigation of global GHG emissions over the coming decades, that could offset the projected growth of global emissions or reduce emissions below current levels."*

This report recommends a broad range of economically viable steps to mitigate climate change. The recommendations specific to Toronto are as follows:

> *"Energy efficiency options for new and existing buildings could considerably reduce CO_2 emissions with net economic benefit. Many barriers exist against tapping this potential, but there are also large co-benefits.*
>
> - *By 2030, about 30percent of the projected GHG emissions in the building sector can be avoided with net economic benefit.*
> - *Energy efficient buildings, while limiting the growth of CO_2 emissions, can also improve indoor and outdoor air quality, improve social welfare and enhance energy security.*
> - *Opportunities for realising GHG reductions in the building sector exist worldwide. However, multiple barriers make it difficult to realise this potential. These barriers include availability of technology, financing, poverty, higher costs of reliable information, limitations inherent in building designs and an appropriate portfolio of policies and programs.*
> - *The magnitude of the above barriers is higher in the developing countries and this makes it more difficult for them to achieve the GHG reduction potential of the building sector."*

This report further defines selected policies, measures, and instruments that have shown to be environmentally effective in at least a number of national instances. These policies are summarized in Table 3-7, which shows the level of government responsible for the policy, measure or instrument.

Table 3-7: Environmentally Effective Policies, Measures, and Instruments

Sector	Policies, measures and instruments shown to be environmentally effective	Key constraints or opportunities
Buildings	Appliance standards and labelling	Periodic revision of standards needed
	Building codes and certification Attractive for new buildings.	Enforcement can be difficult
	Demand-side management programmes	Need for regulations so that utilities may profit
	Public sector leadership programmes, including procurement	Government purchasing can expand demand for energy efficient products

[27] Source: http://www.ipcc.ch/SPM040507.pdf

Sector	Policies, measures and instruments shown to be environmentally effective	Key constraints or opportunities
	Incentives for energy service companies (ESCOs)	Success factor: Access to third party financing
Industry	Provision of benchmark information	May be appropriate to stimulate technology uptake. Stability of national policy important in view of international competitiveness
	Performance standards	
	Subsidies, tax credits	
	Tradable permits	Predictable allocation mechanisms and stable price signals important for investments
	Voluntary agreements	Success factors include: clear targets, a baseline scenario, third party involvement in design and review and formal provisions of monitoring, close cooperation between government and industry.
Responsibility	Federal Government	(The federal government has provided benchmark information and performance standards to some industrial segments for at least 15 years.)
	Joint Federal/Provincial Government	(Both the federal and provincial governments have Energy Acts that regulate product efficiency. The federal government has used voluntary agreements in the past.)
	Provincial Government	(Ontario currently has an emissions trading regulation that does not include GHGs)
	Joint Provincial/Municipal Government	(Building codes are mandated by the province, but enforced by the municipality. The City delivers DSM programs both directly, and through Toronto Hydro, but the province regulates)
	Municipal Government	(The City operates the Better Buildings Partnership and the Better Buildings New Construction programs)

Urban Heat Island Effect

On hot summer days, cities can be up to 4.5°C hotter than their suburban and rural surroundings. This phenomenon occurs because urban development results in large amounts of paved and dark coloured surfaces (e.g., roofs, roads, parking lots, etc.), that absorb the sun's heat, causing the surface and ambient air temperature to rise.[28]

The Urban Heat Island ("UHI") Effect can adversely impact a city's public health, air quality, energy demand, and infrastructure costs.

Mitigating Urban Heat Islands is a simple way to decrease the risk to public health during heat waves, while also reducing energy use, the emissions that contribute to global warming, and the conditions that cause smog.

The following recommendations have been proposed by the International Council on Local Environmental Initiatives ("ICLEI") to reduce UHI:[29]

- **Use Reflective Roofing Materials:** Reflectivity can range from a low of 3 percent for black shingles to 80 percent for white roofing materials.
- **Green Roofs with Vegetation or Roof-Top Gardens:** Plant vegetation on a roof cools it significantly, while combining energy savings with aesthetic and ecological goals.
- **Use Reflective or Other Cool Paving Materials:** Pavement engineering studies have demonstrated that increasing pavement reflectivity with reflective or cool paving materials like portland and flyash cement concrete, porous concrete, chip-seals, turf-block or porous pavers, and light-coloured asphalt emulsion sealcoats. These materials can lower pavement surface and ambient air temperatures by increasing the percentage of solar radiation that is bounced back into the atmosphere.[30]
- **Shade Parking Lots:** Studies have demonstrated that increasing tree cover in parking lots from 8 percent to 50 percent reduces evaporation of hydrocarbons from car fuel tanks and also reduces NOx emissions from car start-ups.[31]
- **Strategically Select and Site Trees:** Trees that are placed on the west-, northwest-, and east-facing sides of buildings can significantly reduce cooling costs for a typical home or low-rise building during peak summertime demand. Planting deciduous rather than evergreen trees will shade buildings in the summer-time, while allowing the sun to warm them in the winter.
- **Preserve and Plant More Trees:** Preserving and increasing urban tree canopies throughout the community have been demonstrated to decrease summertime electric bills.
- **De-Pave School Yards:** Replacing asphalt playgrounds with green spaces provides children with interesting, safe, and cooler places to play at school.

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[28] ICLEI. http://www.hotcities.org/#anchor706126
[29] Note, that not all recommendations will have the same impact if implemented in Toronto due to factors such as climate, amount of solar radiation, etc.
[30] Ting et al, 2000.
[31] Scott et al, 1999

3.6 Barriers to Implementation

The issue of barriers to energy efficiency and renewable energy projects is well understood and documented. Good program designs seek to first identify the various barriers and then apply market mechanisms or interventions specifically designed to overcome those barriers. In the most simplistic form, a single barrier such as lack of capital is addressed by a single mechanism such as an incentive. In reality, there is usually more than one barrier that a program needs to consider, resulting in more complex program designs.

It is documented in the energy efficiency literature[32] that there is an "efficiency gap" between the levels of investment in energy efficiency that appear to be cost effective based on engineering-economic analysis and the low levels of investment that are actually occurring. The reason for this efficiency gap is generically blamed on market barriers, market failures, and a number of other barriers that have been characterized.

In many cases, more than one barrier may be at play for any given energy efficient or renewable energy investment opportunity. The major barriers that have been cited in the literature include:

- **High information or search costs.** Familiar technologies require minimal investments of time. However, consideration of new technologies may require a significant investment in time to identify energy efficient and renewable energy products and services and/or to learn about related practices.
- **Accounting/funding practices.** Some building sectors are discouraged from lowering energy use because of the nature of their funding arrangements. For example, when funding for operations is based on the previous year, any reduction in operating costs in the current year results in a reduction in the budget for next year.
- **Performance uncertainties.** Familiar technologies have withstood the test of time; they have well known performance characteristics and generally perform well. However, new technologies introduce uncertainties and may lead to problems: for example, early failures of electronic ballasts for energy efficiency fluorescent lighting and leaks in high-tech roofs (i.e., Terminal 3 at Toronto's Pearson Airport). Fear of technology failure is often cited as a critical factor in a decision whether or not to adopt a new technology. The cost of this barrier is the value of resources spent to evaluate the benefits of energy efficiency investments and activities.
- **Transaction costs.** Distribution of new energy efficiency products tends to be limited until demand is firmly established. For example, many high efficiency lighting fixtures are not generally available outside major urban centres. Using new technologies may require additional time, materials, and labour in order to obtain or to apply them.
- **Financing.** The financing barrier refers to significant restrictions on the availability of capital to potential borrowers or to the higher cost of financing (for example, higher interest rates). Some borrowers, for example low-income individuals and small business owners, are frequently unable to borrow at any price as a result of their

[32] See for example: Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency, Golove, B. and J. Eto. LBL-38059. March 1996

economic status or “credit-worthiness.” This potential lack of access to capital can inhibit investments in energy efficiency by these classes of consumers. Home mortgages also provide an interesting example of the financing barrier. Mortgage qualifications, although purportedly designed to match the ability of the borrower to repay the loan with the loan payback requirements, typically do not consider the operating costs of the home being purchased, despite the impact such costs have on the total cash flow of the homeowner. Further repayment terms may not match with the realized utility savings resulting in a mismatch in cash flow.

- **Rules of thumb.** Existing rules of thumb, used by building designers and others limit the focus or scope of factors considered when selecting a technology. For example, office building designers frequently use an allowance such as 1.5 W/square foot for lighting. The design process simply specifies that much lighting, failing to examine energy efficiency or other options to lower that level.
- **Organizational practices or custom.** Organizations budget and operate buildings according to an established practice that typically changes only incrementally. This often leads to owners sustaining high operating costs rather than investing in energy efficiency equipment and/or practices to reduce those costs.
- **Misplaced or split incentives.** Misplaced or split incentives are transactions or exchanges where the economic benefits of energy conservation do not accrue to the person who is trying to conserve. The terms have been used to describe certain classes of relationships, primarily in the real estate industry between landlords and tenants with respect to acquisition of energy efficient equipment for rental property. When the tenant is responsible for the energy/utility bills, it is in the landlord’s interest to provide least-first-cost equipment rather than more efficient equipment for a given level of desired service. There are little or no incentives for a landlord to increase his or her own expense to acquire energy efficient equipment (e.g., refrigerators, heaters, light bulbs, etc.) because the landlord does not bear the burden of the operating costs and will not reap the benefits of reducing those costs.
- **Asymmetric information.** While some participants in a decision making process may have full information on energy efficiency or renewable energy alternatives, others likely do not and, as a result, may not support those alternatives. For example, building designers may understand and recommend energy efficient equipment for new buildings, but an owner who is less familiar with the benefits may remain unconvinced. This barrier also applies to the skills of participants. For example, an owner may ask the designer to do a whole building energy/resource simulation but the designer does not have the training and background required to carry out the analysis. Similarly, a building manager may not have the skills required to use the capabilities of a sophisticated control system.
- **Inseparability of product features.** While the energy efficiency features of a product may be appealing, the product may be rejected because of other characteristics. For example, available compact fluorescent lights do not fit many fixtures and cannot be dimmed, and high pressure sodium lamps are very efficient but produce yellow light that is unattractive in some applications. These other limiting characteristics negatively impact the uptake of these energy efficient products.
- **Externalities.** When the private price charged is less than full costs imposed on society, the difference is called an externality. For example, the cost of greenhouse gas (“GHG”) emissions is not reflected in the market price of fuels. This is one underlying reason why the cost of "green power" is currently higher than "non-green" power.

- **Regulation and related energy pricing.** The regulation barrier refers to mis-pricing energy forms (e.g., electricity, natural gas, etc.), whose price is set administratively by regulatory bodies. These procedures and the cost structure of industries typically results in different prices depending on whether they are set based on average costs (i.e., the regulated price) or marginal costs (i.e., the market price). Historically, the price of electricity as set by regulators is below the marginal cost to produce the electricity. This is still likely the case in Ontario in spite of the provincial government's recent efforts to pass on the true cost of power to consumers. As a result, consumers are not sent the appropriate price signals, leading them to under-invest in energy efficiency and renewable energy solutions.

In the review of current energy efficient programs, where barriers being addressed were identified,[33] the two most prevalent barriers were found to be high information or search costs and organizational practices or custom, followed by performance uncertainties, transaction costs, and asymmetric information.

Measuring the incidence of barriers, how often they exist, and the extent to which they impede selection of cost-effective energy efficient solutions, has never been attempted to the best of our knowledge. One indicator of the relative incidence of barriers is the number of energy efficient programs that are designed to overcome particular barriers.

[33] The identification of barriers was typically not well defined within programs reviewed. Therefore, barriers were assigned based upon our understanding of the program design.

4 Energy Forecasts

This section outlines the energy forecast scenarios produced as a part of this report to inform the development of the Energy Plan for Toronto. The recommendations contained later in this report are made based on these projections.

4.1 Basis for Projections

The calculation of current and projected non-transportation energy use in Toronto from 2006 to 2031 required the development of two models: one for the residential sector, and one for the combined institutional, commercial and industrial sectors ("ICI"). The model for the residential sector included six different building types, and the model for the ICI sector included twenty different building types. Building types were additionally separated between new and existing.

Each model incorporates the data and evaluation methods described in Appendix C. Two scenarios were developed and are explained below:

1. The **Business As Usual ("BAU")** case is defined as the sum of the impact of floorspace additions, replacement or retrofit of energy components and systems in existing buildings, and minimum efficiency regulations that is expected to occur over the planning timeframe.
2. The **Energy Efficient ("EE")** case is defined as the acceleration in the uptake of new technologies and techniques for both new and existing buildings that can be achieved through programs that provide information and/or incentives.

The approach taken to quantify the breakdown of current annual energy consumption in the City followed included the following steps:

1. Account for and quantify the material energy inputs to the City for the base year (2006).
2. Obtain the total floor space of all building types from the City, including low-rise residential, multi-unit residential, commercial, institutional and industrial.
3. Allocate the energy use by energy type to each building type or segment using known energy archetypes for each building type.
4. Adjust segment energy use to match total energy use.

The projections for the **Business As Usual** case were prepared from the analysis of current energy use using the following approach:

1. Obtain five-year projected dwelling unit estimates from the City by residential building type.
2. Obtain five-year projected labour force estimates from the City, and use these to prepare five-year floorspace estimates by ICI segment.
3. Review the known impact of the Ontario Building Code ("OBC") on energy efficiency in each building sector from 1990 to 2016, and project the estimated impact from that point forward.
4. Separate new building additions in five-year increments from existing buildings for each building type, and consider these separately.

5. From the estimates of current use by sector, project energy use forward for each building sector, taking into account changes in floorspace and changes in energy end-uses by new building archetype resulting from the impact of OBC.

The projections for the **Energy Efficient** case were prepared from the Business As Usual case using the following steps:

1. Review past and current energy efficiency programs offered for building energy retrofits by sector, and determine their estimated impact.
2. Review proposed and anticipated new energy technologies and programs for both new and existing buildings and estimate their impact, including the potential savings available from each technology, the amount of incremental savings designed into each program, and the rate of uptake of both, over the planning time frame by building sector and age.
3. Adjust the BAU case for each five-year increment to evaluate the impact of new technologies and programs.

4.2 Summary of Findings

The growth in dwelling units and building floorspace represents a key influence on future energy use in the City from two viewpoints:

- New buildings that add to the total building stock (i.e., either through development of brown or green space) increase the total energy demand, although at a lower rate than the existing building stock.
- New buildings that replace existing buildings may or may not increase energy use, depending upon the size and energy use characteristics of the new building versus the replaced building.

Over time, new and recently added buildings will form an increasing share of the total building stock and, as a result, the overall energy intensity will decrease. Existing buildings will also become more efficient as newer technologies are adopted. Provided that the overall energy intensity decreases faster than the addition of new floorspace, overall energy use will also decrease.

The projections for the residential sector for electricity and natural gas are presented in Figures 4-1 and 4-2, respectively. In spite of the growth in the number of dwelling units, improvements in appliance and equipment efficiency, in addition to the trend toward new houses which are more energy efficient, is expected to result in a reduction in overall energy use in the BAU case. Accelerating the adoption of energy efficient technologies, both existing and yet to be introduced, is expected to increase savings for the EE case. Introducing and accelerating the adoption of renewable energy technologies is expected to result in greater reductions in conventional energy use.

Figure 4-1: Electricity Projections for Residential Sector Buildings

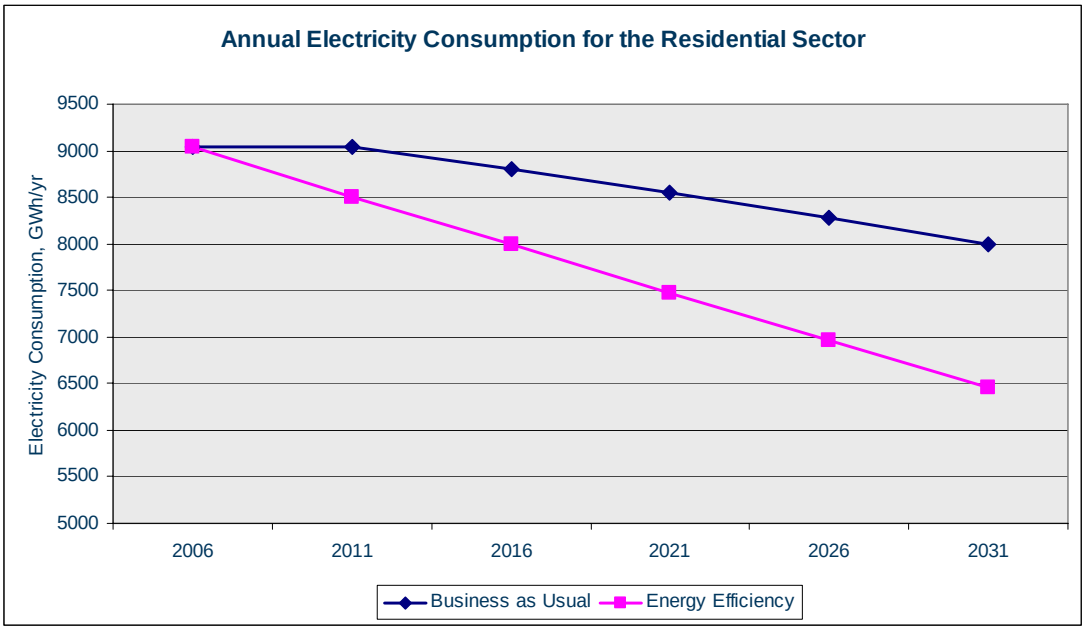
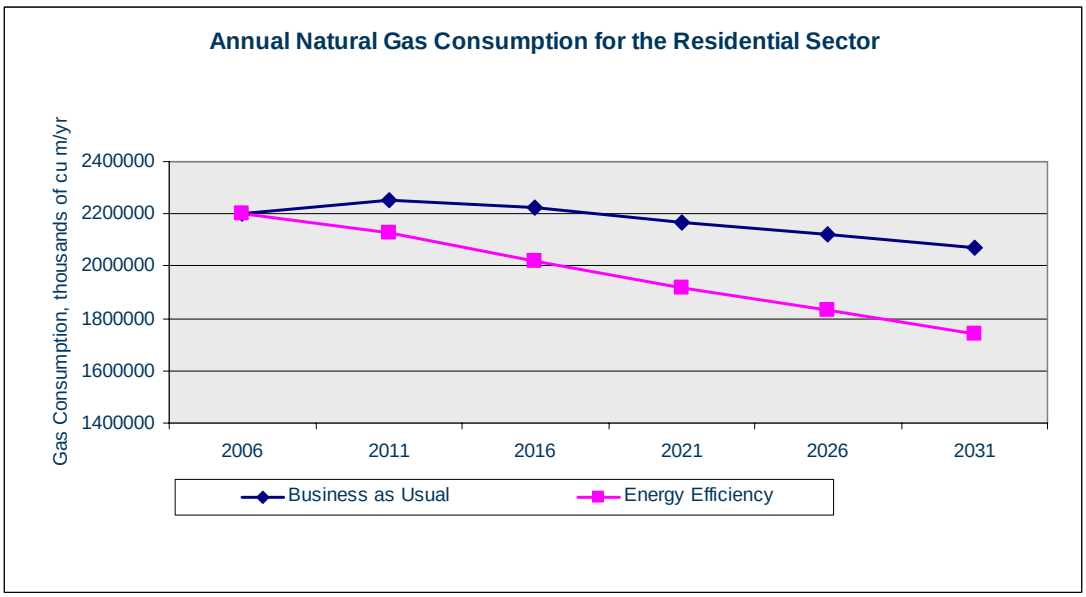


Figure 4-2: Natural Gas Projections for Residential Sector Buildings



The projections for the ICI sector are presented in Figures 4-3 and 4-4 for electricity and natural gas, respectively. For this sector, the anticipated growth in employment in many segments, and the resultant growth in building floorspace, exceeds the improvement in energy intensity. For some sectors (e.g., industrial, etc.), there is projected to be a steady reduction in floorspace, while for others (e.g., office, etc.) growth is projected to occur throughout the period. Office buildings have relatively high energy intensity, while buildings such as warehouses have a low intensity. The result is a projected increase in overall energy intensity over the near term.

Both electricity and natural gas are projected to increase over the period in the BAU case. By applying both leadership and programs, the City and its partners can change this to a net reduction in the Energy Efficient case. This would become a greater reduction through the adoption of renewable energy in this sector.

Figure 4-3: Electricity Projections for the ICI Sector

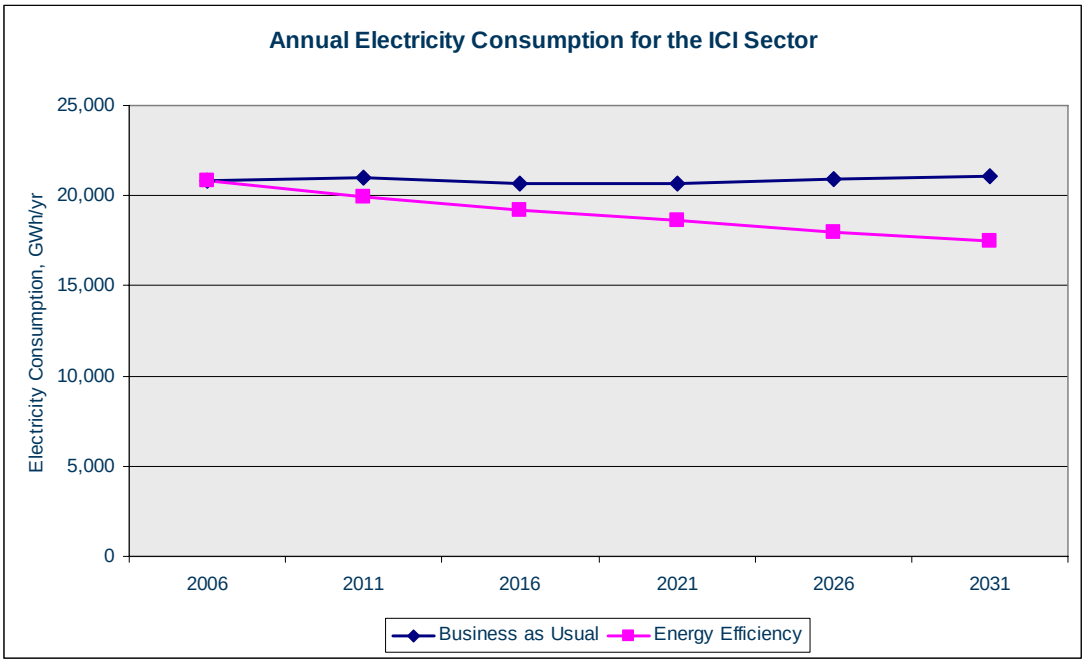
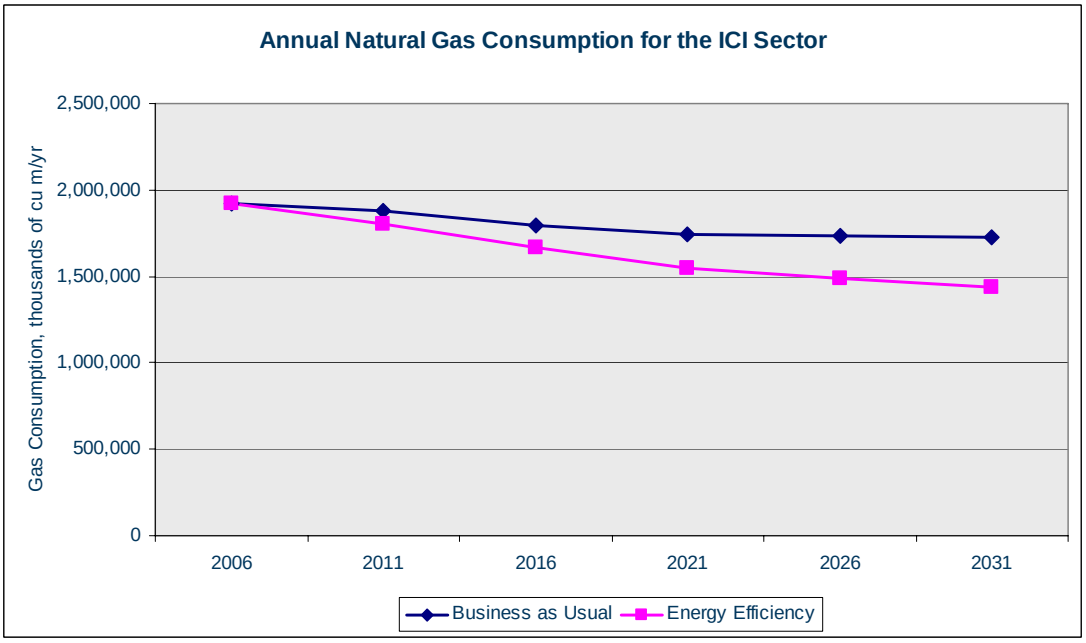


Figure 4-4: Natural Gas Projections for ICI Sector Buildings



4.3 Summer Peak Electricity Demand

The contribution of each sector to the summer peak demand experienced by the THESL system has also been evaluated. As this peak occurs for a limited number of hours each year, it is heavily influenced by the time of use of electricity within each sector and by the use of electricity for space cooling. As a result, the accuracy of these estimates does not approach that developed for the baseline energy uses, or even for the projections. In its IPSP Discussion Paper # 5, the OPA has projected an annual growth in peak demand for Toronto of 0.8 percent per annum between 2005 and 2010 and 1.2 percent per annum between 2010 and 2015.

Figure 4-5 presents an estimate of the share of current summer peak demand by sector.

Figure 4-5: Estimate of Summer Peak Demand Contribution by Sector

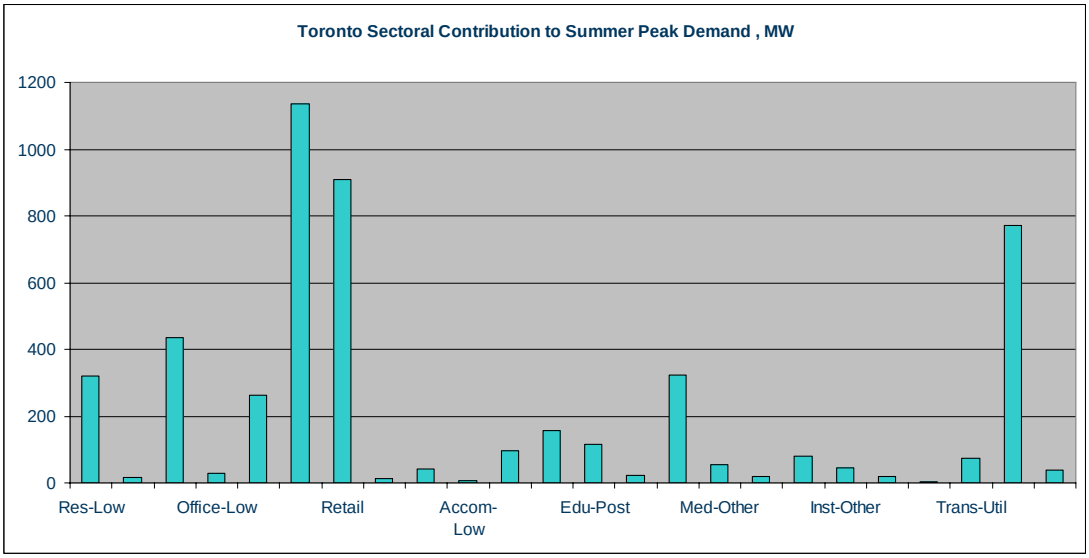
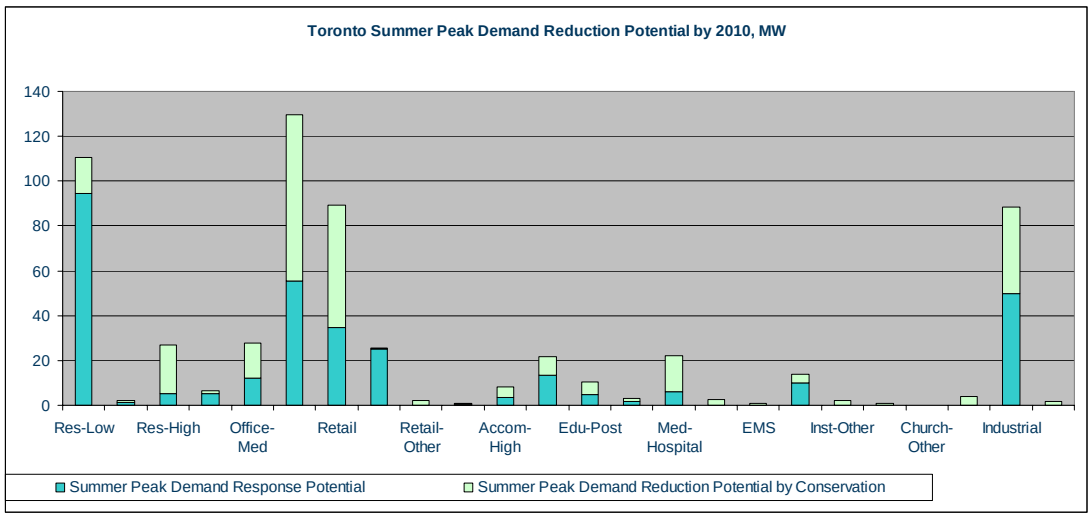


Figure 4-6 presents an estimate of the potential within each sector to reduce peak demand by 2010 through a combination of energy retrofits and demand response.

Figure 4-6: Estimate of Summer Peak Demand Reduction Potential by Sector



The demand reduction from peak demand response in the Low-Rise Residential sector is expected to come from a number of possible actions, including:

- Utility control of central air conditioners, either by raising the temperature set-point, or by cycling the condensing unit during peak periods
- Utility control of swimming pool pumps
- Utility control of other loads such as electric storage water heaters

Demand response in the ICI sector will result from actions, including:

- Peak shaving through the operation of standby generators
- Raising zone space temperature settings in pre-determined cycle
- Dimming or turning off lights that are not required during daytime
- Raising refrigeration temperature set-points during peak periods (food sales sector)

Energy retrofit measures that will result in a reduction of summer peak demand could include the following actions:

- Energy efficient lighting retrofits
- Energy efficient cooling plant retrofits
- Lighting controls such as daylight sensing in occupied spaces and occupancy sensors in unused or little-used spaces

4.4 Summary of Energy Projections by Sector

The energy projections by major sector for the Business As Usual case are summarized in Table 4-1. The energy intensities are averaged for each sector based on the segment analysis developed in the energy projection model. The percent reduction over the base year (2005) has been provided for 2010, 2015, and 2030, and is the net effect of floorspace increase or decrease during each five year period, improvements in energy efficiency mandated by codes and standards for new buildings, and retrofit measures implemented in existing buildings.

Table 4-1: Energy Projections for Business As Usual Case

Sector	Floor space %	Energy Intensity for 2005	Sector Energy Savings Over 2005 for BAU Case %		
		ekWh/ft^2/yr	2010	2015	2030
Office	11%	33.5	3.9%	7.9%	18.7%
Retail	6%	36.7	0.8%	2.4%	9.5%
Multi-Unit Residential	21%	25.1	3.3%	6.2%	17.4%
Low Rise Residential	27%	19.7	7.5%	10.8%	21.4%
Industrial	18%	26.6	4.1%	6.9%	9.9%
School	5%	19.0	3.6%	7.0%	17.4%
Colleges & Universities	1%	26.6	3.5%	6.9%	17.5%
Healthcare	3%	31.7	5.3%	9.6%	20.3%
Municipal	2%	28.4	3.6%	7.2%	18.2%
Other	2%	19.7	3.5%	6.8%	17.4%

The energy projections for the Energy Efficient case are presented in Table4-2. The % reduction for the Energy Efficient case over the Business As Usual case has been presented on a year over year basis. This increment represents the additional energy efficiency improvements that the City and its partners can implement for both new and existing buildings by accelerating the changes through codes and standards, and by increasing the rate of retrofit implementation in existing buildings.

Table 4-2: Energy Projections for Energy Efficiency Case

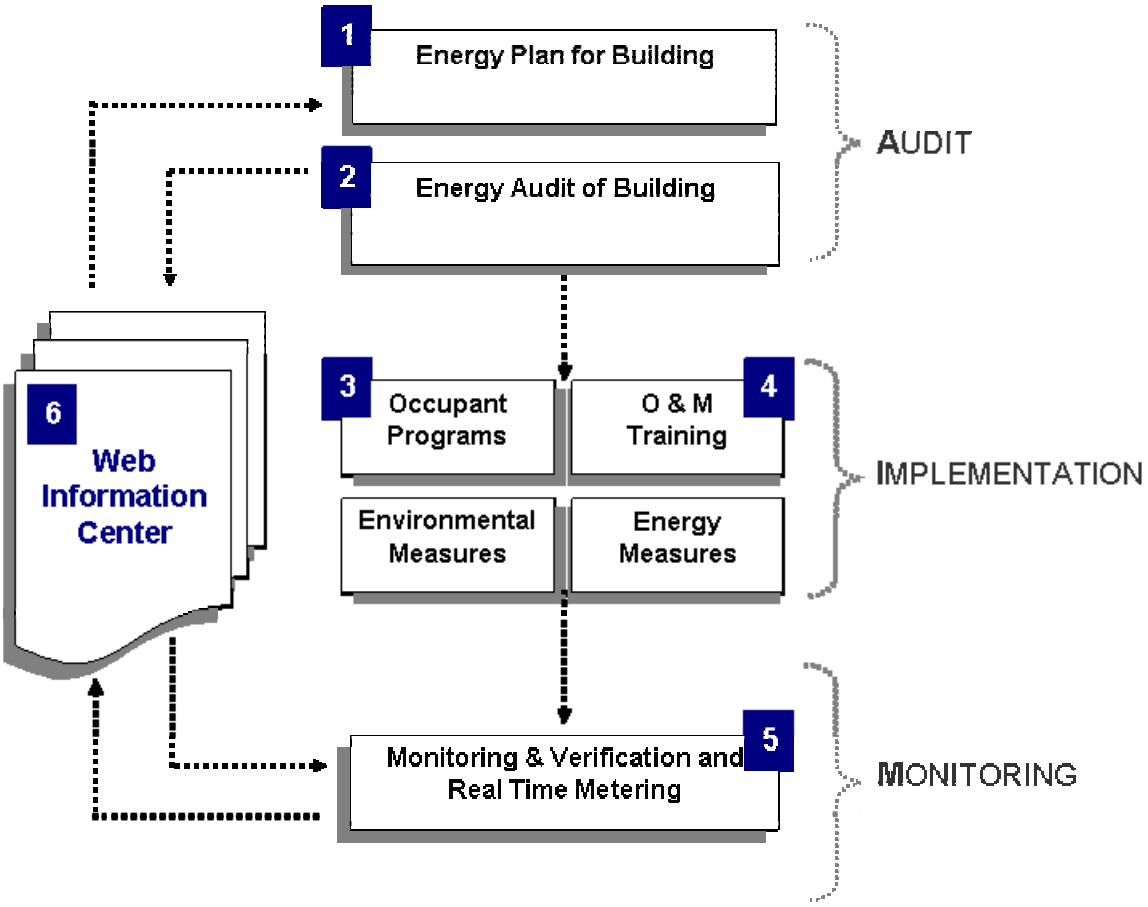
Sector	Floor space %	Energy Intensity for 2005	Sector Energy Savings, Energy Efficient Case Over BAU Case %		
		ekWh/ft^2/yr	2010	2015	2030
Office	11%	33.5	6.2%	7.0%	17.3%
Retail	6%	36.7	7.3%	11.6%	24.8%
Multi-Unit Residential	22%	25.1	5.2%	8.7%	16.5%
Low Rise Residential	27%	19.7	2.4%	5.6%	13.5%
Industrial	18%	26.6	4.2%	7.0%	17.0%
School	3%	19.0	4.4%	7.0%	17.0%
Colleges & Universities	3%	26.6	4.5%	7.1%	17.2%
Healthcare	3%	31.7	4.6%	6.9%	16.8%
Municipal	2%	28.4	4.5%	7.4%	17.9%
Other	5%	19.7	4.1%	6.8%	16.4%

5 A Sector-Based Energy Plan Framework

5.1 The Energy Plan Framework

The development of this report acknowledges that energy management is a process and not a suite of programs. This process can be illustrated by the Energy Plan Framework diagram in Figure 5-1.The Energy Plan Framework encompasses three phases: Audit, Implementation and Monitoring. This strategic process is intended to integrate a variety of business activities including programs, funding, measurement, and reporting. Specific program offerings (e.g., training, education, financial incentives, etc.) occur as part of the implementation phase of the strategic process.

Figure 5-1: Energy Plan Framework



The **Audit Phase** for a building begins with the development of an overall energy plan,[34] which sets out specific goals, targets, and approaches. The City's Energy Plan should include a process for undertaking energy audits within the building, definitions of acceptable energy efficiency measures, identification of potential funding sources to support these measures, and a monitoring protocol for measuring energy savings achieved by these measures. Individual building audits are conducted to determine current energy use by major end use, and potential upgrades to improve the energy efficiency of the building.

The **Implementation Phase** takes the output of the audit and defines the implementation of energy efficiency measures, the roles and responsibilities, the financial requirements, and the training/education required to make the suite of measures successful. Technological improvements alone will not produce the optimum savings. Training and education should be designed to meet the needs of both building occupants and building Operation & Maintenance ("O&M") personnel.

The **Monitoring Phase** provides the energy accounting and metering required to calculate energy savings as a result of the implemented measures. Energy accounting adjusts for a range of factors including weather variations and utility billing periods. The energy accounting may use utility bills (i.e., monthly data) or real time interval metering (i.e., hourly data).

The Energy Plan Framework is an iterative process with a feedback loop from the Monitoring phase to the Audit and Implementation phases to allow for continuous improvements to be made to the process as new information and lessons learned are acquired.

In addition to the process and program elements of the Energy Plan Framework, the Framework diagram depicts the use of web based technology to facilitate advanced communications. Typical energy management reporting would involve both energy accounting and engineering analysis. The use of web based tools allows for two-way communication with all stakeholders. Better communication among stakeholders can, in turn, support higher quality, timely and more effective energy management.

The strategy of using a comprehensive Energy Plan Framework is a departure from program-only based strategies which use incentives to address specific energy concerns. Recognizing the fundamental Energy Plan Framework as a key success factor for achieving energy management objectives is paramount for successful programming outcomes.

5.2 Use of the Energy Plan Framework for Toronto

The Energy Plan Framework outlined above has been developed and positioned as an approach that can be replicated and applied across the different building type sectors, recognizing the fact that the vast majority of the non-transportation use of energy in Toronto occurs in buildings. By using the Energy Plan Framework, the City can help ensure that the key factors for delivering energy efficiency and renewable energy through specific programming initiatives are considered and addressed. The use of this Energy Plan Framework should produce program designs that address specific barriers, leverage existing programs and market relationships, and deliver measurable results. Inherent in the Energy Plan Framework are critical roles for the City, including:

[34] The province of Ontario has recently mandated (through The *Energy Conservation Leadership Act 2006*) that an energy plan for all provincially funded buildings be developed by the building owners' organization.

- The City as the gateway to the programs;
- They City as facilitator of the programs;
- The City as developer of the programs as required;
- The City as operator of the programs as needed;
- They City as the evaluator of the programs; and,
- The City as the aggregator and reporter of the results.

It is not anticipated that the City will play all of these roles at the same time. Rather, the City must be prepared to take on these roles as strategies and opportunities are developed through the use of the Energy Plan Framework. First and foremost, however, the City should focus its efforts on being the gateway to programs for both the City and the community. Establishing the appropriate reporting framework and tools should be the next priority.

The use of energy in existing buildings is the largest determining factor for the City of Toronto when assessing potential energy efficiency opportunities. While new construction trends and practices are important considerations in determining future energy use, especially over the long term, the majority of energy used in the short to medium term will come from the existing stock of buildings. As a result, changes in energy use in that existing stock is critical to the City's future energy use patterns. Renewable energy development is also primarily an activity that will occur in the future. While it has the potential to offer significant benefits, in the proposed framework, renewable energy development is examined as a part of set of implementation measures that are either integrated with buildings directly or serve to supply energy to buildings through the grid.

5.3 Strategy for Toronto Buildings

The focus of this report is on energy efficiency in buildings, which encompasses two dimensions:

1. New buildings and their occupants; and
2. Existing buildings and their occupants.

The strategies for existing buildings described in this report have been developed on a building sector basis. The sector strategy is used since the barriers to energy efficiency are sector specific and the potential association partners are organized around sector activities (i.e., office use). The Energy Plan Framework takes the form of a building sector planning template for each sector.

The strategies for New Buildings have been developed independent of the building sectors,[35] where the audience is building developers, owners and designers. In this case, new building design process and program needs are unrelated to the building type, although they relate to the selection of building technologies, including renewable technologies.

Strategy for New Buildings

New housing and new buildings are a particularly advantageous area for achieving gains in energy efficiency over the long term. Once designed, a new building can operate at or near

[35] The discussion does delineate between commercial buildings and low-rise housing.

its design level of energy efficiency for at least twenty years before any major retrofits are necessary. In some respects, the actual level of energy efficiency is locked in over a much longer period of time.

Recently, a number of programs have moved or are moving to address energy efficiency for new buildings in a comprehensive manner. These include:

- EnerGuide for New Houses (NRCan) – establishes an energy performance standard, requires an independent adviser/auditor, and provides an energy label.
- Commercial Building Incentive Program ("CBIP") (NRCan) – establishes a performance standard, requires energy modeling, and encourages use of Integrated Design Process (now expired).
- Design Advisory Program (Enbridge/Toronto Hydro/City of Toronto) – provides advice and expertise to design teams to meet CBIP and/or exceed the OBC.
- New Building Construction Program - Enbridge currently provides incentives for projected reductions in natural gas use. The City, Toronto Hydro and OPA are also developing incentives for projected reductions in electricity demand.
- The City's Better Buildings New Construction Program ("BBNCP") is already successfully engaging the market and provides a foundation for further programming efforts.

The minimum energy efficiency level of new housing and new buildings is regulated by the Ontario Building Code ("OBC" or "Code"). Since 1990, each successive edition of the OBC has included higher standards of efficiency. Nevertheless, the process of implementing new design practices and technologies into the Code has been slow, and appears to lag behind leading market practice by at least ten years and behind mainstream market practice by at least five years. As an example, the new OBC 2006 finally changed lighting requirements for commercial buildings in a way that requires the use of T8 fluorescent lighting systems, which have been available since the late 1980s, and cost effective since 1993. To overcome this barrier to achieving the available energy efficiency potential, the City should lobby the Ministry of Municipal Affairs and Housing ("MMAH"), the Ministry of Energy ("MoE"), NRCan, and the Canadian Commission on Building and Fire Codes ("CCBFC") to focus their efforts on requiring the elimination of the most wasteful practices, and thereby mandate compliance by owners and developers. Recommendations could include the following:

Part 9 Housing

- Reaffirm and support the commitment to implement the steps outlined in OBC 2006 to move exclusively to a performance path based on NRCan's EnerGuide for New Housing system at a level of 80 by 2012, but establish a schedule that looks at least ten years into the future to allow the industry to prepare for future requirements
- Ensure the provision of adequate training and other resources to develop a corps of trained EnerGuide advisors to provide the necessary design advice with energy modelling, field inspection, and post-construction testing and certification to the low-rise residential sector.
- Ensure a regular ramping up of the minimum energy efficiency of appliances and HVAC equipment, through both the provincial and federal energy efficiency acts and regulations

Part 9 Non-Residential Buildings and Part 3 Buildings

- Revisit the commitment in OBC 2006 for implement by 2012 to require an energy efficiency level of 25 percent better than the MNECB by 2012, as this energy code is now being updated by the CCBFC, rendering this requirement unworkable. Provide

guidance and input to the CCBFC and its committees to ensure that the new MNECB incorporates appropriate technologies, techniques, and targets that will challenge the new building community, but can be achieved using a combination of an integrated design process, and newer conventional and renewable technologies

- Ensure a regular ramping up of the minimum energy efficiency of appliances, office equipment, motors and HVAC equipment, through both the provincial and federal energy efficiency acts and regulations.

While the Province is responsible for making changes to the OBC, enforcement of the OBC requirements is also a key issue, and one which falls within the responsibility of the City. Building officials, including plans examiners and field inspectors, are required to understand and apply a broad range of health, safety, and accessibility codes, standards and bylaws. These officials have also been charged with enforcing standards, including any new or updated requirements for energy efficiency identified in updates to the OBC. As a result, there is a need for these officials to receive regular training in this important area. As an alternative, the City could hire new building design experts in energy efficiency to advise applicants on compliance issues, undertake plans examination, and function as resources for field inspectors by providing written guidance and by being available when issues arise in the field.

The City should consider linking its new building programs to the planning and permit application process by offering information, assistance and incentives to every new building and renovation permit applicant from their first point of contact with the City. In addition to cash incentives, a reward system that encourages participation through accelerated processing or other methods that represent value to the applicant could be offered. This would place the City in the position of leading the market rather than simply enforcing a minimum standard of performance.

The new building process typically follows three steps:

- Design;
- Construct; and
- Commission.

The new building strategy should focus on better design and better commissioning. Staying abreast of new developments is also a challenge for new building designers. The Integrated Design Process (“IDP”) has evolved as the best approach for achieving much higher levels of energy efficiency and environmental performance. This approach requires that the entire design team focus on all aspects of the building design that may have an impact on energy and the environment, making effective use of sophisticated tools, including energy modeling, embodied energy and environmental performance assessment, to develop integrated solutions for achieving higher performance. The strategy for better design will focus on training, education and support of the IDP for new buildings. Existing incentive programs should be integrated within the Toronto new buildings program. Better commissioning can be encouraged through targeted education programs for building designers and contractors.

Strategy for Existing Buildings

Existing buildings (e.g., commercial, institutional, residential, etc.) are the source of almost all non-transportation based energy use in the City. As a result, efficiency improvements or changes in fuel share occurring in the existing stock of buildings will be critical in the future.

For the purposes of this report, existing buildings can be characterized by their type (e.g., residential, commercial, institutional, etc.) and by the nature of their ownership (i.e., private versus public). Public sector buildings can be further characterized by the level of the

government (i.e., provincial, federal, or municipal) with building ownership. City-owned buildings will be of particular importance in order for the City to demonstrate leadership in energy efficiency.

For private sector buildings, most energy efficiency or renewable energy retrofit efforts will be voluntary in nature. While codes and legislation will have an impact, these represent logical conclusions to successful programs (i.e., enact a code or legislative edict after successfully transforming the market to higher levels of efficiency through the use of programs). Given their voluntary nature, programs will need to work within the confines of existing market forces. For example, the availability of capital, access to delivery channels and partners, natural equipment turn-over rates, and competing alternative opportunities must be carefully considered as program elements are developed.

For public sector buildings, particularly those owned by the City, there is an opportunity to advance the rate of uptake of energy efficiency or renewables through more forceful mechanisms, including special directives, aggressive target setting, leading edge demonstrations, etc. It is incumbent upon the various levels of government to consider their various responsibilities. For instance, the provincial government could use its funding powers to make more aggressive energy efficiency targets part of the funding arrangements with the institutional sector.

The City of Toronto can demonstrate its commitment to reducing energy use by showcasing that the City's own buildings are achieving the desired energy goals. The City can demonstrate this commitment in a variety of ways. For example, it could make Toronto City Hall a demonstration building. The recent Design Charette held on May 2, 2007 provided input on a comprehensive energy retrofit and sustainable redesign of City Hall's building systems. Additionally, other City of Toronto buildings can also be promoted as examples of "best practices" and demonstration projects for energy efficiency or renewable energy.

The City of Toronto has articulated clear goals with respect to City owned buildings. These targets include a 20 percent CO_2 level reduction from 1990 levels and a 25 percent contribution from renewable energy in City owned buildings. The City has also launched the Green Development Standard for new buildings in Toronto. The City of Toronto can demonstrate that energy and environmental goals are economically achievable within both City owned buildings and within City funded Agencies, Boards and Commissions ("ABCs").

The City of Toronto can also demonstrate leadership through the integration of asset management and energy management in its buildings. The Public Sector Accounting Board[36] has recommended that all municipalities have a balance sheet and valuation of infrastructure assets (including buildings) by 2009. The integration of capital forecasting with energy management planning will be the key to comprehensive energy retrofits within the Energy Plan for City owned and funded buildings.

The City has already undertaken a variety of energy efficiency initiatives in its own buildings and operations as part of its commitment to "in-house" efforts. This solid experience provides a foundation on which to achieve a best practice and leadership oriented position.

Like the new buildings sector, there are presently many programs that address energy use in existing buildings:

- Enbridge's suite of energy efficiency programs aimed at reducing natural gas use;

[36]Source: http://www.cica.ca/index.cfm/ci_id/1041/la_id/1.htm

- Toronto Hydro's suite of energy efficiency programs aimed at reducing electricity use;
- The federal government's programs, including the recently re-vamped EnerGuide program;
- The Ontario Power Authority's program offerings, including those that are being delivered in partnership with local distribution companies; and,
- The City's Better Buildings Partnership.

All of these programs bring established program parameters and contacts to the market that present obvious opportunities to partner, leverage, and amplify. The City of Toronto has the opportunity to become the information integrator for these programs. Building owners and stakeholders will make informed choices if they can fully understand all the program options.

5.4 Monitoring and Verification (M&V)

The monitoring and verification ("M&V") of energy savings and demand reduction will be a critical part of the City's efforts to reduce energy use and emissions, both for tracking gains in energy efficiency and emissions, and for planning new programs and new directions as the makeup of sectors expand or contract, and as success is achieved in one program area but not in another.

Programs may be either prescriptive or custom, with each having a different approach for evaluation.

For prescriptive programs, which are commonly used for mass markets, savings are often prescribed by an engineering calculation based on an analysis of the typical application. Verification can consist of surveys among a statistically valid sample of participants to determine if the measure is being applied correctly and whether the original assumptions are still valid.

For custom applications, a more detailed approach is required. There is no direct way of measuring energy use or demand savings as instruments cannot measure the absence of energy use or demand. However, the absence of energy use or demand can be calculated by comparing measurements of energy use and/or demand from before and after implementation of an energy conservation measure ("ECM"). Simple comparison by subtraction of post-retrofit energy use from the pre-retrofit quantity does not differentiate between the energy impacts of the ECM and those of other factors such as weather or occupancy. In order to assess the effectiveness of the ECM alone, the influence of these other complicating factors (e.g., weather, usage), must be removed.

Program Design for M & V

Monitoring and Verification is the process that calculates energy savings and determines whether the Implementation measures have worked as intended by the designers and engineers. Much of the procedure for determining energy and water savings relies on the collection of information about the application, the measure or technology, the projected savings, and the before and after performance, including metered utility data.

From a program design perspective, all of the information except for the post retrofit performance is available and should be collected before the project has commenced. The program design must ensure that this information is collected and recorded in a standard format, and that it is retained in the project file. If the information is not collected at this stage, it may not be available once the project has been implemented.

The key players in this process would be:

1. The program designer, who must ensure the data collection process is incorporated in the procedures and documentation;
2. The program manager, who must ensure there is a clear understanding that the all data must be, and has been, collected;
3. The field representative, who must collect the data from the client, the technology supplier, and the energy utility or LDC; and
4. The program auditor, who must ensure that all the data, including the post retrofit performance, has been collected and analyzed, or that deficiencies in data collection are brought to the attention of the stakeholders.

M & V Documents and Protocols

In North America, three major reference documents are used for determining energy and water savings:

1. *International Performance Measurement and Verification Protocol ("IPMVP")*, Vol. 1, 2, 3; Efficiency Valuation Organization
2. *ASHRAE Guideline 14: Measurement of Energy and Demand Savings*; American Society of Heating, Refrigerating and Air Conditioning Engineers
3. *M & V Guidelines: Measurement and Verification for Federal Energy Management Projects ("FEMP")*; US DOE Federal Energy Management Program

The IPMVP Volume 1 is entitled "Concepts and Options for Determining Energy and Water Savings," and will be most applicable to the City's program efforts. Volume 2 is entitled "Concepts and Practices for Improving Indoor Environmental Quality," and is intended for designers and other practitioners. Volume III is provided in two parts: "Concepts and Practices for Determining Energy Savings in New Construction" and "Concepts and Practices for Determining Energy Savings in Renewable Energy Technologies Applications," both of which would be useful for the City's program and for other efforts in these two key areas.

ASHRAE Guideline 14 is specifically targeted at the determination of energy and demand savings from individual facilities or meters in all types of buildings, although it does not include sampling methodologies for use in large scale demand-side management programs or for major industrial process loads.

The FEMP M&V Guidelines were developed in order to verify savings with minimum cost and to the satisfaction of all parties. The Guidelines are based on, and intended to be fully compatible with, the *International Performance Measurement and Verification Protocol (IPMVP)*. They offer four approaches that can be used to cover the spectrum of project complexity, ranging from savings verification with a minimum of measurement and at a minimum cost to a more rigorous approach for more complex projects. In general, the more rigorous the verification requirements, the more expensive the verification process will be.

In addition to these references, the OPA has been preparing a new document for its programs that is expected to be available sometime in 2007.

Reporting

Reporting requirements for DSM and CDM programs have been developed and established over a significant period of time, exceeding twenty years in some jurisdictions.

A typical report must include the following:

- A description of all programs, categorized either by program type or by target market sector;
- A description of the evaluation, and the monitoring and verification procedure followed for each program type;
- A copy of all random audit field studies undertaken with the results; and
- A review of the recommendations from previous audits, and the procedure followed to implement these.

In Ontario, the natural gas utilities have been offering DSM programs since 1995, and have received considerable oversight through the Ontario Energy Board ("OEB"). Their reports are prepared annually, and are subject to intense scrutiny. As a result, their reporting standards have improved with experience, and represent a reasonable standard for the City and others to follow. As indicated above, the OPA will imminently release its M&V protocols for use by the OPA and others delivering CDM programs focused on electricity.

5.5 A Sector-Specific Approach

Our approach to developing the Energy Plan for Toronto has been to focus on energy efficiency and renewable energy opportunities within specific sectors identified by the City including:

- Commercial Office
- Commercial Retail
- Multi-Unit Residential
- Low-Rise Residential
- Industrial
- Schools
- Colleges and Universities
- Healthcare
- Municipal

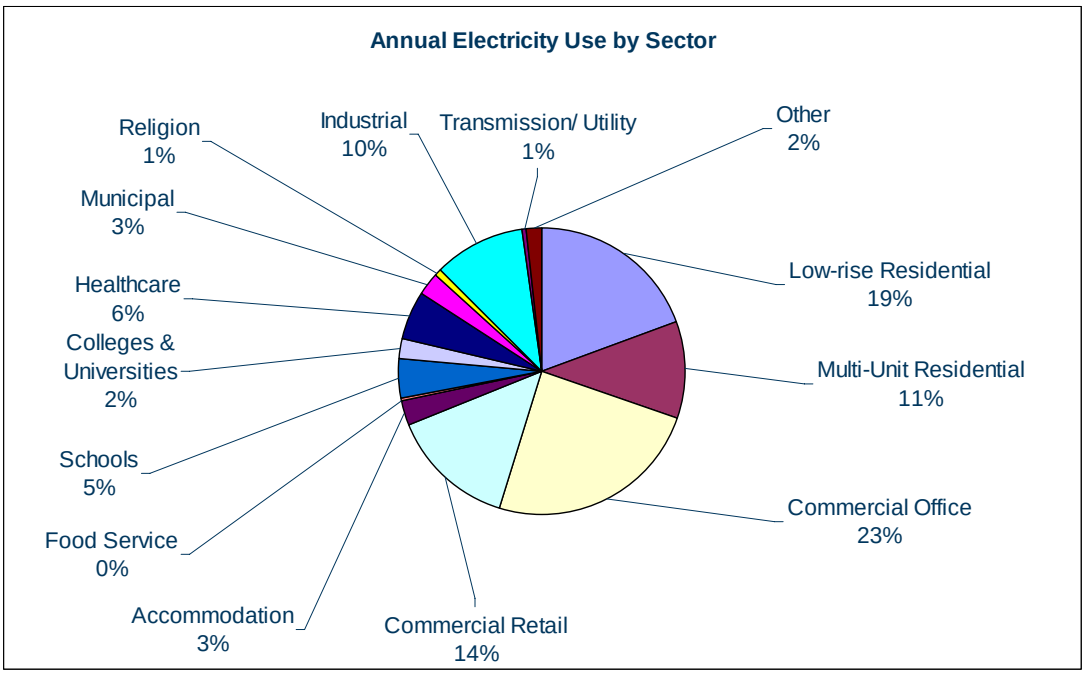
An analysis for each sector was conducted, which includes a description of the specific sector along with a summary of sector specific barriers and policy implications. This was followed by the development of specific programs for each sector which considered sector specific delivery channels, and the development of high level steps for implementation. The final result is the building sector energy plan template.

The first step in developing a sector-specific approach is to consider energy use and floorspace within Toronto by sector. This analysis will assist the City in determining which sectors to focus its efforts on as the sectors that use the most energy are more likely to provide the largest opportunity for energy efficiency measures to be implemented and for targets to be achieved.

Annual Electricity Use by Sector in Toronto

As illustrated in Figure 5-2 below, over 78 percent of electricity use in Toronto is consumed by four key sectors 1) Commercial Office; 2) Low-Rise Residential; 3) Commercial Retail; and 4) Multi-Unit Residential, with the Commercial Office sector using the most electricity.

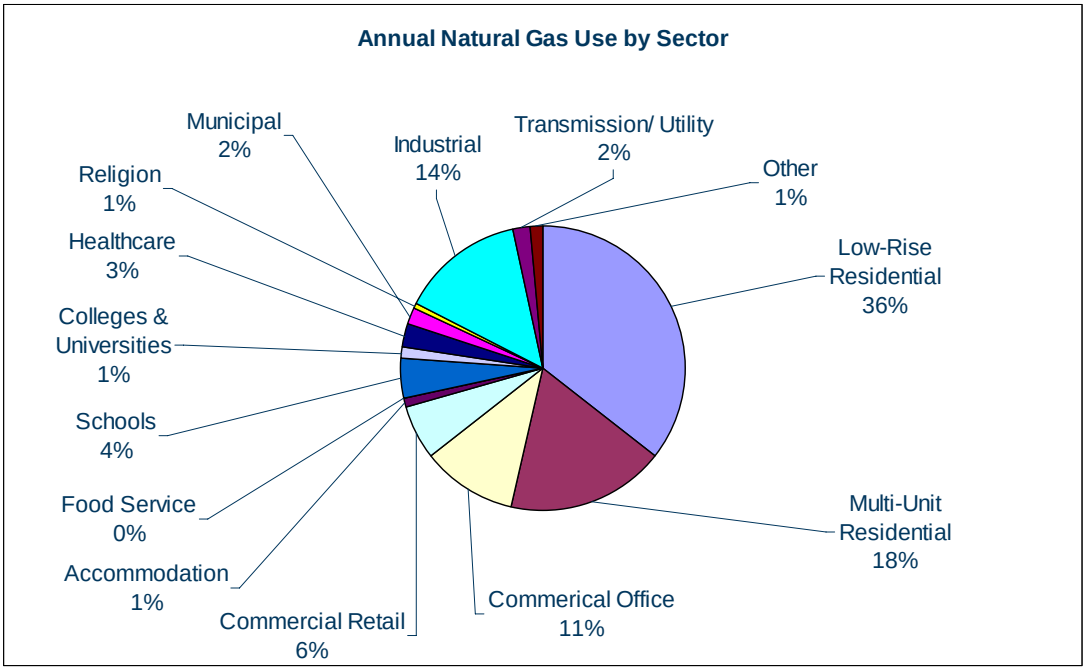
Figure 5-2: Annual electricity use by sector for Toronto



Annual Natural Gas Use by Sector

As illustrated in Figure 5-3 below, over 84percent of natural gas use in Toronto is contributed by five sectors 1) Low-Rise Residential; 2) Multi-Unit residential, 3) Commercial Office, 4) Industrial; and 5) Commercial Retail with the residential sectors responsible for 56 percent of the natural gas usage. .

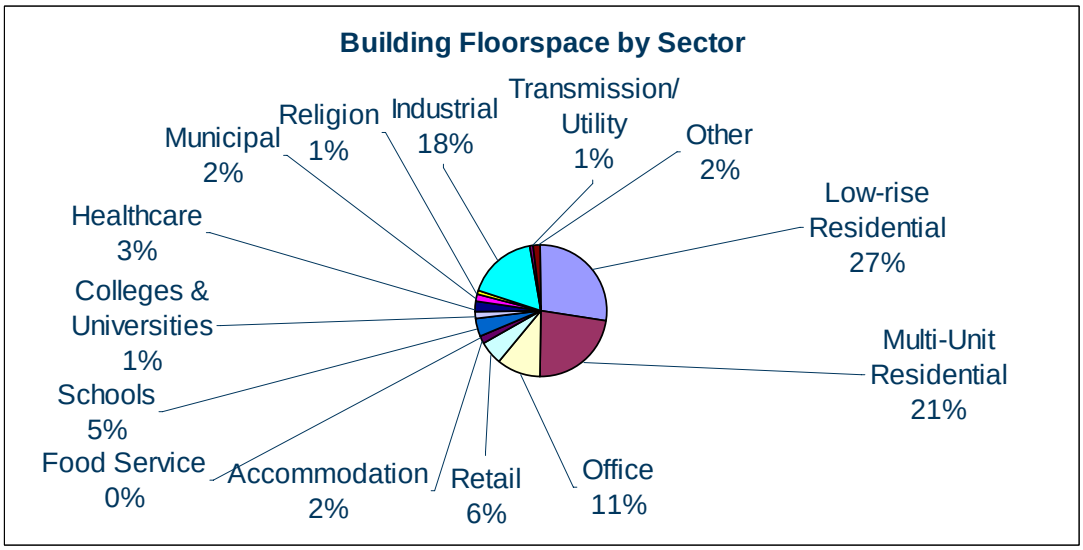
Figure 5-3: Annual natural gas use by sector



Total Floorspace by Sector

The breakdown of floorspace by sector in Toronto is presented in Figure 5-4, and is based on information provided by the City. The largest sectors are Low-Rise Residential and Multi-Unit Residential, representing a total of 49 percent of all building floorspace, followed by the Industrial and Commercial Office sectors.

Figure 5-4: Building Floorspace by Sector



Summary

As illustrated in Figures 5-2, 5-3 and 5-4 above, the primary sector that the City should focus its energy efficiency efforts on is the residential sector, including both Low-Rise and Multi-Unit Residential building segments, as this sector is the largest energy user within the City. The City should also consider developing electricity efficiency programs to focus on and supplement existing programs in the Commercial Office and Commercial Retail sectors.

6 Sector Analysis

This section presents the sector analysis, which represent the foundation for the development of detailed program designs (where marketing and incentive budgets are known). Each template provides a brief discussion of the sector (e.g., barriers, points of leverage, links to current programs, etc.) then goes on to identify potential programs using the Energy Plan Framework process (Audit, Implementation, Monitoring). Finally, each template also provides a description of potential partners and the division of responsibilities, incentives, planning milestones, and policy considerations. Appendix H contains a summary of the key findings of this sector analysis.

6.1 Commercial Office

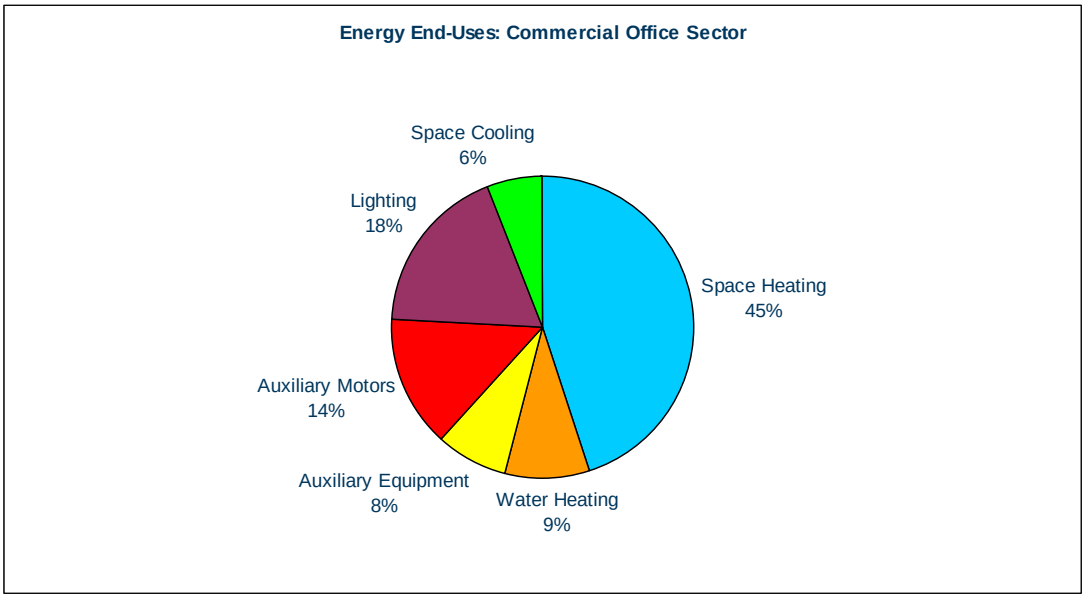
Sector Description

The Commercial Office building sector in Toronto represents 11percent of building floorspace, and consumes 24 percent of electricity use and 11percent of the natural gas use.

Most office space in Toronto was developed and built in the period from 1960 to 1990 as a response to the need for more knowledge workers. The building stock is now approaching the stage where there is a growing need for major building system renewal. The TD Centre is a good example of an office complex where major energy efficiency and renewal projects have been completed for HVAC and lighting systems. Most office buildings will be projecting significant capital expenditures for HVAC and lighting systems as they reach thirty years of age.

The typical energy end use profile for an office building is shown below.

Figure 6-1: Energy End Uses: Commercial Office Sector



Sector Barriers

The following barriers apply to the Office building sector:

- Misplaced or split incentives
- High information or search costs
- Organizational practices or customs

Most office buildings use professional property managers to manage building expenses and tenant activities. The property managers work with annual budgets, while asset management and capital forecasts for building renewal are the responsibility of the owners. The structure of building management has led to selective energy retrofits instead of comprehensive retrofits. The yearly budget cycle is used to plan the retrofits.

The most significant monetary barrier for this sector is the net lease structure, wherein all operating costs including energy are passed on to the tenant. The building owner has no incentive to reduce energy costs since the tenant pays the bill. The tenants have limited control over energy costs since they take no responsibility for retrofits.

Delivery Channels for Leverage

The primary delivery channels for the office building sector are:

- BOMA, Greater Toronto chapter
- The Toronto Board of Trade
- The International Facility Managers Association (“IMFA”), Toronto chapter

BOMA provides the best coverage of the Commercial Office building sector, since its focus is on building owners and managers. The BOMA membership reflects primarily office buildings with some coverage of retail commercial buildings. Many office buildings are mixed use with office and retail space being the most common space types. The OPA has already entered into an agreement with BOMA to be the sector partner for private owned commercial space with a 150MW reduction target.

Links to Current Programs

The current programs with the best correlation for the Office building sector are:

- Better Buildings Partnership (“BBP”) – Training, Technical assistance and E3@work
- OPA – 150MW program through BOMA with incentives of $400 per kW
- Enbridge – Design assistance, audit incentive, high efficiency boiler incentive
- NRCan – ecoEnergy program up to 25percent of project costs for buildings having less than 10,000 m^2.
- BOMA – GoGreen labelling program has an energy component

The major linkage to best practice is the tenant metering systems. Ontario has already made a commitment to smart metering in the residential sector. The same technology can be applied to tenant metering in offices. Best practice with leases shows that net leases can be modified to make investments in energy management possible by the building owners.

The City of Toronto may be able to work in conjunction with the OPA agreement, potentially expanding the program to consider higher incentives and deeper retrofit projects. There may

also be a mechanism to include natural gas and steam saving measures in partnership with Enbridge and Enwave. The infrastructure developed by BOMA can be leveraged for the City's goals.

Program Description

Audit

Existing programs provide audit incentives. The main program requirement will be to work with BOMA (OPA), Enbridge, NRCan and BBP to create a common incentive which can be understood by the office sector stakeholders. The audit incentive is not critical with the OPA measure incentive of $400 per kW. The main goal of the audit phase will be define the audit parameters required for the funding options.

Implementation

The OPA incentive of $400 per kW will drive implementation. The OPA incentive will drive interest and the Clinton Fund or similar mechanism can drive comprehensive retrofit by dictating the term of the agreement, based on life cycle costing. The agreement term will provide the linkage between energy efficient measures and the capital forecast for asset management of building systems. The conservation fund option addresses the net lease barrier since loan repayments are legitimate expenses and the retrofit can be capitalized outside the asset valuation. Other incentives offered by Enbridge, BBP and NRCan can be pooled where appropriate.

The implementation will also provide a tenant metering option. Tenant metering can address the other major barrier in the office sector. The details of the tenant metering option must be reviewed with the sector partner in order to ensure that the program will meet sector needs. A web based application will provide communication to tenants about energy use. The tenant metering option can be funded as part of the comprehensive retrofit.

An O&M training program should also be implemented as part of the retrofit. BOMA has an existing course on energy management and Seneca College offers similar courses. The details will need to be developed with the sector partner, however, the training must be specific to the retrofits to be acceptable.

Monitoring

Monitoring of the retrofit projects will follow the same form as the BOMA agreement with the need to monitor natural gas and steam savings in addition to electricity consumption and demand savings.

The tenant metering option will provide the capability to do real time metering of electricity for each tenant and for the entire building. This information can be linked to the building automation system for better energy management daily. The use of a web based application can communicate the results of program efforts on a daily basis.

Incentive Options

The incentive options selected for the Office building sector are:

- Audit incentives using existing programs;
- Implementation using existing incentives;
- New Clinton Foundation Fund or similar mechanism;
- New tenant metering program;

- New website applications for sector and tenant metering; and
- Modified BBP training and support for O&M personnel/BOMA stakeholders.

Roles and Responsibilities

City of Toronto

- Sector partner selection and agreement
- Assistance with funding options. Pooling of existing incentive programs
- Selection and agreement with training partner (Seneca College)
- Website application development
- Tenant metering development

Sector Partner (BOMA)

- Program sales and marketing
- Collaboration on program development
- Monitoring and verification of savings
- Delivery of training programs with training partner

Planning Milestones

The planning milestones are provided as a reference for detailed planning. The final plan will depend on input from the sector partner. Milestones are ordered in time sequence.

- Selection of sector partner and definition of roles
- Sector partner agreement
- Finalize the program modules for the plan
- Development of fund options
- Pooling of stakeholders on existing incentive programs
- Development of tenant metering program
- Development of pilot web site and beta testing with selected buildings
- Sales and marketing (ongoing)
- Development of training programs (Owner/Manager and O&M)
- Selection of training partner
- Finalize web applications and support
- Monitoring reporting (ongoing from energy reports and from web application)

Policy Implications

The policy implications for the Commercial Office building sector involve the issues of net leases and tenant metering. Many landlords in this sector have already developed leases that address the net lease barrier. The lease language provides for the ability of the landlord to expense investments in energy efficiency provided they are in the tenants interest. The option of a City-backed loan may allow the investments to be expensed within the energy account.

The City of Toronto could consider a by-law relating to office lease structure. The by-law could dictate the treatment of energy efficiency investment in buildings to avoid the net lease barriers.

The City could investigate the legal aspects of a by-law that would require sub-metering of office tenants. Alternately, if a by-law is not possible, the City could work with BOMA to encourage sub-metering of tenants behind the main electrical meter. Sub-metering can benefit building owners by reducing common area costs and eliminating any disputes about energy allocations. Toronto Hydro could provide the revenue metering but the costs are likely to be high and the implementation timeframe long (i.e., five years). The most likely option will be to leave the bulk meter in place and provide sub-metering certified by Measurement Canada.

6.2 Commercial Retail

Sector Description

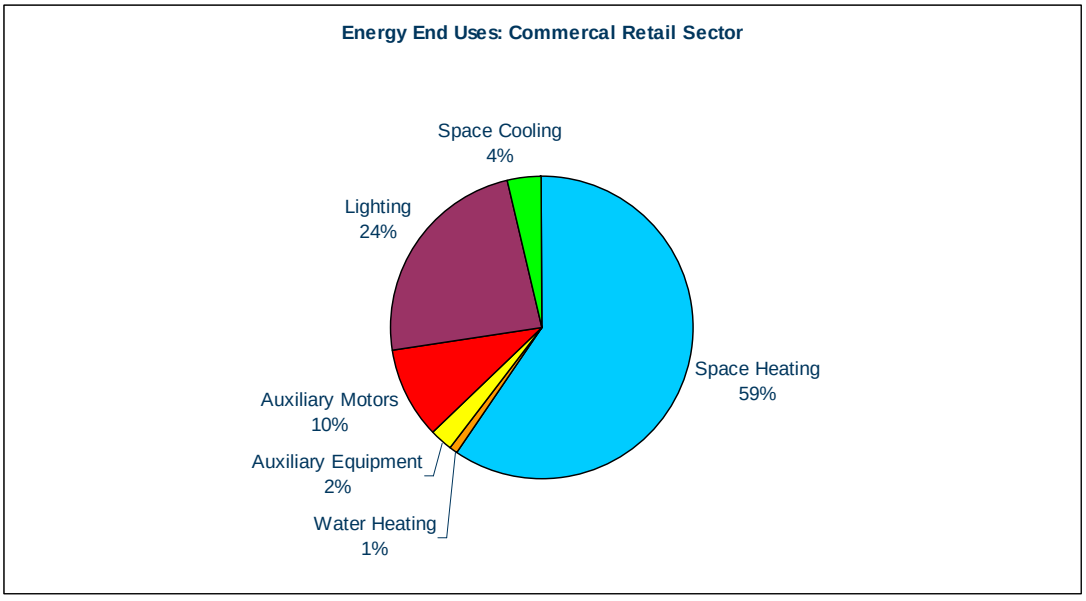
The Commercial Retail sector in Toronto represents 6 percent of building floorspace, and consumes 14 percent of electricity and 6 percent of the natural gas.

Retail buildings include small retail stores, big-box retail stores, shopping centers and supermarket type stores. Retail stores are generally energy intensive with large lighting loads and long hours of operation. Retail stores are the third largest sector for electricity use in Toronto.

Much of the Commercial Retail building stock was built during the 1950 to 1980 period. The heating/cooling systems typically used in retail stores are rooftop units with relatively low efficiencies for both heating and cooling. Most retail stores have their own electricity and gas meters. Larger shopping centres have central HVAC systems with bulk metering, but some have been moving to individual metering to avoid disputes over energy allocations. Energy cost is a large operating expense for most retailers.

The typical energy end use profile for a Commercial Retail building is shown below:

Figure 6-2: Energy End Uses: Commercial Retail Sector



Sector Barriers

The following barriers apply to the Commercial Retail sector:

- Misplaced or split incentives
- High information or search costs
- Organizational practices or customs

The business planning horizon for retailers is no more than five years. Retail sales trends can change quickly and stores are subject to closure, sale or significant renovation. The result of the short planning horizon is that retailers look for short term paybacks from energy projects. Money is also constrained by the business budgets. Investments that can increase sales are preferred over investments that reduce expenses.

Store managers are retailers and have little knowledge of energy management. The managers depend on store control systems to manage energy. Lighting is a major energy use, but it can also be used to create more retail appeal for the store's products or services.

Management commitment is based on the awareness of energy costs as a controllable expense and the planning horizon of the retailer. The availability of longer term money for retrofits will not overcome this planning horizon issue.

Building operators and maintenance personnel lack knowledge concerning the energy management process. Technology transfer is an ongoing problem as there is no formal professional development for O&M personnel.

Delivery Channels for Leverage

The possible delivery channels for the Commercial Retail sector are:

- Retail Council of Canada
- International Council of Shopping Centers
- Toronto Association of Business Improvement Areas ("TABIA")
- BOMA

BOMA has a mandate to represent the retail sector in the OPA 300 MW initiative, with a target of achieving a 150 MW reduction for offices and retail buildings. The Retail Council of Canada is the best channel partner to reach major retailers, while TABIA already delivers energy efficiency programs to small retailers.

Links to Current Programs

The current programs with the best correlation for the retail sector are:

- BBP – Training, Technical assistance and E3@work
- OPA – 150 MW program through BOMA with incentives of $400 per kW
- Enbridge – Design assistance, audit incentive, high efficiency boiler incentive
- NRCan – EcoEnergy program up to 25percent of project costs
- BOMA – GoGreen labelling program has an energy component
- TABIA – energy efficiency programs for small retailers

The best practices of lighting in retail space are of most interest to retailers. Lighting can be used both to save money and to create more retail appeal. Advanced refrigeration also presents an interesting opportunity in this sector, particularly for big box food stores.

The City of Toronto should be able to utilize the OPA agreement for the development of natural gas and water saving measures to the Commercial Retail sector. The infrastructure developed by BOMA can also be leveraged to assist in meeting the City's energy efficiency goals.

Program Description

Audit

Existing programs provide audit incentives. The main program requirement will be to work with BOMA (OPA), Enbridge, NRCan, and BBP, to create a common incentive which can be understood by the retail sector stakeholders. The audit incentive is not critical with the OPA measure incentive of $400 per kW. The main goal of the audit phase will be define the audit parameters required for the funding options.

Implementation

The OPA incentive of $400 per kW will drive implementation of electricity measures, and will raise awareness and interest in energy retrofit. A loan option may be of interest to retailers (i.e., access to the Clinton Fund or similar mechanism). The sector partner (Retail Council) should be consulted on any loan options. Other incentives offered by Enbridge, BBP and NRCan can also be pooled where appropriate.

For smaller retailers, linking to existing TABIA programs through enhanced incentives may provide significant leverage for the City's efforts. There are (or have been) other programs focused on small retailers (e.g., "Cool Shops"). The Clean Air Foundation and the OPA are currently developing program initiatives focusing on this market.

An O&M training program for larger retailers and shopping centres should be implemented as part of any retrofits. Such a program is described in the Commercial Office sector section of this report. As mentioned previously, the training must be specific to the retrofits.

Monitoring

Monitoring of the retrofit projects could utilize the BOMA agreement with the need to monitor natural gas and water savings in addition to electricity savings and demand reduction.

Retail stores may benefit greatly from interval metering. The electricity meter can be connected to the building control system if the store does not have an interval meter from Toronto Hydro.

Incentive Options

The incentive options selected for the Commercial Retail sector are:

- Audit incentives using existing programs;
- Implementation using existing incentives;
- New website application for sector; and
- Modified BBP training and support for O&M personnel.

Roles and Responsibilities

City of Toronto

- Sector partner selection and agreement
- Assistance with funding options
- Pooling of existing incentive programs
- Selection and agreement with training partner
- Website application development

Sector Partners (BOMA, Retail Council, TABIA, and Others)

- Program sales and marketing
- Collaboration on program development
- Monitoring and verification of savings
- Delivery of training programs with training partner

Planning Milestones

The planning milestones are provided as a reference for detailed planning. The final plan will depend on input from sector partners. Milestones are ordered in time sequence.

- Selection of sector partners and definition of roles
- Sector partner agreement
- Finalize the program modules for the plan
- Development of fund agreements and governance for loans
- Pooling of stakeholders on existing incentive programs
- Development of pilot web site and beta testing
- Sales and marketing (ongoing)
- Development of training programs (Retail Manager and O&M)
- Selection of training partner
- Finalize web applications and support
- Monitoring reporting (ongoing from energy reports and from web application)

Policy Implications

The policy implications for the Commercial Retail sector mainly involve the issue of implementing interval metering. Most retail stores already have individual meters as bulk metering is being phased out, which will assist in moving the sector to the next level: interval meters.

6.3 Multi-Unit Residential

Sector Description

The Toronto Multi-Unit Residential Building (“MURB”) sector represents 21 percent of the floor space, and consumes 11 percent of electricity and 19 percent of natural gas.

The MURB sector has three distinct sub-sectors:

- Condominiums;
- Rental buildings; and
- Social housing.

This sector also includes some co-operative ("co-op") housing, but these make up only a small portion of the sector.

Condominiums have been built in the last thirty years and the building stock is "younger" than with rental buildings. Condominium owners have a unique condominium corporation for each building which is managed by an elected board of owners. The condominium board selects a property manager or a company to property manage the building operation and maintenance. The condominium board is also responsible for the development of a reserve fund as required by Ontario law. The purpose of a reserve fund is to maintain a capital fund sufficient for major capital replacement of building systems as the building ages.

Recent legislation in Ontario has mandated the installation of smart electricity metering for condominiums by 2010. Most condominium buildings are bulk metered for electricity and the billing is apportioned by the condominium board based on floor area. The condominium boards are busy reviewing their smart metering options. The conventional "meter under glass" used for residential billing will not be a useable option due to insufficient space in electrical rooms. The monthly incremental cost of individual suite metering is about $12 per month, which covers the cost of hardware, reading, billing and administration. Smart meters provide the ability to review charges on a daily basis and reduce electricity use based on the modified behaviour of suite occupants.

Rental buildings are often older than thirty years, and are governed by Ontario rent control legislation which limits rent increases according to a set of rules. Legislation was passed in the early 1990s to allow rental building owners to expense, rather than capitalize, energy retrofits. The rental building stock has a varied ownership structure with some REITS ("Real Estate Investment Trusts"), some multiple building owners, and some independent investor owners. The rental building stock is aging, and deferred capital renewal of building systems is already a significant issue. There is no mandatory reserve fund for rental buildings.

The Ontario Ministry of Housing is planning legislation dealing with smart metering and individual metering of electricity in Ontario rental buildings. The legislation is planned for the fall of 2007. Many building owners have already modified their rental agreements to give them the right to install individual metering for each apartment provided they credit the monthly rental fee with the average electricity cost per apartment.

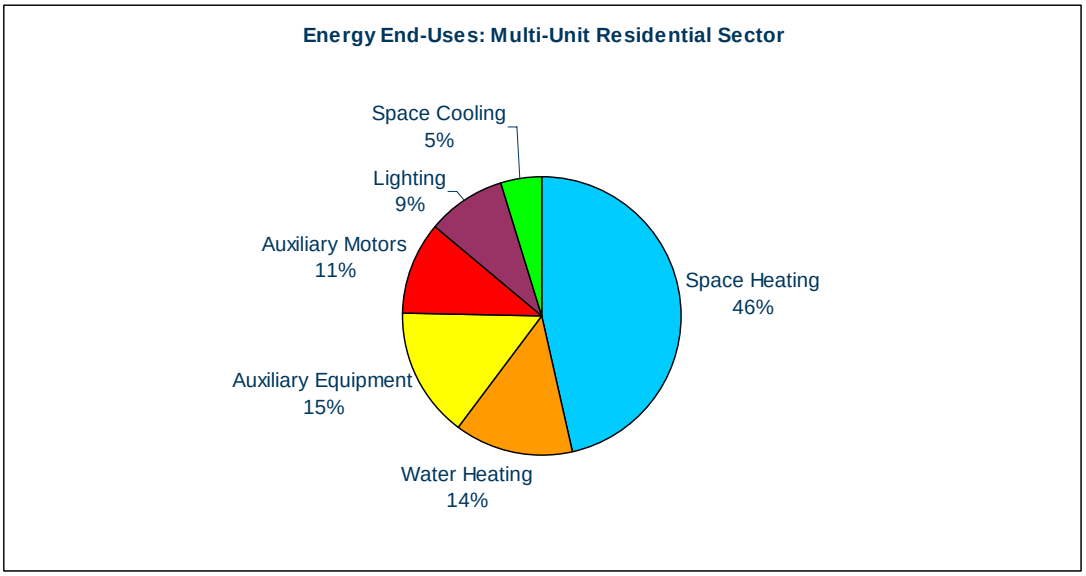
The Social Housing Unit ("SHU") is part of the City of Toronto's Shelter, Housing and Support Division and is responsible for the direct funding and administration of social housing programs in the City of Toronto. SHU has responsibility for approximately 250 non-profit and co-operative social housing providers across the City. Their portfolio is comprised of 90,000 market and rent-geared-to-income units. They house 200,000 people in 600 buildings. The largest provider is Toronto Community Housing Corporation ("TCHC") with approximately 58,200 units. TCHC represents approximately two-thirds of the total portfolio.

Most social housing buildings are bulk metered for electricity, gas and water. The Ontario legislation on smart metering will not impact social housing buildings in Ontario. TCHC has already launched a comprehensive pilot retrofit, the Building Renewal Program, for a group of buildings representing 15percent of their floor space. TCHC has also implemented an interval metering pilot with OZZ Corp involving smart metering for the water, gas and electricity metering in approximately 40 buildings. The interval metering captures data down to 15 minute intervals for the bulk meters in the TCHC buildings.

The MURB sector provides significant potential for water saving measures, which typically has the best payback period of any retrofit in this sector. Water saving measures will also impact the energy for heating and pumping domestic water.

The typical energy end use profile for a Multi-Unit Residential building is shown below.

Figure 6-3: Energy End Uses: Multi-Unit Residential Sector



Sector Barriers

The Multi-Unit Residential sector has the following barriers:

- Misplaced or split incentives
- High information or search costs
- Organizational practices or customs

Most MURBs, with the exception of social housing, use professional property managers to manage building operation and maintenance. The property managers work with annual budgets, while asset management and capital forecasts for building renewal are the responsibility of the owners. The yearly budget cycle is used to plan the retrofits.

The condominium building owner corporation by-laws may require a significant majority of owner votes (i.e., 70percent) in order to approve major energy retrofits. The barrier is selective and depends on the by-law requirement. The mandated reserve fund means that energy retrofits can be combined with major renewal measures.

The rental building owners have significant deferred capital projects in their buildings and budget money according to rent controlled revenues. The lack of money for capital improvements is a significant barrier in rental buildings.

TCHC buildings also lack money to implement major capital projects. The deferral of capital projects is related to building age, typically greater than thirty years. The requirement for capital has accelerated as HVAC and envelope systems reach the end of their useful lives. The lack of money has also affected the budget for energy related projects.

Rental tenants and condominium residents control about 50percent of the energy use in their buildings, and energy management programs will require tenant involvement to be effective.

At present, the majority of occupants do not see energy bills directly, have limited knowledge of energy efficiency measures, and lack incentive as they do not pay the bill directly.

TCHC has begun to address knowledge issues within their pilot project by including a tenant awareness program related to the energy measures in each building. The relationship between asset management and energy management has been explored in the pilot project, and TCHC is now undertaking a more comprehensive capital forecast for the remainder of their buildings.

Delivery Channels for Leverage

The possible delivery channels for the Multi-Unit Residential sector are:

- ACMO – Association of Condominium Managers of Ontario
- OLA – Ontario Landlords Association (GTA chapter)
- TCHC – Toronto Community Housing Corporation

ACMO provides training and continuing education services to condominium managers in Toronto and elsewhere.

OLA is primarily a lobby group. The organization meets in local chapters; there is a Toronto and GTA group which covers the entire area covered by the Energy Plan.

TCHC still has 85 percent of their building stock left to schedule for retrofits as part of their building renewal program; these could be leveraged with the OPA incentives.

The City of Toronto should be able to utilize the OPA agreement for the development of natural gas and water saving measures in this sector. The OPA incentive of $400 per kW will not be a major driver for gas heated buildings. More efforts will be required to penetrate this sector with limited incentives. Buildings which are electrically heated represent targets for conversion to gas, or to a renewable energy source (e.g., geo-exchange source heat pump, etc.).

Links to Current Programs

The current programs with the best correlation for the Multi-Unit Residential sector are:

- City of Toronto – Water saving measures
- OPA – 90 MW program through City of Toronto, plus a separate program for social housing
- Enbridge – conversion incentive, audit incentive, high efficiency boiler incentive
- NRCan – EcoEnergy program up to 25percent of project costs
- BBP – training and technical assistance

The major linkage to best practice is in the area of smart metering systems. Ontario has already made a commitment to smart electricity metering in the Low-Rise Residential sector. The same technology is now legislated for condominiums with a 2007 to 2010 implementation. The rental building legislation is scheduled for fall of 2007.

Best practice programs for tenant and condominium resident involvement in energy management will also be useful references.

Program Description

Audit

Existing programs provide audit incentives. The main program requirement will be to work with OPA agreements, Enbridge, NRCan and BBP to create a common incentive which can be understood by stakeholders in the Multi-Unit Residential sector. The main goal of the audit phase will be to define the audit parameters required for the funding options.

Implementation

The OPA incentive programs will drive implementation. The Clinton Foundation Fund or similar mechanism can drive comprehensive retrofits by dictating the term of the agreement (life cycle costing). This approach will provide the linkage between energy measures and the capital forecast for asset management of building systems. Other incentives offered by Enbridge, BBP and NRCan can be pooled where appropriate.

The implementation can go hand in hand with the installation of smart metering in MUR buildings. The selection of comprehensive measures will make individual metering more useful and more affordable. A web based application will provide communication to tenants about energy use. Tenant/resident workshops can be designed to provide knowledge about saving money.

An owner/property manager workshop will be needed to address the barriers regarding the relationship of asset planning, capital forecasting and energy management. The channel partner can assist with the design and delivery of this workshop.

Monitoring

Monitoring of the retrofit projects could utilize the OPA agreement as they both have the need to monitor natural gas and water savings in addition to electricity savings and demand reduction. Smart metering systems can be used for real time monitoring. The energy use data can be shared with the tenant/resident web portal for better feedback on energy management efforts. TCHC monitoring is currently available through the City of Toronto Energy Cap software and the OZZ interval metering software for selected buildings.

Incentive Options

The incentive options selected for the Multi-Unit Residential sector are:

- Audit incentives using existing programs;
- Implementation using existing incentives;
- Clinton Foundation Fund or similar mechanism;
- New website applications for sector and resident metering;
- New workshop for property managers and owners; and
- Modified BBP training and support for residents.

Roles and Responsibilities

City of Toronto

- Sector partner selection and agreement
- Assistance with funding options
- Pooling of existing incentive programs

- Selection and agreement with training partner
- Website application development
- Training and awareness program for residents

Sector Partner

- Program sales and marketing
- Collaboration on program development
- Monitoring and verification of savings
- Delivery of training programs with training partner

Planning Milestones

The planning milestones are provided as a reference for detailed planning. The final plan will depend on input from the sector partner. Milestones are ordered in time sequence.

- Selection of sector partners and definition of roles
- Sector partner agreements
- Finalize the program modules for the plan
- Development of funding options
- Pooling of stakeholders on existing incentive programs
- Development of smart metering program (integrated)
- Development of pilot sector web site and beta testing with selected buildings
- Sales and marketing (ongoing)
- Development of training programs (Owner/Manager and Resident)
- Selection of training partner
- Finalize web applications and support
- Monitoring reporting (ongoing from energy reports and from web application)

Policy Implications

The policy implications for the Multi-Unit Residential sector involve the issues of smart metering and condominium by-laws dealing with large energy retrofits.

The City of Toronto is not involved directly in the Ontario legislation from the Ministry of Energy or the Ministry of Municipal Affairs and Housing. Legislative issues should be resolved in 2007, prior to the provincial election.

The condominium by-law issue will require more review with the sector partner. ACMO can provide guidance on possible policy options for Toronto.

6.4 Low-Rise Residential

Sector Description

The Low-Rise Residential (“LRR”) building sector accounts for approximately 27 percent of floorspace, 20 percent of the electricity use, and 37 percent of the natural gas use for the

City. The majority of heating fuel oil used in the City is used for space heating in the low-rise residential sector.

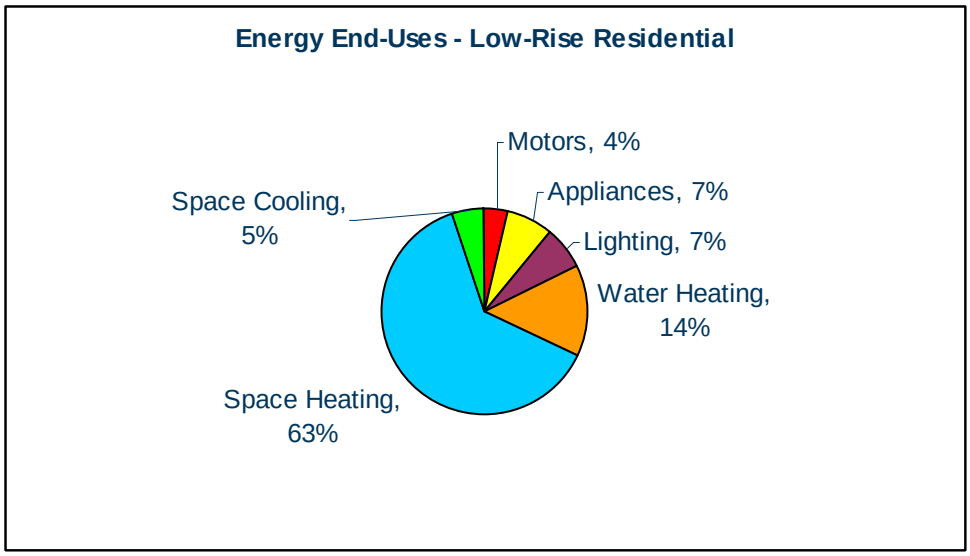
The building stock includes detached houses, semi-detached houses, and townhouses. In addition, there is a broad spectrum of building ages across this stock. While most houses are heated by natural gas, some houses have retained oil furnaces, whereas others are electrically heated with baseboard, electric furnace, or heat pump systems.

All houses have a residential electricity meter, and gas heated homes have a gas meter. Oil fired homes are billed based on each delivery to the oil tank. The Province of Ontario has passed legislation to mandate smart electricity meters in homes by the year 2010. The installation of smart meters will provide the ability to charge the homeowner based on the time of use of the electricity. Toronto Hydro is tasked with installing a large number of smart meters. The installation of smart meters provides a unique opportunity to create energy management awareness and to campaign for energy efficiency measures.

Energy efficiency measures are implemented in this sector on an incremental basis. The decision about new windows or a new furnace is normally made at the end of the useful life of the building component. Energy efficiency decisions are also made at the time of home renovation. Smaller equipment such as lighting and appliances are subject to both discretionary retrofit/replacement decisions and necessary decisions as appliances require replacement.

The typical energy end use profile for a Low-Rise Residential building is shown below.

Figure 6-4: Energy End Uses: Low-Rise Residential Sector



Sector Barriers

The Low-Rise Residential sector has the following barriers:

- High information or search costs
- Misplaced or split incentives

Delivery Channels for Leverage

There are multiple delivery channels in the Low-Rise Residential sector. Recently, consumer based programs offered through retailers have been successful in encouraging customers to

install a variety of lighting and small consumer products.[37] Larger equipment such as water heaters and furnaces rely on contractors for their installation and these contractors represent an obvious opportunity for leverage. The recently formed Energy Efficiency Contractors Network ("EECN") presents a single point of entry for accessing a variety of contractors active in the Low-Rise Residential sector.

Other important channels include the two local distribution companies: Toronto Hydro and Enbridge Gas Distribution. Both have a number of energy efficiency programs currently available to residents of Toronto and there is an obvious opportunity to enhance and amplify these offerings. Toronto Hydro is already a partner in the OPA 300 MW initiative, responsible for delivering 90 MW of reduction, mainly in the Low-Rise Residential sector. The fuel oil delivery companies also present a limited opportunity to engage homeowners.

Links to Current Programs

The current programs with the best correlation for the Low-Rise Residential sector are:

- City of Toronto – Water saving measures
- OPA – 90 MW program through City of Toronto
- Toronto Hydro – A combination of facilitated OPA programs and its own offerings targeting the Low-Rise residential sector. Notable programs include "Summer Savings," "Peak Saver, "and "Refrigerator Roundup"
- Enbridge – a complete suite of residential programs targeting both new and existing homes
- NRCan – new ecoEnergy program using a home audit and target incentives.

The major linkage to best practice is for smart metering systems. Ontario has already made a commitment to smart electricity metering in the residential sector.

Program Description

Audit

The main program requirement will be to work with OPA agreements, Toronto Hydro, Enbridge, and NRCan as appropriate to create a common incentive which can be understood by homeowners. The ecoEnergy program is based on the EnerGuide for existing houses audit program that was delivered successfully in Toronto. The main goal of the audit phase will be to define the audit parameters required for the funding options.

Implementation

The OPA programs delivered by Toronto Hydro will drive implementation. Other incentives offered by Enbridge and NRCan can be pooled where appropriate. A funding mechanism will be the key to overcoming barriers to comprehensive projects. Homeowners are unlikely to incur bank loans for large energy efficiency projects without incentives. The funding application must be "in home" and easy to complete. The best option will be to add any loan

[37] Some notable examples include the "Every KiloWatt Counts" program offered by the OPA, the Holiday Light Exchange program offered by Toronto Hydro and the Keep Cool program by the Clean Air Foundation.

costs to the existing Toronto Hydro utility bill to merge the savings and repayment cash flows.

The implementation can coincide with the installation of smart metering in Low-Rise Residential buildings. The selection of comprehensive measures will make smart metering more useful and more affordable. A web based application will provide communication to homeowners about energy use.

Monitoring

Monitoring of the retrofit projects could utilize existing monitoring and reporting infrastructure, including those operated by the OPA, Enbridge and Toronto Hydro. Smart metering systems can be used for real time monitoring and annual reporting. Given the relative size and potential large number of participants, monitoring may need to defer to prescribed savings and costs.

Incentive Options

The incentive options selected for the Low-Rise Residential sector are:

- Implementation using existing incentives
- New funding mechanism
- New website applications for sector and resident metering

Roles and Responsibilities

City of Toronto

- Sector partner selection and agreement
- Develop funding options
- Pooling of existing incentive programs
- Website application development

Sector Partner

- Program sales and marketing
- Collaboration on program development
- Monitoring and verification of savings
- Website support and delivery

Planning Milestones

The planning milestones are provided as a reference for detailed planning. The final plan will depend on input from the sector partner. Milestones are ordered in time sequence.

- Selection of sector partners and definition of roles
- Sector partner agreement
- Finalize the program modules for the plan
- Development of funding options
- Pooling of stakeholders on existing incentive programs

- Development of smart metering program (integrated)
- Development of pilot sector web site and beta testing
- Sales and marketing (ongoing)
- Finalize web applications and support
- Monitoring reporting

6.5 Industrial

Sector Description

The Toronto Industrial building sector represents 18 percent of floorspace and consumes 10 percent of electricity use and 14 percent of the natural gas use.

Industrial buildings include small industrial shops, large industrial factories, and warehouse buildings. The industrial use buildings in Toronto are mainly associated with light industry activity, although there are still some pockets of heavy industry.

Industrial building stock was built mostly during the post WW II area. The older industrial buildings in Toronto have been renovated for non-industrial use. The heating systems are typically gas-fired unit heaters, with rooftop heating/cooling units which are operating at relatively low efficiencies. Most Industrial buildings have their own electricity and gas meters.

The energy end use profile for an industrial building used for manufacturing is usually dependent on the process energy use. The sector pie charts show that Toronto industry is high on fuel use and low on electricity use, generally for the following reasons:

- Limited or non-existing insulation levels in walls and roofs, and poor quality windows;
- Significant ventilation and exhaust air requirements; and
- Process requirements such as furnaces for heat treatment and paint drying.

The focus of this report is building energy use; energy for industrial processes is outside the scope of the report.

Sector Barriers

The following barriers apply to the Industrial sector:

- Misplaced or split incentives
- High information or search costs

The business planning horizon for industrial business owners is no more than five years. Markets can change quickly and industry must change production to match market needs. Industrial business owners look for short term paybacks from energy projects. Capital funding is constrained by business budgets. Investments that can increase sales are preferred over investments that reduce expenses. Operating budgets are separate from capital budgets. There is also a strong emphasis on maintaining production, and energy is a small item on the profit and loss compared to labour and other costs.

Delivery Channels for Leverage

The possible delivery channels for the Industrial sector are:

Enbridge offers a full suite of programs targeting the industrial sector, with the audit program offering a well-developed existing infrastructure which could be easily leveraged as part of a comprehensive industrial audit program. Toronto Hydro also offers programs targeted at the Industrial sector.

Industry associations are specific to the industry. One example is the Automotive Parts Manufacturers Association. No single industrial association can effectively represent all industrial owners.

NRCan has been very active in the Industrial Sector through their Canadian Industry Program for Energy Conservation and the Industrial Energy Innovators Program. Enbridge participates in both of these, which have now been re-branded under the ecoEnergy brand. Enbridge will be the best partner for delivery in the Industrial sector due to the large natural gas use in this sector and the fact that Enbridge is already active and highly successful in delivering energy efficiency programs.

Links to Current Programs and Best Practice

The current programs with the best correlation for the Industrial sector are:

- OPA – 150MW program through BOMA, for building retrofits only
- Enbridge – Industrial audit and Steam Saver programs, and the high efficiency boiler incentive
- NRCan – ecoEnergy program providing up to 25percent of project costs

Program Description

Audit

Existing programs provide audit incentives. The main program requirement will be to work with Enbridge and NRCan to create a common incentive which can be understood by Industrial sector stakeholders.

Implementation

The OPA retrofit incentive and audit incentives must drive implementation. The OPA incentive will drive interest in energy retrofits. Other incentives offered by Enbridge and NRCan can be pooled where appropriate.

An O&M training program will not be effective since most maintenance activity on the industrial buildings is contracted out to service companies.

Monitoring

Monitoring of the retrofit projects will be based on the use of a common energy accounting software program (e.g., Metrix), however field audits of retrofits are necessary to evaluate actual savings.

Enbridge's current infrastructure brings fully developed monitoring and verification capabilities.

Incentive Options

The incentive options selected for the Industrial sector are:

- Audit incentives using existing programs;
- Implementation using existing incentives; and
- New website application for sector.

Roles and Responsibilities

City of Toronto

- Sector partner selection and agreement
- Pooling of existing incentive programs
- Website application development

Sector Partners (Enbridge and Toronto Hydro)

- Program sales and marketing
- Collaboration on program development
- Monitoring and verification of savings

Planning Milestones

The planning milestones are provided as a reference for detailed planning. The final plan will depend on input from the sector partner. Milestones are ordered in time sequence.

- Selection of sector partners and definition of roles
- Sector partner agreement
- Finalize the program modules for the plan
- Pooling of stakeholders on existing incentive programs
- Development of pilot web site and beta testing
- Sales and marketing (ongoing)
- Finalize web applications and support
- Monitoring reporting (ongoing from energy reports and from web application)

Policy Implications

The policy implications for the Industrial sector are limited to the application of renewable technologies to existing industrial buildings.

6.6 Schools

Sector Description

The Schools building sector represents 5 percent of floorspace, and consumes 5 percent of electricity and 4 percent of natural gas.

The School building sector has two sub-sectors: publicly funded schools and private schools. This report covers the two publicly funded school boards: Toronto District School Board (“TDSB”) and the Toronto Catholic District School Board (“TCDSB”). The TDSB has approximately 550 schools in Toronto and the TCDSB has 201 schools. Private schools are a very small energy user compared to the larger boards.

School boards have been very active with energy retrofits in past years. Each board has been involved with an energy service company agreement, where savings are used to repay investment in energy efficiency measures. The payback period of measures was typically less than ten years.

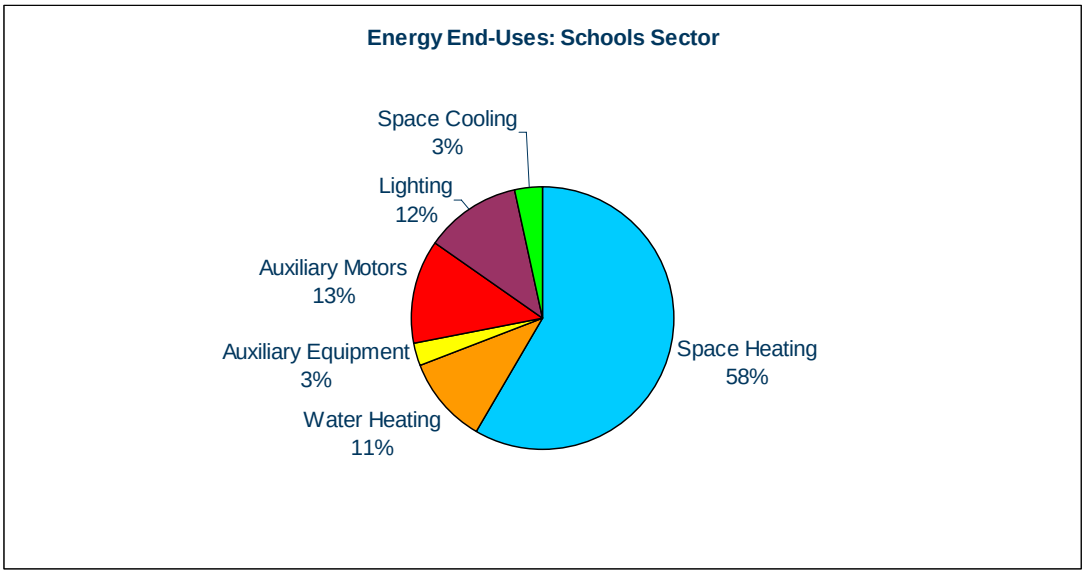
The school boards are required by the Ministry of Education to submit a detailed capital forecast for each school building using RECAPP software. This software can forecast the future capital funding for each building component. The Ministry of Energy has also passed a bill called *The Energy Conservation Leadership Act (2006)* which requires all school boards in Ontario to submit an energy plan. The boards will likely complete their energy plans during the 2007-2008 school year. No attempt is being made to integrate the asset management plans with the proposed energy plan. The alignment of comprehensive energy retrofit measures with the capital forecast for school renewal must be developed to minimize capital spending on school buildings.

The issue of energy and the environment is covered within the school curriculum during two significant school years. Grade 5 science has a large component about energy, while Grade 9 geography has a significant component on energy and the environment. The education component for students is unique to the Schools and the University and College sectors. The students in the Schools sector also provide a link to the Residential sectors since the students represent 50 percent of the homes within the City of Toronto.

The TDSB has been active with a program called EcoSchools which promotes the development of good environmental practices. The focus is activity based in order to achieve a specific rating, similar in concept to the LEED rating. EcoSchools is designed to engage students in learning by using their school as a “learning lab”. The Ministry of Education and the Ministry of Environment have recently endorsed the use of the EcoSchools program in all Ontario schools.

The typical energy end use profile for a school building is shown below.

Figure 6-5: Energy End Uses: Schools Sector



Sector Barriers

The following barriers apply to the Schools sector:

- Misplaced or split incentives
- High information or search costs

School boards have a funding formula for facility operation and maintenance costs. The provincial funding formula also dictates the allocation of capital for replacement and renewal

of school building systems. The capital funding formula provides about $1.00 per sq ft of school floor area per year, which is not adequate for school buildings older than twenty years. The level of funding needed is about 2 percent of building replacement value each year, which translates into a level of about $3.00 per sq ft per year. The current focus of the Ministry of Education is to define the unfunded capital renewal liabilities in each board and to define school buildings, which should be abandoned due to the excessive costs of upgrades and renewal.

School boards have primarily used energy service companies to fund energy retrofits. The term of the agreements has not reflected “life cycle” thinking, and the energy retrofit measures have not been aligned with the capital forecasts in RECAPP. School boards are unlikely to invest in long term energy retrofits given the provincial funding formula. The focus most likely will be on the schools that should be closed due to excessive unfunded renewal liability.

The school boards in Toronto have large plant departments and a good grasp of energy management concepts and technologies, with each board having experience with large energy retrofits, training and technology transfer. The main barrier is the knowledge to link asset management with energy management. The capital forecast for renewal must be aligned with the selection of measures for energy retrofits. The development of consistent documentation and standards of performance for building O&M is a related issue.

Delivery Channels for Leverage

The school associations are not appropriate as channel partners in this sector since there are only two school boards in Toronto. The two channel partners will be the TDSB and the TCDSB.

The primary contact with each board should be at the Superintendent of Business level, which is responsible for the facility asset management and operation of schools. The understanding of the capital forecast and the alignment with energy measures and payback is a key component to gain commitment for comprehensive retrofits.

Energy management also involves the school occupants. The opportunity to integrate teachers and the students’ learning about energy and the environment should not be missed. The right approach will be to develop a plan that includes both facilities and student education components.

Links to Current Programs

The current programs with the best correlation for the Schools sector are:

- Enbridge and City of Toronto new building programs
- City of Toronto – Water saving measures
- OPA – 90 MW program through the City of Toronto
- Enbridge – conversion incentive, audit incentive, high efficiency boiler incentive
- NRCan – ecoEnergy program up to 25percent of project costs
- BBP – training and technical assistance
- OPA – Standing Offer Program for renewable energy

Program Description

Audit

Existing programs provide audit incentives. The main program requirement will be to work with OPA agreements, Enbridge, NRCan and BBP to create a common incentive. The main goal of the audit phase will be to define the audit parameters required for the funding options (if applicable).

Implementation

The OPA incentive will drive implementation. The Clinton Foundation Fund or similar mechanism can drive comprehensive retrofit by dictating the term of the agreement (life cycle costing). The agreement term will provide the linkage between energy efficiency measures and the RECAPP capital forecast for asset management of building systems. Other incentives offered by Enbridge, BBP and NRCan can be pooled where appropriate.

The implementation can work closely with the City's efforts toward meeting its 90 MW program target. The selection of comprehensive measures for natural gas and water can be combined with the electricity measures. A web based application will provide communication to teachers and students about energy use. Student lesson plans which fit with Grade 5 and Grade 9 curriculum can be integrated with the web application.

Barriers related to management commitment can be overcome at the negotiation phase with the 90 MW program. The main issue will be the term of repayment and the financing mechanism. An O&M workshop is needed for plant personnel to deal with the issue of standards of performance and building documentation for energy efficiency.

Monitoring

Monitoring of the retrofit projects could utilize the OPA agreement as they both have the need to monitor natural gas and water savings in addition to electricity savings and demand reduction. Interval metering is installed in the larger schools and can be accessed through Toronto Hydro. Ideally, this information can be made web accessible.

The school boards already use energy accounting software to monitor energy use on a monthly basis. This information can be added to the web application and can be updated monthly to measure the progress.

Incentive Options

The incentive options selected for the Schools sector are:

- Audit incentives using existing programs;
- Implementation using existing incentives;
- Clinton Fund or similar mechanism;
- New website application for energy learning; and
- New workshop for O&M personnel.

Roles and Responsibilities

City of Toronto

- Sector partner selection and agreement
- Develop funding options.

- Pooling of existing incentive programs
- Selection and agreement with training partner
- Website application development
- O&M training development

Sector Partner

- Program structuring and acceptance
- Collaboration on program development
- Monitoring and verification of savings
- Delivery of training programs with training partner

Planning Milestones

The planning milestones are provided as a reference for detailed planning. The final plan will depend on input from the sector partner. Milestones are ordered in time sequence.

- Definition of roles for City and the school boards
- Sector partner agreements
- Finalize the program modules for the plan
- Development of funding options
- Pooling of stakeholders on existing incentive programs
- Development of 90 MW agreement
- Development of pilot sector web site and beta testing
- Development of training program (O&M energy efficiency, standards of performance)
- Selection of training partner
- Finalize web applications and support
- Monitoring reporting (ongoing from energy reports and from web application)

Policy Implications

The policy issues for the Schools sector relate directly to the Ministry of Education funding formulae. Technically, school boards are accountable for the school buildings. Accountability implies both responsibility and authority. The board is responsible but lacks any authority over the funding formulae.

The school board can use the capital forecast and the energy plan to optimize capital spending on school facilities. Energy savings and operating cost savings can be capitalized to provide additional spending for school building renewal. The Ministry of Education must bear the ultimate responsibility for building depreciation, if the capital funding formulae provides too little funding.

There are no known City of Toronto policy impediments to energy efficiency projects in schools.

6.7 Colleges and Universities

Sector Description

The Colleges and Universities sector represents 1 percent of floorspace, and consumes 2 percent of electricity and 1 percent of natural gas.

The Colleges and Universities sector has two sub-sectors. The community colleges in the Toronto area are Centennial College, George Brown College, Humber College and Seneca College. The universities in Toronto are Ryerson University, University of Toronto and York University.

Community colleges were developed in the 1960s and have grown rapidly since that period. Existing buildings are now reaching the stage of significant building renewal since most original buildings are now more than thirty years of age. Community colleges in Ontario recently received a grant to develop an Energy Secretariat which is located in Toronto.[38] The purpose of the Energy Secretariat is to assist colleges with the development of energy plans and to secure incentives available for energy projects. The community colleges have been active in energy management projects. The typical payback period of measures has been less than ten years.

University buildings are older on average, with the exception of York University buildings. University facility departments have a strong technical staff. Like college buildings, they have no building operator in each building. The building operation is managed by building automation systems and a mobile maintenance staff. The Universities sector has been very proactive concerning the issues of building renewal and capital forecasting. The principal associations that represent universities are the Ontario Association of Physical Plant Administrators (“OAPPA”) and the Canadian Association of University Business Officials (“CAUBO”).

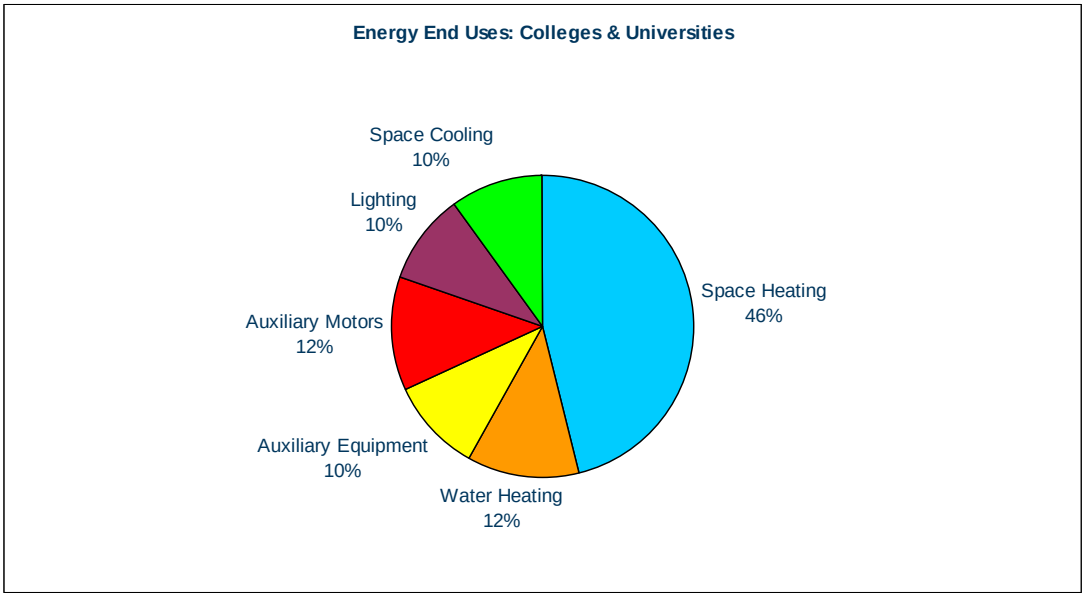
The fuel use is primarily natural gas in this sector. The University of Toronto has a connection to the Enwave system, however, they do not use much Enwave steam. The natural gas boilers are typically capable of dual fuel use to obtain a lower natural gas rate. Both the University of Toronto and York University have gas turbine CHP plants that generate heat and electricity for their campuses.

The Energy Conservation Leadership (2006) applies to colleges and universities since this sector receives public funding from the Government of Ontario. The requirement to prepare an energy plan will be addressed in the fiscal year April 2007 to March 2008.

The typical energy end use profile for a college or university building is shown in Figure 6-6.

[38] Formed in July 2006 with an OPA grant

Figure 6-6: Energy End Uses: Colleges & Universities Sector



Sector Barriers

The following barriers apply to the Colleges and Universities sector:

- Misplaced or split incentives
- High information or search costs

The lack of money is a significant barrier in this sector. The Ontario government has provided funding for infrastructure renewal projects but the sector is being under-funded and the deferral of capital has become critical for older buildings. Budget constraints force energy retrofits to compete with other projects. Shorter payback projects receive most of the energy funding.

The main barrier is the knowledge to link asset management with energy management. The capital forecast for renewal must be aligned with the selection of measures for energy retrofits. The development of consistent documentation and standards of performance for building O&M is also a related issue.

Environmental and energy issues have recently received considerable attention in this sector. The environmental strategies are often driven from the academic side, whereas, the energy strategies are driven by the facilities department. This sector has a unique opportunity to develop a plan that includes the academic and facility requirements. The institutions need a comprehensive strategy at the board level and the means to fund the strategy and retrofits.

Delivery Channels for Leverage

The logical partner for Colleges is the Energy Secretariat which has a mandate to help with energy plans and incentives. The Energy Secretariat will not cover the asset planning issues with college financial officers directly, however, the Energy Secretariat can work with the financial officers to ensure that asset plans and energy plans are in alignment.

The best partner for Universities is the OAPPA since this organization has worked with asset issues and energy issues. The CAUBO organization is a possible partner, but CAUBO has a

broader mandate and less of an energy and facilities focus. This sector has also used a company called VFA for asset capital forecasting. The capital forecasting must be aligned with the energy plan.

Links to Current Programs

The current programs with the best correlation for the Colleges and Universities sector are:

- Enbridge and City of Toronto new building programs
- City of Toronto – Water saving measures
- OPA – 90 MW program through City of Toronto with incentives of $400 per kw
- Enbridge – conversion incentive, audit incentive, high efficiency boiler incentive
- NRCan – ecoEnergy program up to 25percent of project costs
- BBP – training and technical assistance
- OPA – Standard Offer Program for PV, Wind and bio-fuel generation

Program Description

Audit

Existing programs provide audit incentives. The main program requirement will be to work with OPA agreements, Enbridge, NRCan and BBP to create a common incentive. The main goal of the audit phase will be define the audit parameters required for the conservation funding options.

Implementation

The Clinton Foundation Fund or similar mechanism and the OPA incentive will drive implementation. The fund requirements can drive comprehensive retrofit by dictating the term of the agreement (life cycle costing). The agreement term will provide the linkage between energy efficiency measures and the VFA capital forecast for asset management of building systems. Other incentives offered by Enbridge, BBP and NRCan can be pooled where appropriate.

The implementation could be combined with the efforts on the 90 MW program. The selection of comprehensive measures for natural gas and water can be combined with the electricity measures. A web based application will provide communication to professors and students about energy use.

Barriers related to management commitment can be overcome at the negotiation phase with the 90 MW program. The main issue will be the term of repayment and financing mechanism. An O&M workshop is needed for facility personnel to deal with the issue of standards of performance and building documentation for energy efficiency.

Monitoring

Monitoring of the retrofit projects could utilize the OPA agreement as they both have the need to monitor natural gas and water savings in addition to electricity savings. Interval metering is installed in the larger buildings and can be accessed through Toronto Hydro. Ideally, this information can be made web accessible.

The Colleges and Universities sector already use some type of energy accounting software to monitor energy use on a monthly basis. This information can be added to the web application and can be updated monthly to measure the progress.

Incentive Options

The incentive options selected for the Colleges and Universities sector are:

- Audit incentives using existing programs;
- Implementation using existing incentives;
- New Clinton Foundation Fund or similar mechanism;
- New website application for energy management; and
- New workshop for O&M personnel.

Roles and Responsibilities

City of Toronto

- Sector partner selections and agreement
- Develop funding options. Pooling of existing incentive programs
- Selection and agreement with training partner
- Website application development
- O&M training development

Sector Partner

- Program structuring and acceptance
- Collaboration on program development
- Monitoring and verification of savings
- Delivery of training programs with training partner

Planning Milestones

The planning milestones are provided as a reference for detailed planning. The final plan will depend on input from the sector partner. Milestones are ordered in time sequence.

- Definition of roles for City and College or University
- Sector partner agreements
- Finalize the program modules for the plan
- Development of funding options
- Pooling of stakeholders on existing incentive programs
- Development of 90 MW agreement and coordination of water and natural gas
- Development of pilot sector web sites and beta testing (University and College)
- Development of training program (O&M energy efficiency, standards of performance)
- Selection of training partner
- Finalize web applications and support
- Monitoring reporting (ongoing from energy reports and from web application)

Policy Implications

The policy issues for the Colleges and Universities sector relate to the capital funding issues for an aging building infrastructure. The lack of sufficient capital funds has led to deferral of capital projects for building renewal.

There are no known City of Toronto policy impediments to energy efficiency projects in schools.

6.8 Healthcare

Sector Description

The Healthcare sector represents 3 percent of floorspace, and consumes 6 percent of electricity and 3 percent of natural gas.

Healthcare floor space includes hospitals, clinics, labs, medical offices and long-term healthcare buildings. Hospitals make up the majority of the healthcare building space in Toronto.

The hospitals on the University Avenue corridor use Enwave central steam rather than having natural gas fired boilers.

The hospitals have been very active with energy retrofits in past years. Hospitals have used energy service companies ("ESCOs") and have developed their own energy projects using engineering design assistance. Most hospitals have a Director of Engineering Services ("DES") responsible for facility operation and maintenance. The DES is usually a member of the Canadian Healthcare Engineering Society ("CHES").

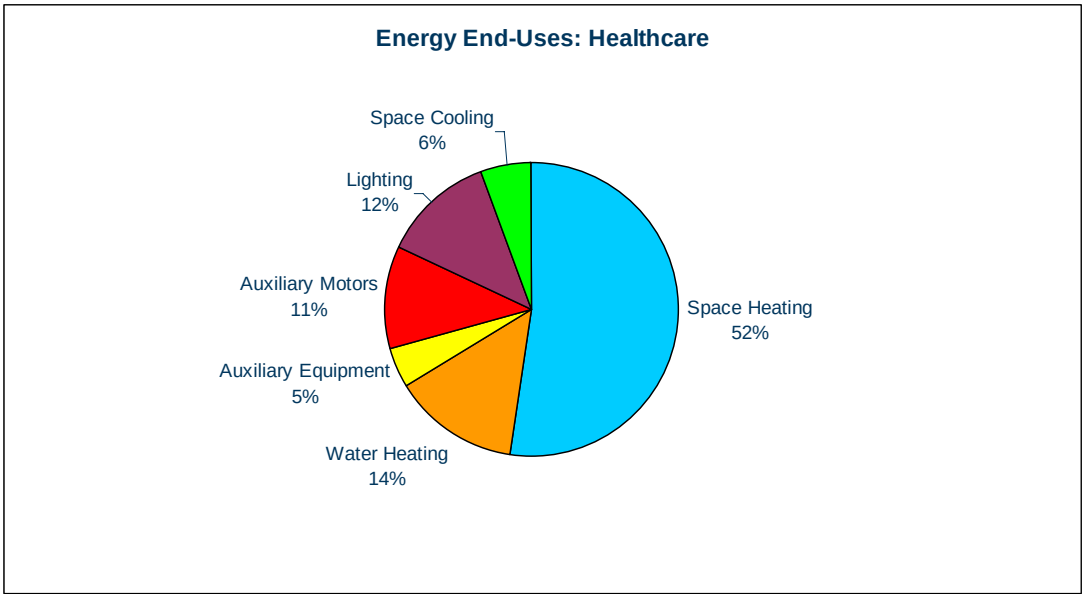
Hospitals have been challenged to balance their budgets during the last ten-year period. Budget deficits have placed pressure on hospital facility managers to reduce operation costs and defer spending on capital replacements for building systems.

The Ministry of Energy has also included hospitals under *The Energy Conservation Leadership Act (2006)*, requiring each to develop an Energy Plan. The hospitals will likely complete their energy plans in the April 2007 to March 2008 fiscal period. The alignment of comprehensive energy retrofit measures with the capital forecast for hospital renewal must be developed to minimize capital spending on hospital buildings.

The Ontario Hospital Association ("OHA") provides the forum for discussion of hospital issues among senior executives. The Ontario Hospital Association is organized into regions with one region being the Greater Toronto Area. Hospital CFOs meet on a regular basis to discuss common challenges and share best practices.

The typical end use profile for a healthcare building is shown in Figure 6-7.

Figure 6-7: Energy End Uses: Healthcare Sector



Sector Barriers

The following barriers apply to the Healthcare sector:

- Misplaced or split incentives
- High information or search costs
- Organizational practices or custom

Hospitals have been strongly impacted by the reduction of federal transfer payments and the subsequent amalgamation of hospitals in the Toronto area starting in 1995. The reduction of heathcare budgets placed significant stress on facility budgets. Major capital projects were deferred due to lack of money, and energy related projects were focused on shorter term paybacks due to lack of money within hospital budgets.

Hospital Plant personnel have a good grasp of energy management concepts and technologies, and have experience with large energy retrofits. The use of commissioning is most prevalent in hospitals with their more complex systems. The main barrier is the knowledge to link asset management with energy management. The capital forecast for renewal must be aligned with the selection of measures for energy retrofit, and funding must be made available for longer payback items. The development of consistent documentation and standards of performance for hospital O&M is a related issue.

Delivery Channels for Leverage

The two best partnering options for Healthcare sector buildings will be the Toronto regional chapters of the OHA and CHES.

The OHA is the best partner for leverage, since the barrier issues are linked directly to the CFO position. The financial support must be in place to support longer payback energy retrofits which align with the asset management plan and the capital forecast.

CHES can be an effective partner for the delivery of O&M related training for hospitals.

Links to Current Programs

The current programs with the best correlation for the healthcare sector are:

- Enbridge and City of Toronto new building programs
- City of Toronto – Water saving measures
- OPA – 90 MW program through City of Toronto with incentives of $400 per kW
- Enbridge – conversion incentive, audit incentive, high efficiency boiler incentive
- NRCan – EcoEnergy program up to 25percent of project costs
- BBP- training and technical assistance
- OPA Standard Offer Program for PV and bio-fuel generation

Program Description

Audit

Existing programs provide audit incentives. The main program requirement will be to work with OPA agreements, Enbridge, NRCan and BBP to create a common incentive. The main goal of the audit phase will be to define the audit parameters required for the funding options (if applicable).

Implementation

The potential use of the Clinton Foundation Fund and the OPA incentive of $400 per kW will drive implementation. The funding requirements and rules can drive comprehensive retrofit by dictating the term of the agreement (life cycle costing). The agreement term will provide the linkage between energy efficiency measures and the capital forecast for asset management of building systems. Other incentives offered by Enbridge, BBP and NRCan can be pooled where appropriate.

The implementation could work with the efforts on the 90 MW program. The selection of comprehensive measures for natural gas, central steam and water can be combined with the electricity measures. A web based application can provide communication to healthcare workers to involve them in energy management efforts.

Barriers related to management commitment can be overcome at the negotiation phase with the 90 MW program. The main issue will be the term of repayment and financing mechanism. An O&M workshop is needed for hospital plant personnel to deal with the issue of standards of performance and building documentation for energy efficiency.

Monitoring

Monitoring of the retrofit projects could utilize the OPA agreement as they both have the need to monitor natural gas and water savings in addition to electricity savings. Interval metering is installed in the most healthcare buildings (all buildings with electrical demand above 100 kW have interval meters) and can be accessed through Toronto Hydro. Ideally, this information can be made web accessible.

The hospitals are energy intensive and will benefit from sub-metering of all types of energy use.

Incentive Options

The incentive options selected for the Healthcare sector are:

- Audit incentives using existing programs;
- Implementation using existing incentives;
- New Clinton Foundation Fund or similar mechanism;
- New website application for energy management; and
- New workshop for O&M personnel.

Roles and Responsibilities

City of Toronto

- Sector partner selections and agreement
- Develop funding options. Pooling of existing incentive programs
- Selection and agreement with training partner
- Website application development
- O&M training development

Sector Partner

- Program structuring and acceptance
- Collaboration on program development
- Monitoring and verification of savings
- Delivery of training programs with training partner

Planning Milestones

The planning milestones are provided as a reference for detailed planning. The final plan will depend on input from the sector partner. Milestones are ordered in time sequence.

- Definition of roles for City and healthcare sector partners
- Sector partner agreements
- Finalize the program modules for the plan
- Development funding options
- Pooling of stakeholders on existing incentive programs
- Development of 90 MW agreement
- Development of pilot sector web site and beta testing
- Development of training program (O&M energy efficiency, standards of performance)
- Selection of training partner
- Finalize web applications and support
- Monitoring reporting (ongoing from energy reports and from web application)

Policy Implications

The policy issues for the Healthcare sector relate directly to the Ministry of Health and Long Term Care's funding formulae. Technically, the Hospital Board is accountable for the

hospital buildings. Accountability implies both responsibility and authority. The Hospital Board is responsible but the Board lacks any authority over the funding formulae. As a result, many hospitals have increased local community fundraising to address budget issues and new building requirements.

There are no known City of Toronto policy impediments to energy efficiency projects in hospitals.

6.9 Municipal

Sector Description

The Municipal building sector represents 2 percent of floorspace, 4 percent of electricity use and 2 percent of natural gas use (excluding social housing expenditures on energy), and includes the following types of organizations:

- City of Toronto Corporate Government
- City Agencies, Boards and Commissions
- Social Housing

Social housing has already been covered under the MUR sector template. The remainder of the municipal buildings include Works buildings, TTC, EPCT, Exhibition Place, Metro Zoo, TEDCO, Arena Boards, AOCC, TPL, Parking Authority, Ambulance and Fire buildings. This template excludes the TTC's transportation energy related issues.

The Energy and Waste Management Office ("EWMO") acts as the energy manager and coordinator for most municipal buildings. The previous five year Energy Plan developed by the EWMO in 2003 contained the following sections:

Report Section	Topic
1.0	Energy Supply
1.1	Electricity
1.2	Natural Gas
1.3	Green Power
2.0	Energy Efficiency
2.1	Energy Retrofits
2.2	New Technology
2.3	Energy Efficiency Guidelines for the Construction of New Buildings
2.4	Training, Education and Communications
3.0	Energy Information Monitoring & Tracking
3.1	Enhanced Energy Information System
3.2	Expanded Information System

Key objectives of the 2003 Energy Plan were:

- A reduction of GHG emissions by 20percent from 1990 levels;
- Use of 25percent renewable energy in existing buildings; and
- Green development standard guidelines for new municipal buildings.

This Energy Plan also had a strong focus on energy monitoring for all municipal buildings and energy retrofits to reduce energy use and CO_2 emissions. Energy Cap was selected as the energy accounting software for the creation of energy baseline use and the monitoring of energy savings. The program uses monthly utility bill data for tracking energy use. Energy Cap also has the ability to accept interval meter data from utility meters.

The original objectives of the Energy Plan are still reasonable goals for the short term. Moving forward, these City objectives could be expanded to embrace asset management needs, to develop standards of performance for building systems and documentation, and to add real time metering within a building automation strategy.

The City of Toronto and the associated ABCs must also develop an asset planning system to deal with the Public Accounting Standards Board requirement that municipalities create a balance sheet for the value of their infrastructure, and be able to track capital expenditures against asset value. The requirements apply to buildings and must be completed by the year 2009.

Sector Barriers

The following barriers apply to the Municipal sector

- Misplaced or split incentives
- High information or search costs

The lack of money is a significant barrier as budget constraints force energy retrofits to compete with other municipal projects. Shorter payback projects receive most of the energy funding. The requirement for municipalities to create a balance sheet and asset management plan for building infrastructure by 2009 provides a unique opportunity to align the asset management plan and the Energy Plan to optimize the capital spent on City buildings.

Environmental and energy issues have recently received considerable attention in the Municipal sector. The management commitment and leadership started with the BBP and EWMO. The development of the Climate Change Plan and the Toronto Energy Plan can now put the resources in place for the City to succeed in meeting its targets and objectives.

Delivery Channels for Leverage

The training initiatives for property managers, asset managers and O&M personnel will be developed through the EEO since the EEO must work with multiple sectors. The EEO training partners can work with the EWMO to create suitable training and technology transfer.

Links to Current Programs

The current programs with the best correlation for the Municipal building sector are:

- Enbridge and City of Toronto new building programs
- City of Toronto – Water saving measures
- OPA – 90 MW program through City of Toronto with incentives of $400 per kw
- Enbridge – conversion incentive, audit incentive, high efficiency boiler incentive
- NRCan – ecoEnergy program up to 25percent of project costs
- BBP – training and technical assistance
- OPA – Standard Offer Program for PV, Wind and bio-fuel generation

Program Description

Audit

Existing programs provide audit incentives. The main program requirement will be to work with OPA agreements, Enbridge, NRCan and BBP to create a common incentive. The main goal of the audit phase will be define the audit parameters required for the funding options.

Implementation

The OPA incentive of $400 per kW will drive implementation, with the Clinton Foundation fund also a potential driver. The fund regulations and rules could drive comprehensive retrofits by dictating the term of the agreement (life cycle costing). The agreement term will provide the linkage between energy efficiency measures and the capital forecast for asset management of building systems. Other incentives offered by Enbridge, BBP and NRCan can be pooled where appropriate.

The implementation should be integrated with the efforts on the 90 MW program. The selection of comprehensive measures for natural gas and water can be combined with the electricity measures. A web based application will provide communication to ABCs using Energy Cap software.

Barriers related to management commitment can be overcome at the negotiation phase with the 90 MW program. The main issue will be the term of repayment and financing mechanism. An O&M workshop is needed for facility personnel to deal with the issue of standards of performance and building documentation for energy efficiency.

Monitoring

Monitoring of the retrofit projects could utilize the OPA agreement as they both have the need to monitor natural gas and water savings in addition to electricity kWh and kW savings. Interval metering is installed in the larger buildings and can be accessed through Toronto Hydro. Ideally, this information can be made web accessible.

The Energy Cap software will be used to monitor savings and real time metering will be phased into the larger buildings.

Incentive Options

The incentive options selected for the Municipal sector are:

- Audit incentives using existing programs;
- Implementation using existing incentives;
- New conservation fund loan option;
- New website application for energy management; and
- New workshop for O&M personnel.

Roles and Responsibilities

City of Toronto

- Sector partner selections and agreement
- Develop funding options. Pooling of existing incentive programs
- Selection and agreement with training partner

- Website application development
- O&M training development
- Asset management training development
- Program structuring and acceptance
- Collaboration on program development
- Monitoring and verification of savings
- Delivery of training programs with training partner

Planning Milestones

The planning milestones are provided as a reference for detailed planning. The final plan will depend on input from the sector partner. Milestones are ordered in time sequence.

- Definition of roles for City
- Finalize the program objectives and modules for the plan
- Development funding options
- Pooling of stakeholders on existing incentive programs
- Allocation of responsibility for demand reduction under the 90 MW agreement
- Development of pilot sector web site and beta testing
- Alignment of capital forecasting and energy retrofit measures
- Development of training programs (O&M energy efficiency, standards of performance)
- Selection of training partner
- Finalize web applications and support
- Monitoring reporting (ongoing from energy reports and from web application)

Policy Implications

The policy implications for the City will involve new building guidelines, use of renewable technologies in existing buildings, and the development of best practices in the integration of energy management with asset management.

City of Toronto Buildings Energy Plan Issues

One of the most significant issues related to the development of an Energy Plan for City buildings and the buildings of its ABCs is the new accounting requirements for asset accounting of municipal infrastructure. The background on the Public Sector Accounting Board's requirement is shown below.[39]

[39] From the Ontario Municipal Benchmarking Initiative's ("OMBI") Guide March 2007

Figure 6-8: Public Sector Accounting Board Requirements

The Public Sector Accounting Board's PS3150 presents Canadian and Ontario municipalities with a whole new approach to accounting for tangible capital assets. Starting in 2009, capital asset accounting will follow what many recognize as a "private sector model." That is, assets that meet the definition of "tangible capital" will be capitalized on acquisition and their cost allocated to future accounting periods through an annual amortization expense. Multi-year construction projects will be reported as asset "work in progress" until capitalized on completion.

There are other coincident changes in reporting standards as well. *PSAB Handbook* Sections 1000, 1100 and 1200 have all been amended to require that municipalities change certain elements of their existing reporting approach by the year 2009. The sum of these changes is to move from the present "modified accrual" (in some cases, "cash") basis of accounting to "full accrual."

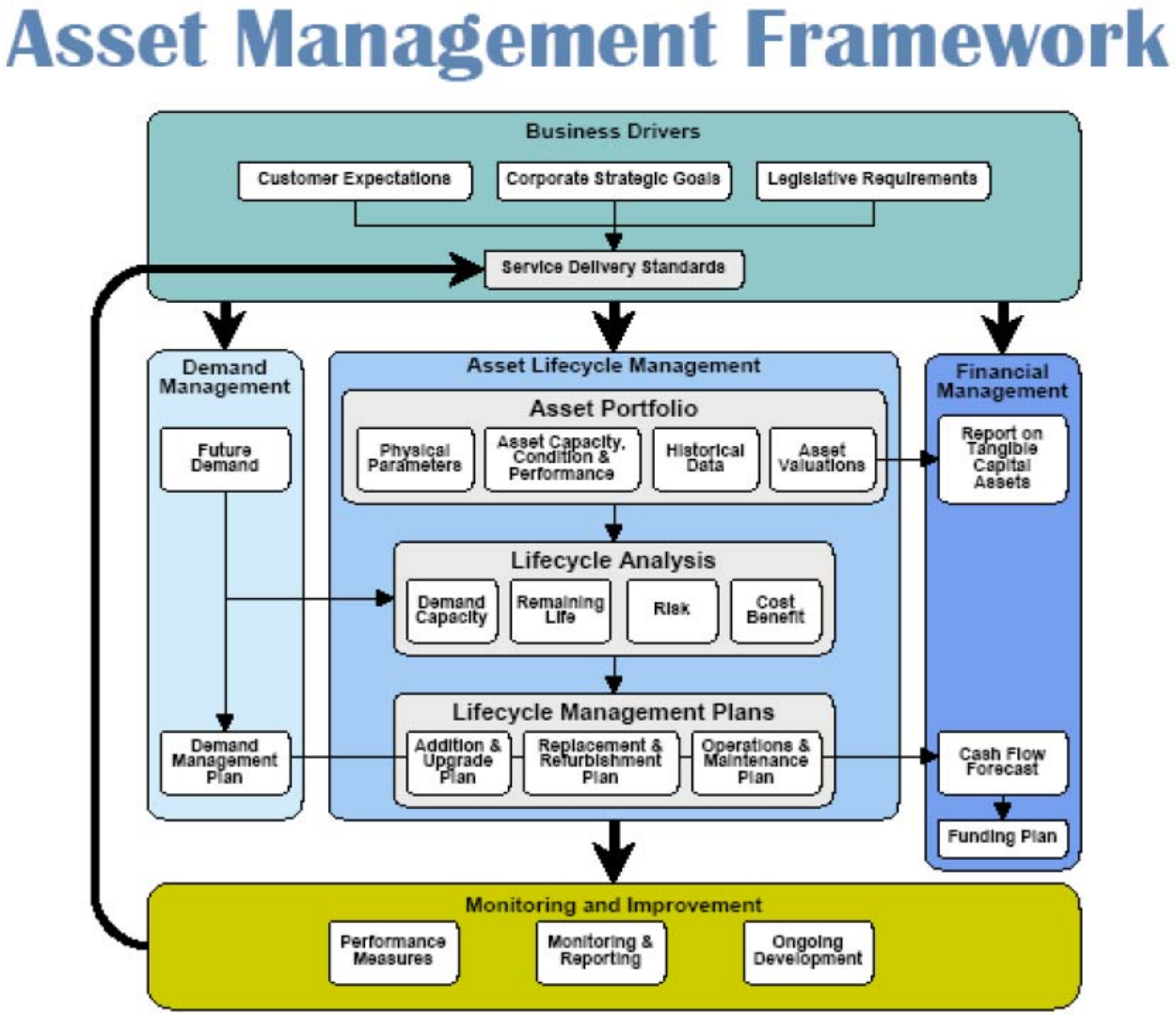
Together, these changes will require municipalities to change their processes for reporting, budgeting and day-to-day accounting for tangible capital assets. They will need to carry out a fairly extensive list of tasks to be able to comply with the new standards.

This manual has been developed to assist Ontario municipalities to do just that. It covers what will be required for the initial asset valuation for January 1, 2009, and then looks at the ongoing work that will be required to maintain tangible capital assets accounts after January 1, 2009.

Development of a Strategic Framework for Energy and Environmental Activities

The development of a strategic framework for energy and environmental activities will need to recognize the framework of asset management in buildings. The asset management framework is shown in Figure 6-9, and is taken from the OMBI reference guide.

Figure 6-9: Asset Management Framework[40]



The principal processes in the framework are facility planning and capital planning for building replacement and renewal. Energy management is directly related to Life Cycle Management Plans as shown in the diagram. Energy efficiency measures must be in alignment with the City buildings capital forecast for replacement and refurbishment.

Best practice indicates that the City should move to a Capital Plan that will incorporate the following features:

- Complete inventory of all building assets

[40] From the Ontario Municipal Benchmarking Initiative's ("OMBI") Guide March 2007

- Nomenclature for describing the assets
- Useful life of each building component
- Replacement cost of each building component
- Priority system for ranking capital need

The Capital Plan can then forecast all capital expenditures for each building and establish funding priorities. The un-funded projects can also be tracked as a measure of building condition. The Facility Condition Index is defined as the un-funded capital project value divided by the entire building replacement cost and expressed as a percentage. The Capital Plan is important to energy projects, as many energy measures involve some form of building renewal. For example, the replacement of an old roof with a new energy efficient roof includes two components:

1. Purchase of a replacement roof (renewal capital); and
2. Purchase of the additional insulation to achieve energy savings.

Most comprehensive energy measures will involve some form of building renewal and component replacement. Strategically, the City should want to maximize the use of energy savings measures to fund building renewal in the Capital Plan. The planning and operation functions are also linked by their information requirements. Figure 6-10 shows the linkages.

Figure 6-10: Asset Management Framework Linkages[41]

Asset Management Framework

	FACILITY PLAN	CAPITAL PLAN	OCCUPANTS	OPERATIONS	MAINTENANCE	ENERGY MANAGEMENT
Process	Need / Enrollment	Inventory	Inputs	Standards & Documentation	Inputs	Audit
	Functions / Technology	Assessment	Activities	Operate / Control	Repair / PM	Measure Implementation
	Space Forecast	Capital Forecast	Monitor & Outputs	Monitor & Outputs	Monitor & Outputs	Monitor & Outputs
IT need to manage asset	Building / Space nomenclature	Building Asset register	Occupancy Plans and Scheduling	Building Documentation Building / Space nomenclature Equipment nomenclature	Asset Register Equipment Nomenclature	Building Documentation Equipment Nomenclature
Links	Links to Capital Plan new building Vs Retrofit existing occupant needs Energy plan	Links to Space forecast Energy Measures Maintenance	Links to Needs Enrollment Functions Technology	Link to Maintenance Energy Management	Link to Capital Plan Replacement	Link to Capital Plan Loads Systems Plant

[41] From the Ontario Municipal Benchmarking Initiative's ("OMBI") Guide March 2007

The development of an Energy Plan for City buildings and ABC buildings should address the new PSAB 3150 changes and include the development of a coherent strategy for building system nomenclature and standards for O&M documentation of building systems.

Standards of Performance for Energy Efficient Operation

Standards of performance are needed to operate buildings efficiently. A standard of performance is by definition measurable and quantifiable. Some examples of standards of performance for buildings are:

- Desirable space temperature for heating
- Desirable domestic hot water tank temperature
- Minimum light level in a hallway
- Maximum CO2 level in occupied spaces
- Desirable mixed air temperature for an air handler
- Energy use target for a utility like water/gas/electricity

Definition of the standards is not arbitrary. The standards must reflect building code requirements, good O&M practices, and building occupant needs.

Efficient building operation must be defined in order to be managed and measured. If we cannot quantify standards for efficient operation, we will not be able to measure operation and maintenance effectiveness. We also risk having significant operation failures if we do not monitor and correct operational problems. The City of Toronto or a related organization must define accountability for O&M in each building.

Standards for Building Documentation and Nomenclature

The building drawing files provide a record of original building design and retrofit projects. No up to date “as built” drawings are usually available on file. Drawing files are expensive to maintain and each engineering designer will have a different method of drawing symbols and selecting the nomenclature of building equipment.

A plan is required to integrate the documentation needs for the following purposes:

Building Operation	Needs are system schematics and standards of performance.
Maintenance	Needs are nomenclature for building assets, equipment and a database for historical maintenance costs and activity.
Building Redesign	Needs are a standardized set of CAD drawings for schematics and building floor plans.
Asset Management	Needs are a nomenclature for building assets and a database for capital planning of asset expenditures.

The development of the asset capital forecast and the development of energy retrofit projects will provide the City with the opportunity to define the system nomenclature and the standard symbols used for CAD drawings. Energy efficiency training can easily incorporate the development of the O&M documentation.

Monitoring & Verification Options

The monitoring and verification options for utility use are:

- Energy Accounting with monthly utility bills
- Real Time Utility metering
- Building Automation integrated with real time meters

Historically, the City has relied on financial reporting to track utility costs with monthly reports. Energy Cap is an energy accounting program for monthly utility bills, however, the software does have the capability to use real time meter input. The City of Toronto is not currently using the real time metering capabilities.

The Energy Accounting software can adjust for a number of variables. The most important variables are the number of days in a meter reading period and the weather differences. For example, if we want to compare natural gas use in February of 2006 to February of 2005, we must adjust for the weather difference. Energy Cap can perform these adjustments if used properly. The software can be useful for M&V purposes by using a reference year of energy use (before retrofit measures) to compare against monthly utility use (after a retrofit). The software calculates the cost avoidance which is defined as the reduction of utility use (after adjustment for variables) at the current cost of the utility. Example: the program calculates 1000 m^3 of natural gas reduction at the current price of $0.35 per m^3 equals cost avoidance of $350.

The strengths of the Energy Cap program are:

- Toronto has already licensed the software
- Software can handle large volumes of utility bills with EDI (electronic data interchange)
- Software has real time metering data capability
- The weaknesses of the Energy Cap program are:
- Reports are historical in nature (report is already 30 days old when issued)
- Data is monthly in nature
- Software cannot adjust for all variables of occupancy and use

Energy accounting software can be used effectively for utility budgeting and utility bill verification. Although the occupancy and the use of a building may change, the energy savings can be tracked using Energy Cap with an accuracy of approximately 5 percent over an entire year. The accuracy for individual monthly comparisons is much less than the 5 percent. In summary, energy accounting software is useful for energy budgeting and energy tracking on an annual basis.

Real time metering has several advantages over monthly utility bill monitoring:

- It provides real time feedback on energy use
- Data is hourly and not monthly
- Hourly data can be linked to building automation systems

Real time metering can also be established as a standalone system for electricity, natural gas and water meters. The readings can be made web accessible, but the standalone system cannot directly relate to the dependent energy variables in a building.

The best M&V option for City buildings will be to develop a building automation system strategy that can integrate interval real time utility meter data. The building automation system has the capacity to develop target energy use profiles based on building use and outdoor air temperature. The real time meter data can then be compared directly to the target on an hourly basis. This strategy will work economically for buildings larger than about 25,000 sq ft of floor area.

Energy Plan Outline for City Owned Buildings

An outline of the City Owned Buildings Energy Plan has been prepared as a guide to assist with the incorporation of the concepts and issues presented in this report and can be found in Appendix E.

7 Preferred Energy State for Toronto

The City of Toronto's vision is to become a "clean, green, and sustainable city," an objective it has been working to achieve for a number of years. The Energy Plan for Toronto will set the stage for future actions, streamlining a wide variety of targets and priorities in order to implement energy efficiency and renewable energy programs to meet this and the City's other stated objectives. The Energy Plan will assist in fostering a new era of green-thinking in the City, one that can be used to effectively respond to the current uncertainties in the energy sector, while promoting a growing awareness of and commitment to sustainable energy technologies, whether they are related to buildings, transportation, or electricity generation.

7.1 Future Energy State for Toronto

The preferred state of energy for Toronto was outlined in the IndEco report, released on June 5, 2006. The significant attributes of this future energy state include:

Coordinated plans support and help achieve the Corporate City's energy and sustainability goals

- The Energy Plan for Toronto will be a key energy planning tool for the City, and should be updated regularly. The Energy Plan for Toronto should take an integrated approach toward energy sustainability and efficiency aimed at meeting the City's stated objective of becoming a sustainable city. It should be grounded in the need for sustainable energy infrastructure which can encourage and reward efficient generation, transmission, and distribution, together with the use of renewable energy sources and other energy-use initiatives, such as fuel substitution.

Broad-based awareness and commitment to energy sustainability, "conservation first," and green energy

- Council and senior management commitment is an essential component of the Energy Plan for Toronto. In addition, the City will need to attain commitment for its Energy Plan from stakeholders at all levels, including City agencies, municipal employees, and the general public. The City should also work with its key stakeholders to enhance its sustainability image and to create broad based recognition of Toronto as a city with a "Conservation Culture." The City will also need to work with both provincial and federal agencies in order to meet joint objectives, and to leverage any support that may be offered.

- Over the long term, the success of initiatives set out in the Energy Plan will become an integral component of creating a sustainable funding structure.

There is an integrated and coordinated City Government and ABC structure to manage energy issues

- At the operational level, the Energy Plan for Toronto will need to be supported by knowledgeable and dedicated staff and an array of financial tools which will ensure concrete actions can be taken to ensure that the City can achieve its short and long term goals. Progress of the programs implemented as part of the Energy Plan for

Toronto will need to be monitored through an integrated governance and reporting structure, and measured against appropriate targets.

- The Energy Plan for Toronto's integrated approach will link tightly with other dedicated City plans (e.g., the Sustainable Urban Development Plan, the Clean Air Action Plan, Climate Change Plan, the Exhibition Place Environmental Plan, and the Sustainable Energy Transportation Plan) already working toward sustainability and energy efficiency, in order to take advantage of any potential synergies and efficiencies.

There is a coherent system within the City Government and ABCs for consistent messaging and tracking of energy sustainability

- The City of Toronto will need to develop a communications plan to support the implementation of the Energy Plan for Toronto and to take a proactive approach toward creating awareness and support for the Plan. It will need to encourage municipal agencies to support the programs identified within the Energy Plan, while at the same time convince them to develop their own sustainability projects. As a part of the communications plan, the City will need to report on specific actions taken to achieve the goals, objectives, and targets of the Energy Plan for Toronto on a regular basis.

- Communications will also play an important role in showcasing programs aimed at recognizing leaders in sustainability, whether they are City employees, municipal agencies, or private individuals and organizations. By celebrating and communicating achievements, the City will be able to better encourage the required behavioural changes needed to meet its long term energy efficiency objectives.

The City Government and ABCs foster strong partnerships in Toronto

- The Energy Plan for Toronto will seek to encourage partnerships with the community aimed at creating sustainability programs which can be delivered through the most effective and efficient means possible. The success of these partnerships should be communicated to the public in order to showcase and promote best practices.

The City Government and ABCs continually improve environmental and energy performance

- Instrumental to the development of the Energy Plan for Toronto is the need to set out targets and to measure actions and programs by these targets to ensure the overall goals of the Energy Plan are achieved over time. These targets should seek to raise the bar in terms of energy conservation activities, making stretch goals which are attainable but require increased effort to be achieved. These targets will need to be reviewed and updated on a regular basis, and should be proactively communicated to all stakeholders along with the progress made in achieving these targets.

8 Conclusions and Recommendations

The City of Toronto is at a crossroads with respect to energy supply and demand in Toronto. The current environment can be considered both a great challenge for the future and a great opportunity. The decisions the City makes now will have a significant impact on the life and prosperity of the City, not just in the short term, but for decades to come.

Moving forward, it is envisioned that the Energy Plan for Toronto will be a document of both vision and action, a means toward implementing change. To help the City with its endeavors, this section outlines a strategy for moving forward along with key priorities that the City should consider as it moves forward to create its Energy Plan for Toronto.

8.1 A Strategy Forward

As a general strategy, the City should follow a disciplined approach to developing and implementing an Energy Plan for Toronto. Specifically, the approach should include the following key steps, which are the steps that have been followed in developing this report:

1. Measure the current energy state, by sector, developing the appropriate indicators which will be measured and tracked over time;
2. Define a future state by sector, and thereby the estimated gap between future versus current (i.e., what needs to be accomplished);
3. Identify, define and, where appropriate, consolidate programs which can help close the gap;
4. Identify program opportunities (i.e., where the above suite of programs do not completely fill the patchwork);
5. Establish a process which will support moving toward the future state (i.e., audit, implement, monitor);
6. Establish City oversight and administration offices, tools (e.g. internet tools, etc.) to support the processes; and
7. Revisit the Energy Plan and reassess progress on a regular basis. Report on progress on the indicators as developed at the outset.

The strategy for the development of the Energy Plan for Toronto must address the key barriers to achieving the results envisioned in the future energy state. The dimensions of the Energy Plan can be categorized as follows:

- City's Own House In-Order
- Toronto Existing Buildings
- Toronto New Buildings
- Renewable Energy Technologies

These dimensions and the barriers associated with each dimension are summarized below.

City's Own House In-Order

The City of Toronto must be able to show and demonstrate that it is taking steps to address energy efficiency within its own operations by demonstrating:

- Best practices in its own energy program for City and ABC buildings;

- Use of renewable technologies in existing City buildings and new City buildings;
- Use of sustainable design practices and innovative environmental elements for new and existing City buildings, recognizing that retrofitting existing buildings brings different challenges; and
- A cross-functional approach to energy management.

The potential barriers for the City in implementing its "Own House In-Order" program that have been identified are generally policy, economic and organizational in nature:

- **Policy consistency.** Many of the program initiatives must be undertaken over a period of years whereas the political imperatives may change more regularly, resulting in a reduced focus on energy matters;
- **Financial commitment**. Many of these program initiatives, together with the potential for comprehensive energy retrofits in existing buildings, could be initially costly with a long payback period. Additionally, there will also be evolving financial reporting and life-cycle costing implications; and
- **Organizational Authority.** Currently is no one department within the City that has complete responsibility for energy efficiency. As a result, each department has not necessarily approached energy issues in a consistent manner.

We recommend that the City develop an Energy Plan for City buildings and ABC related buildings that provides leadership by demonstrating best practices by showing that the City is taking steps to address energy efficiency. The new City focused Energy Plan should integrate asset management, energy retrofits in existing buildings, new building policy and the demonstration of renewable energy technologies.

Toronto Existing Buildings

The existing buildings in the city, and their associated energy needs, are characterized by building sector according to occupancy and use. To be effective, the development of an Energy Plan for Toronto should:

- Design partnering strategies to leverage and promote energy efficiency within each building sector. Unlike with City owned buildings, the City must work with external partners to encourage and support adoption and change, rather than working internally; and
- Ensure adequate program funding exists to support potential negative considerations such as longer term paybacks.

The barriers for existing buildings are building sector specific. These barriers are described in detail in the building sector energy plan templates and include key elements, including:

- "Split incentives" in the Office sector where the landlord/owner pays for the energy retrofit, but the tenant receives the savings under a net lease for office space; and
- Policy barriers relating to a building owner's inability to easily obtain building permits for a solar system on a roof due to zoning bylaws, the limited requirements defined in the OBC, and the unfamiliarity of building plans examiners and field inspectors with this technology.

We recommend that the City develop sector specific plans and sector partnerships for existing buildings as detailed in the building sector templates.

Toronto New Buildings

The City of Toronto administers the building permit and inspection process which is geared toward enforcement of the Ontario Building Code ("Building Code" or OBC) and other applicable regulations. The Building Code is designed to assure health, safety, accessibility, and minimum levels of energy efficiency. The strategy proposed for new buildings includes:

- Enforcing minimum standards through the building permit process; and
- Promoting energy efficient design by providing advice to permit applicants that is consistent with life cycle costing and sustainable design principles.

Toronto has already developed a Green Development Standard for its own buildings. Every new building should demonstrate integrated energy and environmental design.

The barriers for new buildings include:

- The role of building permit plans examination, field inspectors and the approval of innovative design features, which were unforeseen by the Building Code. The building permit and inspection department is focused on Code compliance and not approval of Code mandated energy and environmental design features and those not covered in the OBC. More training and expertise, and new approval procedures are required to deal with the barriers; and
- The OBC needs to be updated to reflect more stringent energy efficiency standards. For example, the use of T8 fluorescent lamps was only recently required in buildings, whereas the technology has been more cost effective since 1993.

We recommend that the City expand the development of the Green Development Standard to address the education required for the integrated design process, the permit approval and inspection process, and building commissioning. We also recommend that the City work directly with the OBC committees to lobby for the inclusion of more efficient technologies and renewable technologies in new buildings.

Renewable Energy Technologies

It is likely that the use of renewable technologies will grow rapidly over the timeframe in which the Energy Plan for Toronto will be implemented. The strategy for renewable energy involves creating awareness, education, promotion, and demonstration of the technologies. Renewable energy technologies should be applied in both new and existing buildings as the technologies and their cost effectiveness improve, and the market acceptance of these technologies increases. Since renewable energy sources can be more expensive than conventional energy, the overarching strategy for renewable energy should focus on efficiency first, wherein the strategy becomes:

- First minimize the building loads; then
- Optimize building systems; then
- Select the most efficient plant.

Energy efficient measures focus on minimizing loads and optimizing systems. Renewable technologies focus on optimizing systems and selecting efficient plant. Energy efficient measures are always positioned first and renewable measures are applied after the selection of efficiency measures.

The barriers for renewable technologies are primarily financial, educational, and policy oriented:

- Financial, because the economics may be unproven, unattractive (i.e., may not competitive at present with more traditional technologies), or riskier;
- Educational, insofar as building designers are reluctant to try new technologies (i.e., risk, awareness, cost) and they may not fully understand the benefits of the technology.
- Policy oriented, as issues relate to conflict with building codes and design review for permit application; and

We recommend that the City develop a renewable technology plan that will help establish a clear baseline for each renewable technology in Toronto; develop strategies to educate, promote, and demonstrate each technology; and establish specific targets for the technology in each building sector for new and existing buildings. This plan should also consider and use incentives as required to accelerate the adoption of renewable energy technologies.

8.2 Key Priorities

In the development of this report, a number of key priorities have been identified for the City to consider as it implements its Energy Plan for Toronto, including:

1. Building the City's Centralized Role;
2. Leverage and Integration of Existing Programs;
3. Partnering with the Community;
4. Partnering with the Sectors;
5. Utility and Incentive Partnering;
6. Development of a Toronto Conservation Fund;
7. Policy Barriers;
8. Training and Technology Transfer; and
9. Energy Benchmarking

Each of these priorities is described in further detail below, along with any identified recommendations.

Building the City's Centralized Role

The City has a complex mix of interests and representation from both internal and external stakeholders and it has a number of competing priorities focused around energy efficiency, renewable energy, and climate change. Consequently, it is critical that the City provide leadership for and centralized coordination of the various initiatives in order to achieve its long term energy efficiency goals.

A key gap identified in the development of this report is the lack of information available on the cost and benefits of current programs and initiatives. There is no formal process to quantify the overall savings (i.e., benefits) of the energy efficiency initiatives currently underway within the City; as a result, there is no way for the City to know if it is achieving its objectives, or the cost associated with making progress.

To address this gap, the City should consider the development of a standard template which gathers specific information on all energy efficiency and renewable energy initiatives within Toronto, regardless of the sponsoring agent. At a minimum, the information gathered should include the following:

- Project description;
- Estimate of savings potential considering:
  - Baseline information (Audit)
  - Details on measures and technologies employed (Implementation)
  - Measuring and tracking of savings (Monitoring)
- Links with other programs;
- Funding requirements; and
- Timelines for implementation and resource requirements.

This information should be housed in a centralized repository or "portal" that would allow all stakeholders, both internal and external, to have access. This repository could also be expanded to include information about environmental and climate change activities and initiatives. Ultimately, this portal could also be used as a primary gateway for new programs that the City will develop in the future. Ideally, a "single point of entry" to any and all programs will eliminate confusion and provide consistency in reporting results.

To support this information repository, the City should nominate a department or individual(s) that would have overall accountability and responsibility to report on all consolidated energy efficiency and renewable energy efforts. This department or individual(s) should be given the appropriate authority to allow them to enforce the standardization of information gathered and shared on energy efficiency initiatives. This department or individual(s) should also work with other City resources to develop minimum standards, through a cost effectiveness analysis, for the approval of proposed programs and/or initiatives. This will further increase the City's discipline around monitoring and tracking the benefits of energy efficiency and renewable energy programs being implemented within Toronto.

By creating this centralized coordination of energy efficiency and renewable energy initiatives, the City will be able to install a measure of discipline around the introduction of new programs and initiatives. It will also allow the City to better quantify the overall impact of these initiatives on meeting the City's overall energy efficiency and renewable energy goals.

We recommend that the City create an appropriately resourced centralized repository of energy efficiency and renewable energy program data and information, which includes basic information about programs, links to other partners, savings potential, and funding requirements. This entity should immediately start on developing a portal that allows all stakeholders to access the information. The current Energy Efficiency Office would be the logical candidate for this role.

Leveraging and Integrating Existing Programs

There is a wealth of information available regarding energy efficiency and incentive programs for Toronto buildings. A review of this information shows that many of these programs are prescriptive in nature and offer incentives for specific types of savings or measures. With such a diversity of information on current programs, building owners and occupants cannot always be fully knowledgeable about the energy programs relating to their sector and may be confused about the various options available to them. Considering this complexity, owners and building managers may prefer to avoid the perceived "red tape" and "bureaucracy" of participating in these programs; as a result, they are not able to realise their full energy management potential.

The OPA 300 MW initiative should be used to leverage Energy Plan efforts. The sector partners of the OPA initiative, BOMA and Toronto Hydro, should be leveraged in the implementation of the Energy Plan for Toronto. These partners should be used for the Office

and Residential (Low-Rise) sectors respectively. While the OPA initiative deals specifically with electricity measures alone, the Energy Plan for Toronto can leverage this base structure to promote a comprehensive energy (i.e., all fuels) and water management plan. Enbridge Gas Distribution is already active in these markets and represents an obvious partnering opportunity.

We recommend that the City leverage existing programs and incentives within the process based Energy Plan Framework. The integration of existing programs should help avoid confusion in the marketplace and assist in simplifying program choices. There is an opportunity for the City of Toronto to play a key role as the "information broker" for the substantial array of incentive programs. Partnering with existing incentive programs will be the key to this "information broker" role.

Partnering with the Community

Partnering with the community presents a significant opportunity to leverage energy efficiency activities within building sectors. The primary roles of a building sector partner or partners should be to:

- Help define building sector needs for training and education;
- Leverage marketing with association members; and
- Monitor and communicate among stakeholders.

A partnering approach is currently being utilized by the OPA for its 300 MW Directive with respect to the City of Toronto. BOMA was selected to represent commercial privately owned buildings, while Toronto Hydro was selected as the residential low-rise sector partner in order to assist in meeting the OPA's Directive.

Partnering with utilities and other government or NGO backed energy incentive programs is desirable to minimize market confusion and maximize market acceptance of the Energy Plan for Toronto's initiatives, as identified for each building sector. Ideally, the variety of utility and government incentives should be combined within the proposed energy management framework.

Partnering is also an effective tool for working with energy management firms ("EMFs") who already service building owners and property managers. The EMF role can extend beyond implementation of energy efficiency measures. EMFs can also help with marketing energy management retrofits to specific building targets. In recent years, the Better Building Partnership has pioneered an EMF partnering strategy successfully.

We recommend that the City consider using the community partnering approach for all energy efficiency and renewable energy efforts. The use of the Energy Plan Framework should ensure that these organizations are properly identified.

Partnering with the Sectors

Within the sector analysis, sector specific partners were identified as a significant opportunity and method for the City to work collaboratively with the community. The City should consider taking its existing relationships, and any new relationships being developed, to the next level by formalizing its interactions with these groups. The City should identify specific initiatives and/or programs that can be implemented in collaboration with these sector specific partners. It should then formalize these partner relationships by clearly defining the roles and responsibilities of each stakeholder involved. It can be expected that these initiatives will require funding from the City, however, where possible, it may be advantageous to examine joint funding, particularly with three major funding groups now active in the local market: the OPA, Enbridge and Toronto Hydro.

Another benefit of formalizing relationships with sector partners is the marketing and communication knowledge and opportunities available through these organizations. The City should consider implementing joint marketing campaigns aimed at increasing penetration of initiatives within specific sectors. This would allow the City, with the support and collaboration of its sector specific stakeholders, to provide clear and consistent messaging on the benefits of energy efficiency and renewable energy to its target audience.

The BOMA experience presents an interesting model to consider. BOMA is the primary delivery agent for the OPA's 150 MW initiative aimed at the office and retail sectors. Seeking partnerships with sector associations presents an attractive way to engage the marketplace. Supporting and amplifying existing initiatives, such as the BOMA/OPA program can be expected to be highly cost effective. The City would need to consider how it can improve the offerings of existing programs and those under consideration. Enhanced incentives, co-marketing, or back-end administrative support each represent a potential means to improve a program design. The specific needs will be sector and opportunity dependent.

We recommend that the City consider using the sector partnering approach for all energy efficiency and renewable energy efforts that it may consider. The Energy Plan Framework should ensure that these organizations are properly identified.

Utility and Incentive Partnering

Three major utilities are responsible for delivering most of the energy in the City: Toronto Hydro, Enbridge Gas Distribution, and Enwave. Partnering with these utilities for the delivery of energy efficiency and/or renewable energy initiatives presents a significant opportunity for the City. Toronto Hydro and Enbridge in particular offer key opportunities for the City to integrate and amplify their existing suite of programs, and to develop new ones as required.

Between them, Toronto Hydro and Enbridge offer a broad spectrum of programs, in addition to delivery channels and pathways to the marketplace that they have already developed. Enbridge has a full suite of energy efficiency programs targeting all sectors. Toronto Hydro, either in partnership with the OPA or on its own, has programs targeting many of the sectors of interest to the City.

The review of existing initiatives indicates that while the potential programming partnerships are many, there is also a need to consider a mechanism by which these programs can be accessed through a single point of entry which ensures that any organization or individual wishing to participate can have full access to all relevant programs. Additionally, with an integrated approach there would be an increasing rationale for a complete marketing "blitz" aimed at a creating a significant acceleration in the participation rates for both existing programs and any new programs that might be considered.

The review also identified the main types of programming efforts: information/education, incentive, research, and codes and standards. A complete suite of programs requires that the City be active in all of these areas. Education and incentive based programs are the mainstays of the utility initiatives, and partnering, including adding to the existing incentive base is likely to be a very cost effective way to deliver savings. Research and codes and standards (i.e., advocating for codes and standards at the provincial and federal levels) are areas where the City will need to consider new efforts and support. The utilities tend to be less involved in these kinds of activities. Integrating these activities with the other programming activities will increase the likelihood of a successful market transformation to higher levels of efficiency and renewability (i.e., where the implementation of a code or standard represents the natural conclusion of an education/incentive based program).

We recommend that the City consider using the utility partnering approach for all energy efficiency and renewable energy efforts. The Energy Plan Framework should ensure that these organizations and their offerings are properly identified.

Development of a Toronto Conservation Fund

An integral part of implementing the Energy Plan for Toronto is to establish a source of capital that would assist in funding the initiatives identified for energy efficiency projects within the community.

Based on interviews with City officials, we understand that the development of a Conservation Fund to support the Energy Plan for Toronto is being contemplated, focusing on providing support for initiatives targeted primarily toward the residential sectors. These initiatives could be supported through grant-based and loan-based initiatives (e.g., zero-interest or low interest loans being provided to homeowners).

There are a number of potential sources of financing (e.g., the City, the provincial government, the Ontario Power Authority, the federal government, or the new Clinton Foundation initiative) that could establish the initial capital and/or the recurring dedicated funding for the Fund.

Considering the primary target sector is residential, it is expected that there would be a need to manage a high volume of transactions, both in terms of managing and approving applications and with administering transactions (e.g., advancing and documenting funding, accounting and collecting on any repayments, etc.). As a result, any Conservation Fund established would require an effective administrative framework to support these high volumes.

There are a number of options for structuring the administration of this Fund. For example, it could be established as a trust arrangement, whereby a third-party administrator could be responsible for making investments for the Fund and managing the day-to-day processes and administration. Alternatively, the Fund could be structured in a manner to incorporate both third-party management of the day-to-day administrative processes of the Fund and partial City oversight and final sign-off of approved funding and/or investments. These types of arrangements could allow the City to utilize its internal expertise and policy setting orientation, while leveraging a third party's administrative experience.

We recommend that the City consider creating a Conservation Fund and/or exploring alternative funding sources to support the implementation of the Energy Plan for Toronto.

Policy Barriers

The implementation of major energy retrofits and renewable energy projects will likely encounter both sector specific barriers and City specific policy barriers with respect to building permits and existing regulations.

Sector specific barriers will require a comprehensive review with building sector partners to find the best options to address those barriers. In some cases, new by-laws may be required. Other barriers may require close cooperation with City departments to expedite the resolution of issues and the development of specific training, education/awareness, and incentive programs

Public consultation has resulted in the identification of current City practices that will create barriers to specific energy initiatives.

We recommend that the City review the specific policy barriers identified in this report and work with stakeholders to develop the best options to overcome these barriers.

Training and Technology Transfer

Training and technology transfer will be a key part of the City's strategy within the Energy Plan for Toronto and the overall energy framework. Experience indicates that energy management must include training and education as part of the strategic process if it is to achieve sustainable results.

Potential problems associated with current building practices include:

- Incomplete commissioning at the time of construction;
- Building operations staff that have not been provided adequate training to understand the building systems;
- Poorly maintained systems and equipment; and
- Changes to buildings systems without proper environmental systems adjustments.

In addition, modern buildings are becoming increasingly more sophisticated and complex to operate and maintain. As existing buildings are retrofitted, new technologies will also affect the a building's operation and maintenance. Building system operators have a particular need to continue their education in order to operate these complex systems under tighter operational constraints, while saving energy and enhancing building performance.

Building occupants also play a significant role in the energy management of buildings. Education is required for occupants, including communication about energy use within the building and the building's overall energy management process goals. The use of web based technology for each building sector could encourage both education and communication of energy management results.

We recommend that the City partner with colleges and universities to ensure that training is available to all stakeholders who are involved in any aspect of a project that is a part of a program offered by the City and its DSM and CDM program partners.

Energy Benchmarking

Benchmarking is commonly used to establish comparison points for measuring change over time or for comparing against other energy users. From an energy perspective, there are a variety of commonly used benchmarks including energy use per $GDP (Gross Domestic Product), energy use per person, energy use per household and energy use per square foot of floor space.

While energy benchmarks present an easy way to quickly compare one's energy activity with others or to track changes over time, it is important to note that a benchmark represents an index which is intended to simplify what might be very complex issues. As such, changes can occur to an index which may result in misleading interpretations of the index change. For example, if the benchmark is energy use per household and the index is showing a decline over time, one might conclude that houses are becoming more efficient, while in fact the decrease might be due to a decline in the number of people per home or the average size of homes. Taken out of context and without an in-depth understanding of the actual variables, the use of the index in this case presents a conclusion which is misleading. The user of energy benchmarks must always be cautioned about comparisons to others using a sole indicator. Energy use represents a complicated interaction of multiple variables and determinants.

For Toronto to develop and use meaningful benchmarks, it is appropriate that the index(s) be established in a manner that minimizes the likelihood of mis-leading interpretations of results. The best way to achieve this goal is to have multiple indices tracking multiple measures. That way, while any one index might have a questionable trend at any given time,

it is only one in a host of indices that are being measured and the likelihood of all of them yielding questionable interpretation of results at the same time is low.

This benchmarking approach is commonly used in the evaluation of “market transformation” energy efficiency programs wherein for any given program there can be many indices or “metrics” that are used to determine the success of failure of the program. When a majority of the indices are moving in a positive direction, then the program is deemed to be having influence. As well, there will be metrics that represent “near” indicators of change – energy reduction for example and those that represent “distant” indicators of change – number of qualified contractors for example.

Establishing the appropriate indices must be done in conjunction with the sector and program development plans, as described in Section 5. The benchmark indices will vary across sectors and across decision types. It is also important that they be developed with a view to the data and information requirements. There is no point developing a benchmark index if there is no chance that the supporting information can be collected. Engaging the sector delivery channels and partners at the outset of the program design is thus critical for the data collection requirements that are done as part of the benchmark evaluation.

It is however understood that the City requires benchmarks that it can use immediately. The simplest forms are those developed as part of the energy forecast presented in Section 4 and Appendix C. These are energy intensities for the six residential segments as shown in Table 8.1 and energy intensities for the eight Industrial, Commercial and Institutional (ICI) segments as shown in Table 8.2. These represent total energy use (expressed as equivalent kW/h per square foot per year) for the base year 2006.

As indicated above, the use an interpretation of these must always be qualified. Comparisons across segment should not be made. On-going comparisons within segments must be made using the same segment, energy and floor space definitions. Changes to the indices over time need to be understood in light of the changes to each variable. As part of the sector planning and roll-out, more indices will need to be developed, however these must be developed on the basis of the program need and design. The intensity benchmarks expressed here represent a reasonable starting point for further development.

Table 8-1: Residential Sector Benchmarks

Sector	Energy Intensity, ekWh/ft^2/yr
Single Family	23.7
Semi-Detached	20.9
Row House	19.9
Apartment in Duplex	23.5
Apartment < 5 Stories	20.4
High Rise	25.1

Table 8-2: ICI Sector Benchmarks

Sector	Energy Intensity, ekWh/ft^2/yr
Office	33.5
Retail	36.7
Industrial	26.6
School	19.0
College & University	26.6
Healthcare	31.7
Municipal	28.4
Other	19.7

We recommend that the City develop benchmarks across a variety of energy efficiency and renewable energy activities, using these as part of an annual evaluation exercise. These benchmarks should be specified at a level of disaggregation that allows for a robust and meaningful analysis, consistent with the sector plans as outlined in Section 6. Tables 8-1 and 8-1 represent good starting points for this benchmarking analysis. They City may also wish to develop more aggregated indicators for the purposes of ease of communication; however these must be supported by the detailed approach.

Appendix A: Glossary of Terms

In alphabetical order, below the definitions of terms used in this report:

Term	Definition
Baseline	The initial (current) condition. The baseline is found by taking a data inventory of the current situation.
Biomass	Living and recently dead biological material which can be used as fuel or for industrial production. Most commonly, biomass refers to plant matter grown for use as biofuel, but it also includes plant or animal matter used for production of fibres, chemicals or heat. Biomass may also include biodegradable wastes that can be a source of fuel.
Combined heat and power (CHP)	Also known as cogeneration. The use of a heat engine to simultaneously generate both electricity and useful heat.
City ABCs	The City's Agencies, Boards and Commissions
City Community	The community within the boundaries of the City of Toronto
City Government	Refers to all of the City Divisions and City-owned buildings
Climate change	The variation in the Earth's global climate or in regional climates over time. It describes changes in the variability or average state of the atmosphere over time scales ranging from decades to millions of years. These changes can be caused by processes internal to the Earth, external forces (e.g. variations in sunlight intensity) or, more recently, human activities.
Compact fluorescent lamps (CFLs)	A type of lamp designed to fit into roughly the same space as an incandescent lamp, but with the advantages of a fluorescent lamp. Compared to incandescent lamps of the same luminous flux, CFLs have a longer rated life and use 25percent of the energy.
Conference of the Parties	The Conference to the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC).
Cooling load	The amount of heat that must be removed from a building to maintain comfortable conditions for the occupants. It is usually expressed in "tons", where a ton of cooling is equivalent to the amount of latent heat absorbed by a ton of ice in 24 hours as it changes to water. It can also be used to describe the contribution to the electrical load placed on the local distribution system due to space cooling.
Cost curves	Diagrammatic depictions of the relationship between the cost of an option and its potential energy savings, usually over a period of time in the future.

Term	Definition
Deep lake water cooling	A system that uses cold water pumped from the bottom of a lake, where it is naturally maintained at a stable temperature of 4°C (39°F), as a source of cooling for direct use in buildings. The use of deep lake water cooling reduces the use of electricity for space cooling.
Demand side management (DSM); also known as Conservation and demand management (CDM)	Energy management as seen from the perspective of an energy local distribution company, because it occurs on the customers' side (the "demand side") of the energy meter. Energy management entails actions that influence the quantity or patterns of use of energy consumed by end users, such as actions targeting reduction of peak demand during periods when energy-supply systems are constrained.
District cooling	Systems that generate chilled water at a central plant and distribute it to buildings for space cooling.
District heating	Systems that generate heat in a central plant and distribute it as steam or hot water to buildings for space and service water heating.
Floorspace	The gross floor area of a building or group of buildings, usually measured either in square feet or square metres. Energy analysis of buildings often uses floorspace as one of the key determinants of consumption.
Forecast	The process of estimation in unknown situations. In the context of this project, forecast refers to future projections as related to energy use and demand.
Geo-exchange	Systems that utilize the near-constant (less than 30 feet) or constant (more than 30 feet) temperature of the ground to provide some or all of the energy for space heating and/or space coolng.
Greenhouse gas emissions	Components of the atmosphere that contribute to the Greenhouse effect. Some greenhouse gases occur naturally in the atmosphere, while others result from human activities such as the combustion of fossil fuels. Greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Carbon dioxide, methane, nitrous oxide and three groups of fluorinated gasses (sulfur hexafluoride, HFCs, and PFCs) are the major greenhouse gases and the subject of the Kyoto Protocol
Incentive	Any factor, financial or non-financial, that provides a motive for a particular course of action, or counts as a reason for preferring one choice to the alternatives.
Load factor	The ratio of the average load during a given period to the peak load occurring during that period.

Term	Definition
Nitrogen Oxides (NOx)	A generic term for mono-nitrogen oxides. These oxides are produced during combustion, and are a contributor to air pollution.
Ontario Building Code (OBC)	A provincially mandated document that establishes minimum requirements for health, safety, accessibility and resource conservation for all housing and buildings constructed or renovated in the province. Municipalities are responsible for enforcing the OBC in their jurisdiction. A municipality may not establish higher minimum standards than those specified in the OBC. The current edition is 2006.
Ozone	Ozone (O3) is a triatomic molecule, consisting of three oxygen atoms. It is an allotrope of oxygen that is much less stable than the diatomic species O2. Ground-level ozone is an air pollutant with harmful effects on the respiratory systems of animals. On the other hand, ozone in the upper atmosphere protects living organisms by preventing damaging ultraviolet light from reaching the Earth's surface.
Passive solar energy	Solar energy that can be used to convert solar radiation into usable heat, cause air-movement for ventilation or cooling, or store heat for future use, without the assistance of other energy sources.
Electrical peak demand vs. consumption	Peak demand describes the power that the electricity system must provide at a given point in time when that demand is at its highest. In Ontario, that peak typically occurs on a summer weekday when air conditioning and lighting loads are high, and is measured in Watts or multiples thereof. Electricity consumption (sometimes referred to as "Energy") is the rate of use of power, and is measured in Watt-hours or multiples thereof.
Retrofit	The addition of new technology or features to older systems.
Solar insolation	A measure of solar radiation incident on a surface.
Sustainability	Meeting the needs of the present generation without compromising the ability of future generations to meet their needs.
Total resource cost	A measure of cost effectiveness that uses projections of energy savings, equipment cost and "avoided costs" to determine if a project or program is cost effective. It represents a "Societal" perspective on demand side energy investments.
United Nations Framework Convention on Climate Change (UNFCCC)	An international environmental treaty produced at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro in 1992. The treaty aimed at reducing emissions of greenhouse gas in order to combat global warming.

Term	Definition
United Nations Intergovernmental Panel on Climate Change (IPCC)	The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by two United Nations organizations, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), to evaluate the risk of climate change brought on by humans, based mainly on peer reviewed and published scientific/technical literature.
Urban heat island	An urban heat island (UHI) is a metropolitan area which is significantly warmer than its surroundings.
Volatile Organic Compounds (VOCs)	Organic chemical compounds that have high enough vapour pressures under normal conditions to significantly vaporize and enter the atmosphere. VOCs are sometimes accidentally released into the environment, where they can damage soil and groundwater contaminants. Vapours of VOCs escaping into the air contribute to air pollution.

Appendix B: Jurisdictional Scan Background and Findings

Objective

The objective of the jurisdictional scan was to identify best practices around the world and select potential energy conservation programs that could be implemented in the City of Toronto as part of its Energy Plan. The findings of the jurisdictional scan was consolidated with those of the research of existing initiatives at the City of Toronto and used as the basis for the identification of preferred program options.

Methodology

The jurisdictional scan was conducted in three phases:

1. City selection
2. Jurisdictional research
3. Selection of initiatives

The sections below describe these three phases in more detail.

City Selection

The process for the selection of cities included in the jurisdictional scan consisted of the following two steps:

1. **Identification of potential cities for the jurisdictional scan**

   A list of 36 potential cities was developed from the following sources of information:

   - Request for Proposal for Technical Support Services for the Development of the Energy Plan for Toronto (City of Toronto, RFP No. 9163-06-7417, pg. 5)
   - PwC's proposal in response to the above Request for Proposal (pg. 69)
   - Information provided by City staff and recommendations put forward at the project kick-off meeting on January 12th, 2007
   - Initiatives, publications and media articles on the world greenest or most sustainable cities
   - Consultation with subject matter experts

2. **Ranking of cities to select those to include in the jurisdictional scan**

   The cities were ranked using the following criteria:

   - Cities that support the Cities for Climate Protection (CCP) campaign run by the International Council for Local Environmental Initiatives
   - Cities that support the Clinton Climate Initiative championed by the William J. Clinton Foundation

- Cities included in the SustainLane 2006 ranking of the 50 US largest cities and specifically those in the Climate Change and Policy category
- Cities identified as one of the 10 best places to live by the Economist Intelligence Unit
- Cities included in the Energy section of the "Environmental best practices in cities around the world" report prepared by City of Toronto's Environmental Office
- Cities included in the "Cities of the Future" report published by PwC in 2005
- Cities recommended by subject matter experts and City of Toronto's Energy Efficiency Office

The following 21 cities were selected for the jurisdictional scan:

Austin, TX, US	**Gothenburg, Sweden**	**Oxford, UK**
Barcelona, Spain	**London, UK**	**Portland, OR, US**
Berlin, Germany	**Los Angeles, CA, US**	**Rizhao, China**
Calgary, AL, Canada	**Malmo, Sweden**	**San Francisco, CA, US**
Chicago, IL, US	**Markham, ON, Canada**	**Seattle, WA, US**
Copenhagen, Denmark	**Melbourne, Australia**	**Sydney, Australia**
Freiburg, Germany	**New York City, NY, US**	**Vancouver, BC, Canada**

Jurisdictional Research

The jurisdictional research consisted of gathering the following information from public sources for each of the 21 selected cities:

- General city description, including population, area and climate
- Energy plans and policies if applicable
- Information on energy agencies or other organizations such as utilities or private-public partnerships if applicable
- Information on energy conservation initiatives at the municipal level as well as provincial or national level if applicable

The following information was identified for each initiative: name, brief description and source.

A total of 188 initiatives were identified in the 21 cities researched.

Selection of Initiatives

The objective of this phase was to select best-in-class initiatives that were relevant to the City of Toronto and that will completely or partially be considered for the selection of program options as part of the development of the Energy Plan.

1. **Ranking of initiatives**

   The following criteria were used:

- **City Criteria**

  City Criteria refers to how the selected city compares to Toronto, especially in aspects such as area, population and climate. The following table presents the criteria used to rank a city's similarity to Toronto:

	Area	Population	Climate
Description	Area comparable to Toronto's 620 km^2	Population comparable to Toronto's 2.5 million (5 million in the GTA)	Climate comparable to Toronto's, i.e. humid continental
Criteria	H = 620 km^2 ± 50 km^2 M = 620 km^2 ± 200 km^2 L = other	H = 2.5 million ± 0.5 million M = 2.5 million ± 1 million L = other	H = similar climate M = other L = tropical

- **Initiative Criteria**

  Initiative Criteria refers to the researched initiative's potential success in achieving energy conservation if implemented in Toronto.

	City-wide energy conservation impact	Ease of initiative implementation	Potential use of initiative or technology by target audience	Applicable to key sectors
Description	How much impact would the initiative (or the technology supported by the initiative) have in conserving energy in the city as a whole? Assume the initiative will be used by the target audience (note: use other criterion to rank the potential use of the program)	How easy is to implement the initiative? Factors to consider: * Government support * Investment required * Infrastructure in place	What is the probability that the initiative will be accepted in Toronto and will it receive buy in from the community (or will it implement the technology it supports)?	Is the initiative applicable to the following key sectors?: * Residential * Commercial * Industrial

Criteria	H = high impact (i.e. large energy conservation potential) M = medium impact L = low impact	H = easy to implement M = average L = difficult to implement	H = high acceptance M = medium acceptance L = low acceptance	H = 3 key sectors included M = 2 key sectors included L = 1 key sectors included

Each of the above criteria was assigned a value that reflects its importance in comparison to the other ranking criteria. These values were:

0.5	▪ Area ▪ Population ▪ Ease of initiative implementation ▪ Potential use of initiative or technology by target audience
1	▪ Climate ▪ City-wide energy conservation impact ▪ Applicable to key sectors

Based on the city criteria and the initiative criteria, each initiative was ranked and awarded a low (L), medium (M-, M & M+) or high (H-, H & H+) grade.

Energy agencies or organizations as well as energy plans and policies were not ranked. Twenty energy-related plans or policies were identified. It is important to note that in some cities, energy plans, commitments and initiatives fall under the climate change umbrella. In these cases, energy conservation is one among many actions aimed at reducing greenhouse gas emissions.

2. Identification of initiatives ranked as high

All initiatives awarded with an H-, H or H+ grade were identified and reorganized under the following initiative types:

- Assessment tools
- Climate change
- Education
- Green building and conservation programs
- Green power
- Organizations and agencies
- Rebates and grants
- Solar and other renewable energy sources
- Street lighting

Fifty five initiatives were awarded an H-, H or H+ grade and 67percent of them fell under one of the following types: green buildings and conservation programs, rebates and grants, and solar and other renewable energy sources.

Sixteen of the twenty one cities researched had at least one initiative awarded with an H-, H or H+ grade.

Limitations

The reader should consider the following limitations when evaluating the results of the jurisdictional research and analysis:

- The information gathered was obtained from readily publicly available information.
- No interviews were carried out with representatives from the selected cities.
- PwC has not undertaken an independent audit or verification of the information gathered.
- As our research has been primarily based on publicly available secondary research, we have not been able to capture many of the internal programs that many municipalities may currently support.
- The information presented is up-to-date as of February 2007. Cities change and update their initiative offering continuously and thus, a list of best-in-class initiatives should be always considered dynamic.

Highlights of 55 Initiatives

	City	Name	Description	Program Type	Jurisdiction	Target Sector	Link
1	Austin, TX, USA	**Air Conditioner Rebates**	Rebates for customers who install high efficiency HVAC equipment. Customers do not require you to have an energy audit to qualify.Rebate Items: Central Split Systems and Package Air Conditioners and Heat Pumps (14 SEER/11.5 EER or greater); Window Air Conditioners Solar Water Heaters; Heat Pump Water Heaters (all-electric homes only); Heat Recovery Water Heaters (all-electric homes only) .	rebates and grants	n/a	residential and commercial	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Residential/Air%20Conditioner/index.htm
2	Austin, TX, USA	**Rebates & Incentives** (Commercial Energy Management Services)	Commercial rebates and incentives are offered to Austin Energy customers as part of our Commercial Rebate Program. These programs are designed to help you implement energy efficiency measures that can reduce your electric demand by offering financial incentives to offset your initial investment.	rebates and grants	n/a	commercial	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Commercial/Commercial%20Energy/index.htm
3	Austin, TX, USA	**Small Business Rebates & Incentives** (Commercial Energy Management Services)	Designed to help qualified small-to-midsize and not-for-profit businesses implement a variety of energy efficiency measures.	rebates and grants	n/a	commercial	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Commercial/Commercial%20Energy/smallBusiness.htm
4	Austin, TX, USA	**Green Building Program®**	Through consulting, resources, and education, the Green Building Program can help build a more environmentally-sound home or workplace.	green building	n/a	residential	http://www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/index.htm
5	Berlin, Germany	**Solaranlagenkataster**	Database to register every solar system installed in the City (http://www.solarkataster.de/).	renewable energy	municipal	residential, industrial and commercial	http://www.berlin.de/sen/umwelt/klimaschutz/solaranlagenkataster/
6	Berlin, Germany	**Campaigns for the protection of climate**	Various campaigns for the conservation of energy. For example "Energy eater wanted".	climate change	municipal	residential and commercial	http://www.berlin.de/sen/umwelt/klimaschutz/kampagnen/
7	Berlin, Germany	**Solar Roof Exchange**	Solar panels installed in public buildings with financing from the private sector.	renewable energy	municipal	municipal	http://www.berlin.de/sen/umwelt/klimaschutz/solardachboerse/
8	Berlin, Germany	**Berliner Impulse**	Information and advisory program on energy conservation and GHG reduction.	education	municipal	residential, industrial and commercial	http://www.berliner-impulse.de/
9	Calgary, AB, Canada	**Ride The Wind**	Commencing 2001 September 1, Calgary Transit entered into a partnership with ENMAX and Vision Quest Windelectric Inc. to develop a program (Ride the Wind) that uses wind-generated electricity to power the Ctrains.	green power	municipal	municipal	http://www.calgarytransit.com/environment/ride_d_wind.html
10	Calgary, AB, Canada	**Green Power Initiative**	The City of Calgary made an unprecedented commitment to increase its green electricity consumption to 75% of total use by January 2007 through an agreement with ENMAX Energy Corporation.	green power	municipal	municipal	http://www.calgary.ca/portal/server.pt/gateway/PTARGS_0_2_771_203_0_43/http;/content.calgary.ca/CCA/City%20Living/The%20Environment/Climate%20Change%20and%20Air%20Quality/Climate%20Change/What%20The%20City%20is%20Doing%20about%20Climate%20Change/Major%20City%20Accomplishments%20to%20Date.htm
11	Calgary, AB, Canada	**Streetlights and Traffic Signals**	* Streetlight Retrofitting: Calgary Roads completed their 'EnviroSmart' streetlight program in 2005. Approximately 37,000 residential streetlights have been retrofitted to more energy efficient lamps. * Light Emitting Diode (LED) Traffic Signals: Calgary Roads is retrofitting its traffic heads and pedestrian signals with Light Emitting Diode (LED) technology. LEDs use 80% less energy.	street lights	municipal	municipal	http://www.calgary.ca/portal/server.pt/gateway/PTARGS_0_2_771_203_0_43/http;/content.calgary.ca/CCA/City%20Living/The%20Environment/Climate%20Change%20and%20Air%20Quality/Climate%20Change/What%20The%20City%20is%20Doing%20about%20Climate%20Change/Major%20City%20Accomplishments%20to%20Date.htm
12	Chicago, IL, USA	**Energy Efficiency Programs (by DEO)**	* Boiler Efficiency/Motor Master Workshops - two energy-efficiency workshops tailored specifically to building industry professionals * Energy Efficiency in City Buildings - In late 2000, the City of Chicago took two significant steps to improve energy efficiency in City buildings: (i) audit and retrofit 15 million square feet of public buildings and (ii) design new municipal facilities—libraries, police stations and other public buildings—to be more energy-efficient. * Industrial Rebuild Program - The City of Chicago DOE, in partnership with ComEd, the University of Illinois at Chicago's Energy Resources Center and the Illinois Waste Management and Research Center (WMRC), developed a program to help the most energy- and waste-intensive industries in Chicago become more energy efficient. Called the Industrial Rebuild Program, it is modeled after the U.S. Department of Energy Industrial Technologies Program, Industries of the Future.	green building	municipal	residential, industrial, municipal and commercial	http://egov.cityofchicago.org/city/webportal/portalDeptCategoryAction.do?BV_SessionID=@@@@0804283852.1170880533@@@@&BV_EngineID=ccceaddkdkqfeigcefecelldffhdffn.0&deptCategoryOID=-536890273&contentType=COC_EDITORIAL&topChannelName=Dept&entityName=Environment&deptMainCategoryOID=-536887205

	City	Name	Description	Program Type	Jurisdiction	Target Sector	Link
13	Chicago, IL, USA	**Energy Grants & Loans (by Department of the Environment - DOE)**	* 2006 Solar Thermal Grants Program Application. * Energy Grants - From time to time, the City of Chicago DOE has funds available to make grant for projects related to energy-efficiency, renewable energy, cogeneration, distributed generation and other energy areas in which DOE is active. * Energy Loans - From time to time, the City of Chicago DOE has funds available to make low- or no-interest loans for projects related to energy efficiency, renewable energy, cogeneration, distributed generation and other energy areas .	rebates and grants	municipal	residential, industrial, municipal and commercial	http://egov.cityofchicago.org/city/webportal/portalDeptCategoryAction.do?BV_SessionID=@@@@0956342659.1170881059@@@@&BV_EngineID=ccccaddkdeemkhicefecelldffhdfgm.0&deptCategoryOID=-536890675&contentType=COC_EDITORIAL&topChannelName=Dept&entityName=Environment&deptMainCategoryOID=-536887205
14	Chicago, IL, USA	**Renewable Energy (by DOE)**	* Chicago Solar Partnership - The Chicago Solar Partnership (CSP) is a public-private consortium established, under the organization of the Illinois Solar Energy Association (ISEA), to advance the development of the solar energy industry in the Chicago metropolitan area. (http://www.chicagosolarpartnership.com). * Solar Thermal Technology - hot water or space heating by collecting and concentrating solar radiation. * Wind Power: Chicago Prospects - A report detailing how wind power may contribute to Chicago's goal of obtaining 20% of its energy from renewable sources.	renewable energy	provincial / municipal	residential, industrial, municipal and commercial	http://egov.cityofchicago.org/city/webportal/portalDeptCategoryAction.do?BV_SessionID=@@@@0956342659.1170881059@@@@&BV_EngineID=ccccaddkdeemkhicefecelldffhdfgm.0&deptCategoryOID=-536894093&contentType=COC_EDITORIAL&topChannelName=Dept&entityName=Environment&deptMainCategoryOID=-536887205
15	Chicago, IL, USA	**Residential Energy Assessment Program (REAP) (by DOE)**	An online home efficiency assessment tool which provides homeowners with the ability to assess the efficiency of their home and tips for conserving energy.	assessment tool	municipal	residential	http://webapps.cityofchicago.org/ERC/
16	Chicago, IL, USA	**Green Building (by DOE)**	* Chicago Center for Green Technology. * Chicago's Green Building Agenda. * Green Building Resources. * Chicago's Green Building Pilot Projects - In the design and construction of its municipal buildings. * The Chicago Standard - to guide the design, construction, renovation, operation and maintenance of municipal facilities. * Green Bungalow Initiative - pilot program sponsored by the City of Chicago to determine whether green building principles could be applied affordably to existing homes. * Green Homes for Chicago - pilot project undertaken by the City of Chicago to determine if green building technologies and practices could be incorporated affordably into new residential construction. * LEED Accredited Employees - The City of Chicago encourages employees to become LEED accredited by the US Green Building Council.	green building	municipal	residential, municipal and commercial	http://egov.cityofchicago.org/city/webportal/portalDeptCategoryAction.do?BV_SessionID=@@@@0735308186.1170881774@@@@&BV_EngineID=ccccfaddkdkgfeiicefecelldffhdffn.0&deptCategoryOID=-536887181&contentType=COC_EDITORIAL&topChannelName=Dept&entityName=Environment&deptMainCategoryOID=-536887205
17	Freiburg, Germany	**FREIBURG SOLAR CITY**	SolarRegion Freiburg is a long term development vision that the city of Freiburg in southwest Germany has embraced since 1986.	renewable energy	municipal	residential, industrial, municipal and commercial	http://www.solarregion.freiburg.de/solarregion/freiburg_solar_city.php
18	London, UK	**The London Hydrogen Partnership**	The London Hydrogen Partnership was launched in April 2002, to work towards a hydrogen economy for London and the UK. It aims to: * Produce and implement the London Hydrogen Action Plan * Establish and maintain dialogue among all sectors/actors relevant to the hydrogen economy * Disseminate relevant materials * Provide a platform for funding bids and initiation of projects http://www.lhp.org.uk/	renewable energy	municipal	residential, industrial, municipal and commercial	http://www.london.gov.uk/mayor/environment/energy/london-hydrogen-partnership.jsp
19	London, UK	**London Renewables**	Operating from spring 2003 to spring 2005, the London Renewables steering group worked with the London Energy Partnership to enable London to meet its renewable energy targets, as set in the Mayor's Energy Strategy. The London Renewables programme promoted the uptake of renewable energy technology in the capital. In particular, its programme focused on increasing the amount of renewable energy technologies used in new buildings and developments. Activity in this area continues through the work of the London Energy Partnership. London's renewable energy targets aim to generate at least 665GWh of electricity and 280GWh of heat, from up to 40,000 renewable energy schemes by 2010. (http://www.london.gov.uk/mayor/environment/energy/renew_targets.jsp). The Government Office for London's Sustainable Development Unit set up 'London Renewables', a partnership now led by the Mayor of London with DTI match funding.	renewable energy	municipal	residential, industrial, municipal and commercial	http://www.london.gov.uk/mayor/environment/energy/london_renew.jsp
20	London, UK	**Energy Saving Trust**	The Energy Saving Trust, set up by the Government, is one of the UK's leading organisations addressing the damaging effects of climate change. The goal of the Trust is to achieve the sustainable and efficient use of energy, and to cut the carbon dioxide emissions which are mainly to blame for global warming.	organization	federal	residential, industrial, municipal and commercial	http://www.est.org.uk/

	City	Name	Description	Program Type	Jurisdiction	Target Sector	Link
21	London, UK	**Clear Skies initiative**	The Department of Trade and Industry's Clear Skies initiative gives homeowners and communities a chance to use renewable energy by providing grants and advice. Homeowners can obtain grants of between £400 and £5,000 whilst community organisations can receive up to £100,000. Clear Skies can help find out about grants – whether you're eligible, how to apply, which installers are approved and which products qualify for a grant.	rebates and grants	federal	residential and commercial	http://www.clear-skies.org/
22	London, UK	**Green Energy Centre**	The Green Energy Centre has been established to help everybody make use of renewable energy technologies in order to reduce the environmental impact of energy use. The website includes information about how you can use renewable energy, including information about the discounts and grants for renewable energy installations.	education	n/a	residential, industrial, municipal and commercial	http://www.greenenergycentre.org.uk/
23	London, UK	**Sun Rise Solar Scheme**	Sun Rise Solar Scheme is a scheme for the installation of solar water heating and photovoltaic panels, providing access to bulk discount systems and affordable installation. It is the first scheme to contain these two technologies in the country.	renewable energy	municipal	residential and commercial	http://www.greenenergycentre.org.uk/sunrise.asp
24	London, UK	**EnergySmart**	EnergySmart is a nationwide scheme to provide boilers and solar equipment for installation by the installer of your choice, or installed loft and cavity wall insulation. Saving energy is as good as using renewable energy, and is a good step towards reducing your impact on the environment.	renewable energy	federal	residential and commercial	http://www.london.gov.uk/london-life/environment/how-to-be-green/energy.jsp
25	Los Angeles, CA, USA	**LADWP rebates and programs**	* REfrigerator Turn-In and REcycle Program (RETIRE) * High-Efficiency Clothes Washer Rebate Program * Energy Load Monitoring (ELM) Program - Providing medium to large commercial and industrial customers with tools to view, modify and analyze their energy load data. * Green Power Program * Home Energy Efficiency Rebates for many appliances (http://www.ladwp.com/ladwp/cms/ladwp000478.jsp?)	rebates and grants	municipal	residential, industrial and commercial	http://www.ladwp.com/ladwp/areaHomeIndex.jsp?contentId=LADWP_REBATES_SCID
26	Los Angeles, CA, USA	**Commercial Lighting Efficiency Offer (CLEO) Program**	For business or non-residential customers.	street lights	municipal	industrial and commercial	http://www.ladwp.com/ladwp/cms/ladwp000572.jsp
27	Los Angeles, CA, USA	**Solar Power Initiative**	The cost of eligible solar PV systems is reduced with Incentive funds, which function like rebates. LADWP customers, both residential and commercial, may participate.	rebates and grants	municipal	residential, industrial, municipal and commercial	http://www.ladwp.com/ladwp/cms/ladwp004196.jsp
28	Markham, ON, Canada	**MECO@Work and MECO@Home Employee Awareness Program**	Promotes MECO's purpose and brand across the Town by encouraging staff to engage in energy conservation at work and at home. While at work, Town staff will be encouraged to change their energy consumption patterns.	education	municipal	residential, municipal and commercial	http://www.markham.ca/markham/Channels/meco/programs.htm
29	Markham, ON, Canada	**Energy and Environmental Management System (EEMS)**	MECO has taken the initiative to purchase the Energy and Environmental Management System (EEMS) from the Region of York—a versatile, web based software designed to record and manage energy consumption and expenses of buildings, street lights, and other types of facilities. EEMS has the capability to track electricity, natural gas, water and waste water accounts, and other fuel usage (gasoline, propane, etc.), as well as provide analyses on utility performance.	organization	municipal	municipal	
30	Markham, ON, Canada	**powerWISE**	powerWISE® is a partnership between the Ontario Government and the six participating local electricity distribution companies including PowerStream and Toronto Hydro.	green building	provincial	residential, industrial, municipal and commercial	http://www.powerwise.ca
31	Melbourne, Victoria, Australia	**Sustainable Living in the City program**	Aims to raise environmental awareness, reduce the everyday environmental impact of high-rise residential living, by providing residents and building managers of high-rise apartments with the knowledge, skills and resources to reduce their impact on the environment. The program includes: * building and/or apartment retrofits to reduce water and energy use, and improve waste management; and * practical workshops and information covering waste, water, energy, transport and biodiversity.	green building	municipal	residential (high rise)	http://www.melbourne.vic.gov.au/info.cfm?top=218&pa=2582&pg=3341
32	Melbourne, Victoria, Australia	**Queen Victoria Market Solar Energy**	1328 solar panels on the roof of the Queen Victoria Market. The solar system, launched in April 2003, is the largest urban grid-connected solar photovoltaic installation in the Southern Hemisphere. It has the capacity to generate 252,000 kilowatt-hours of electricity each year for the Queen Victoria Market - enough to power around 46 average homes a year. This project, funded by the Australian Greenhouse Office and the City of Melbourne, was awarded to BP Solar with Origin Energy.	renewable energy	municipal	municipal	http://www.melbourne.vic.gov.au/info.cfm?top=218&pa=2582&pg=1614
33	Melbourne, Victoria, Australia	**Sustainable Melbourne Fund**	Established by the City of Melbourne in 2004, with an initial investment of $5 million, the Sustainable Melbourne Fund seeks to invest in projects that enhance the environment and deliver economic benefits for the people of Melbourne.	green building	municipal	residential, industrial and commercial	http://www.melbourne.vic.gov.au/info.cfm?top=218&pg=1611

	City	Name	Description	Program Type	Jurisdiction	Target Sector	Link
34	Melbourne, Victoria, Australia	**You have the power. Save energy**	The 'You have the power. Save energy' campaign is encouraging all Victorians to save energy at home to cut greenhouse gas emissions and reduce the impact of climate change.	education	provincial	residential	http://www.sustainability.vic.gov.au/www/html/1525-you-have-the-power-save-energy.asp?intSiteID=3
35	Melbourne, Victoria, Australia	**Rebates**	Rebates are available on the following items through the Victorian and Federal Governments to help households use energy more sustainably: * AAA shower heads - Rebate of up to $10 available. * Solar hot water systems - Rebates of up to $1500 available. * High efficiency gas heaters - Rebates of up to $1000 available. * High efficiency gas hot water systems - Rebates of up to $700 available. * Photovoltaic energy systems - Rebates of up to $4000 available.	rebates and grants	provincial / federal	residential	http://www.sustainability.vic.gov.au/www/html/1538-rebates.asp
36	Melbourne, Victoria, Australia	**GreenPower**	GreenPower is a national accreditation program that sets stringent environmental and reporting standards for renewable energy products offered by electricity suppliers to households and businesses across Australia. If you choose a government accredited GreenPower product, your energy supplier agrees that the equivalent amount of energy you nominate is produced from renewable sources, avoiding the use of coal-derived power.	green power	federal	residential, industrial, municipal and commercial	http://www.greenpower.gov.au
37	New York, NY, USA	**Programs - New York State Energy Research and Development Agency**	NYSERDA's principal goal is to help all New York State utility customers solve their energy and environmental problems while developing new, innovative products and services that can be manufactured or commercialized by New York State firms. * New York Energy $martSM Loan Program * FlexTech * Peak Load Reduction Program - PON 1097	green building	provincial	residential, industrial and commercial	http://www.nyserda.org/programs/Default.asp
38	Oxford, UK	**Energy and fuel programs**	Insulation Heating systems Grants and offers Fuel poverty Fuel Bills and Tariffs Building regulations Appliances Lighting No cost and low cost tips Renewable energy Climate Change Levy Ventilation, damp and condensation Water efficiency Windows	green building	municipal	residential, industrial, municipal and commercial	http://www.oxford.gov.uk/environment/energy-efficiency.cfm
39	Oxford, UK	**Climate Change Levy**	The CCL is a national tax on non-domestic energy use, established to promote energy efficiency and to help the UK meet a commitment to reduce greenhouse gas emissions by 20% by the year 2010.	climate change	federal	residential, industrial, municipal and commercial	http://www.oxford.gov.uk/environment/levy.cfm
40	Portland, OR, USA	**Solar Now!**	Solar Energy Options for Homes and Businesses: * Solar Now! Commercial Options * Solar Now! Water Heating Options * Solar Now! Electric System Options	renewable energy	municipal	residential and commercial	http://www.portlandonline.com/osd/index.cfm?c=43478&
41	Portland, OR, USA	**Energy Conservation and Renewable Energy for the City (corporate)**	* City Energy Challenge - Since 1991, the City of Portland has saved more than $2 million a year in energy costs. * 100% Renewable by 2010 - All energy for City Facilities will come from new clean sources. * Waste Methane Used for Fuel and Power Generation - As part of the sewage treatment process a significant amount of waste methane is produced. * Energy Efficient Traffic Signals - All red and green traffic signals now use LED technology. * Powered by the Sun and Wind! - Parking meters, trucks and more use solar and wind energy.	renewable energy	municipal	municipal	http://www.portlandonline.com/osd/index.cfm?c=42399
42	Portland, OR, USA	**Energy Trust Oregon**	* Energy Trust of Oregon, Inc., began operation in March 2002, charged by the Oregon Public Utility Commission (OPUC) with investing in cost-effective energy conservation, helping to pay the above-market costs of renewable energy resources, and encouraging energy market transformation in Oregon. * As part of its oversight of Energy Trust, the OPUC has adopted performance measures against which to benchmark Energy Trust's performance. For 2006, among other these measures are:(i) Save at least 20 average megawatts of electricity, computed on a three-year rolling average basis at a levelized cost of no more than 2 cents per kilowatt-hour; (ii) Save at least 700,000 therms of gas, computed on a three-year rolling average basis at a levelized cost of no more than 30 cents per therm. * Energy Trust serves Oregon customers of Pacific Power, Portland General Electric, NW Natural and Cascade Natural Gas.	organization	n/a	residential, industrial, municipal and commercial	http://www.energytrust.org/

	City	Name	Description	Program Type	Jurisdiction	Target Sector	Link
43	Portland, OR, USA	**Energy Trust Oregon - Program Incentives**	Home Energy Solutions: * Existing homes, Home Performance with ENERGY STAR, manufactured homes and multifamily buildings * ENERGY STAR® new homes, manufactured homes and multifamily buildings * ENERGY STAR clothes washers and compact fluorescent lightbulbs * Solar electric and water heating systems Business Energy Solutions: * Existing buildings * New buildings * Industrial buildings and processes * Energy from renewable sources such as solar, organic waste and wind Renewable Energy Programs * Solar electric and solar water heating using the power of the sun * Wind generation from utility scale to single turbines, and loaned anemometers * Biopower from wood waste, landfill and wastewater gas, manure and other organic sources	green building	n/a	residential, industrial, municipal and commercial	http://www.energytrust.org/library/Program_Incentives/index.html
44	Portland, OR, USA	**Oregon Department of Energy**	Incentives and information for energy conservation.	organization	municipal	residential, industrial, municipal and commercial	http://oregon.gov/ENERGY/CONS/BUS/bushome.shtml
45	Portland, OR, USA	**Oregon Business Energy Tax Credit**	Oregon offers a tax credit of up to 35 percent of the incremental cost of a solar energy system. The tax credit is claimed over 5 years: 10 percent the first two years and 5 percent the remaining three years. If the eligible project costs are $20,000 or less, the tax credit may be taken in one year.	rebates and grants	provincial	commercial	http://www.oregon.gov/ENERGY/RENEW/Solar/Support-BETC.shtml
46	San Francisco, CA, USA	**Consumer Energy Center of the California Energy Commission**	The Consumer Energy Center went on line in 1995 to offer the public a one-stop site on the Internet for the latest information about energy resources and how to use them wisely in our home, work and vehicles.	education	provincial	residential and commercial	http://www.consumerenergycenter.org/index.html
47	San Francisco, CA, USA	**Go Solar California!**	This website is a joint effort of the California Energy Commission and the California Public Utilities Commission. This site provides consumers a "one-stop shop" for information on rebates, tax credits, and incentives for solar electricity systems in California. It has programs for new houses, existing houses, non-residential buildings, low income housing, & municipal utility consumers.	renewable energy	provincial	residential and commercial	http://www.gosolarcalifornia.ca.gov/index.html
48	San Francisco, CA, USA	**California Solar Initiative - CSI**	As part of Governor Arnold Schwarzenegger's Million Solar Roofs Program, California has set a goal to create 3,000 megawatts of new, solar-produced electricity by 2017 - moving the state toward a cleaner energy future and helping lower the cost of solar systems for consumers. The California Solar Initiative Offers: * Photovoltaic incentives starting at $2.50 per watt for systems up to one megawatt in size. * Funds for solar installations for existing and new low-income and affordable housing. * A pay-for-performance incentive structure to reward high-performing solar projects.	renewable energy	provincial	residential, industrial and commercial	http://www.gosolarcalifornia.ca.gov/csi/index.html
49	San Francisco, CA, USA	**New Solar Homes Partnership**	The California Energy Commission will manage a 10-year, $350 million program to encourage solar in new home construction, known as the New Solar Homes Partnership (NSHP).	renewable energy	provincial	residential	http://www.gosolarcalifornia.ca.gov/nshp/index.html
50	Seattle, WA, USA	**Seattle City Light's energy efficiency programs and services**	* Conservation Services For Your Business * Conservation Services For Your Home - Conservation information and services including information about weatherization, efficient lighting and appliances, and tips for saving energy. * Customer Generation - generating electricity on their premises using solar or other technologies. Includes information on net metering, permitting and new financial incentives. * Energy Smart Services - Financial incentives and technical assistance to help medium to large businesses reduce electricity use and costs. * Neighborhood Power Project. * Lighting Design Lab - Efficient lighting assistance for commercial customers and lighting designers.	green building	municipal	residential and commercial	http://www.seattle.gov/light/conserve/
51	Seattle, WA, USA	**Seattle's (Building) Energy Code**	Energy Code requirements are subdivided by occupancy type: Residential Energy Code (single family, multi-family, hotel and motel guest rooms, both low-rise and high-rise), Nonresidential Energy Code.	green building	municipal	residential and commercial	http://www.seattle.gov/DPD/Codes/Energy_Code/Overview/default.asp
52	Sydney, Australia	**Energy Rebates**	* Energy blackout rebates * Pensioner Energy Rebates * Life Support Electricity Rebates * Energy Accounts Payment Assistance (EAPA)	rebates and grants	provincial	residential	http://www.deus.nsw.gov.au/Energy/Information%20for%20Consumers/Energy%20Rebates.asp#TopOfPage

	City	Name	Description	Program Type	Jurisdiction	Target Sector	Link
53	Sydney, Australia	**GreenPower**	GreenPower is a national accreditation program that sets stringent environmental and reporting standards for renewable energy products offered by electricity suppliers to households and businesses across Australia. If you choose a government accredited GreenPower product, your energy supplier agrees that the equivalent amount of energy you nominate is produced from renewable sources, avoiding the use of coal-derived power.	green power	federal	residential, industrial, municipal and commercial	http://www.greenpower.gov.au
54	Vancouver, BC, Canada	**Power Smart at Home - BC Hydro**	* Fridge Buy-Back Program. * Lighting Rebates. * Windows Rebate Program. * Analyze My Home.	green building	n/a	residential	http://www.bchydro.com/powersmart/
55	Vancouver, BC, Canada	**Power Smart for Business - BC Hydro**	* High-Performance Building Program for Small to Medium Commercial Buildings. * High-Performance Building Program for Large Commercial Buildings. * New Home Program. * Compressed Air Initiative. * Refrigeration Initiative. * Power Smart Partner Program, for our largest business customers. * Green Power Certificates. * Power Smart Success Stories.	green building	n/a	commercial and industrial	http://www.bchydro.com/business/

General Findings

The following could be commented from the jurisdictional scan research, analysis and results:

- A total of 188 initiatives were identified in the 21 cities, from which 55 were awarded a high mark.
- 16 of the 21 cities researched had at least one initiative awarded with a high mark.
- 67percent of the initiatives awarded a high mark fell under one of the following initiative types: green building and conservation programs, rebates and grants and solar and other renewable energy sources.
- Many cities rely on provincial and national initiatives to support their energy conservation initiatives.
- Many cities include their energy conservation plans and initiatives under the climate change umbrella. In these cases, energy conservation is one among many actions aimed at reducing greenhouse gas emissions.
- From the 21 cities researched, the following cities have stand up as progressive examples of energy conservation commitments and activities:
  - City of London because of its Energy Plan
  - The state of California because of its solar energy programs
  - Copenhagen because of its Main District Heating Network initiative
  - Portland for its energy conservation and renewable energy initiatives for City Corporate
- Chicago was identified as the most similar to Toronto in area, population and climate. Berlin, Calgary and New York followed.

Jurisdictional Research and Ranked Initiatives

Please see Appendix F.

Appendix C: Current and Future Energy Consumption in Toronto

Methodology

The calculation of current and projected non-transportation energy use in Toronto from 2006 to 2031 required the development of two models, one for the residential sector, and one for the combined institutional, commercial and industrial sectors ("ICI"). The model for the residential sector had 6 different building types, and the model for the ICI sector had 20 different building types. In addition, buildings were separated into new and existing. Each model incorporates the data and evaluation methods described in below.

1. The **Business As Usual ("BAU")** case is defined as the sum of the impact of floorspace additions, replacement or retrofit of energy components and systems in existing buildings, and minimum efficiency regulations that is expected to occur over the planning timeframe.
2. The **Energy Efficient ("EE")** case is defined as the acceleration in the uptake of new technologies and techniques for both new and existing buildings that can be achieved through programs that provide information and/or incentives.

The approach taken to quantify the breakdown of current annual energy consumption in the City is summarized as follows:

1. Account for and quantify the material energy inputs to the City for the base year (2006).
2. Obtain the total floor space of all building types from the City, including low-rise residential, high-rise residential, commercial, institutional and industrial.
3. Allocate the energy use by energy type to each building type or segment using known energy archetypes for each building type.
4. Adjust segment energy use to match total energy use.

The projections for the Business As Usual case have been prepared from the analysis of current energy use using the following approach:

1. Obtain five-year projected dwelling unit estimates from the City by residential building type.
2. Obtain five-year projected labour force estimates from the City, and use these to prepare five-year floorspace estimates by ICI segment.
3. Review the known impact of the Ontario Building Code ("OBC") on energy efficiency in each building sector from 1990 to 2016, and project the estimated impact from that point forward.
4. Separate new building additions in five-year increments from existing buildings for each building type, and consider these separately.
5. From the estimates of current use by sector, project energy use forward for each building sector, taking into account changes in floorspace and changes in energy end-uses by new building archetype resulting from the impact of OBC.

The projections for the Energy Efficient case have been prepared from the Business As Usual case using the following steps:

1. Review past and current energy efficiency programs offered for building energy retrofit by sector, and determine their estimated impact.
2. Review proposed and anticipated new energy technologies and programs for both new and existing buildings and estimate their impact, including the potential savings available from the technology, the amount of incremental savings designed into the program, and the rate of uptake of both, over the planning time frame by building sector and age.
3. Adjust the BAU case for each five-year increment to evaluate the impact of new technologies and programs.

Use of Energy Archetypes

Energy use in buildings of all types (except industrial buildings) can be characterized by an archetype that specifies energy end-use intensity. The units are commonly specified as equivalent kilowatt-hours per square foot (ekWh/ft^2) of gross floor area. In the US, the Energy Information Administration has been providing these archetypes for over 25 years using field surveys across 5 climatic zones. In Canada, NRCan commissioned a similar survey in 2002 by Statistics Canada. A sample of energy archetypes is provided in Table C-1, representing new buildings in Ontario designed to meet OBC 1997.

Table C- 1: Typical Energy Archetypes

Energy Intensity by End-Use, ekWh/ft^2/yr	MUR	Office	Retail	Schools	College/ University
Space Heating	11.7	15.1	21.8	11.1	12.3
Water Heating	3.4	2.9	0.3	2.0	3.1
Auxiliary Equipment	3.8	2.6	0.9	0.5	2.7
Auxiliary Motors	2.7	4.7	3.6	2.4	3.2
Lighting	2.3	6.2	8.7	2.3	2.6
Space Cooling	1.2	1.9	1.4	0.6	2.7
Total	**25.1**	**33.5**	**36.7**	**19.0**	**26.6**

From these archetypes, it is evident that different building types use energy for end-uses at different rates. In addition, energy from different sources can be differentiated by end-uses such as space heating and water heating for natural gas. Provided the penetration rate of each energy source is known, an accurate estimate of both current and projected energy uses by fuel source can be developed.

Energy archetypes have been developed for existing buildings, and for new buildings designed in accordance with the OBC for past editions, current editions, and known future editions.

For the residential sector, the archetypes were developed based on energy use per dwelling unit rather than per unit of floorspace.

The Impact of the Ontario Building Code on Energy Efficiency

The energy efficiency requirements specified in the Ontario Building Code represent the minimum level of energy performance that must be met by all new building owners and designers.

Commencing in 1990, the OBC implemented minimum requirements for low-rise housing – also defined as Part 9[42] residential buildings – for insulation and window performance. This continued through amendments issued in 1993, and in OBC 1997, although there was a small backtracking on the issue of full height basement insulation. With the introduction of OBC 2006, these requirements were increased again, and also include the following:

- Minimum gas furnace annual fuel utilization efficiency (AFUE) of 90percent;
- The introduction of a performance option by citing EnerGuide[43] 80 as meeting all energy efficiency requirements;
- A commitment to incorporate full height basement insulation in 2009; and
- A commitment to require EnerGuide 80 in 2012.

For Part 3[44] buildings and Part 9 non-residential buildings, the OBC introduced the use of an energy code, ASHRAE/IES 90.1, "Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings" to determine that a building is designed to be energy efficient, through an amendment in 1993. The Canadian Model National Energy Code for Buildings, 1997 (MNECB), was added as an optional energy code in OBC 1997. OBC 2006 has significantly ramped up the energy efficiency of new buildings by replacing ASHRAE/IES 90.1-1989 with ANSI/ASHRAE/IESNA 90.1-2004, and by reinforcing MNECB with the Lighting and mechanical equipment sections from ASHRAE 90.1-2004, and by establishing more stringent requirements for the Building Envelope section in both energy codes. Furthermore, OBC 2006 has committed to an even higher level of energy efficiency for 2012, when it is expected to require the energy performance of new buildings to exceed the MNECB by 25percent.

The impact of the OBC on the energy efficiency of both Part 9 and Part 3 buildings is significant because all buildings must meet these requirements. While enforcement is not universally applied, eventually both designers and building officials develop a sufficient understanding of the requirements so that design and construction changes to conform.

For both Part 9 and Part 3 buildings, the OBC has a clear set of requirements that are expected to remain unchanged through 2017, and this has demonstrated a commitment to

[42] Defined in the OBC as buildings having a building floor area of 600 m^2 or less, and 3 or fewer stories.
[43] EnerGuide for New Houses is a program operated by NRCan, requiring the services of a certified auditor to review plans, prepare an energy model of the house, perform inspections during construction, and undertake a blower door test following construction. A label certifying the EnerGuide rating is provided to the builder.
[44] Defined in the OBC as having a building floor area greater than 600 m^2, and greater than 3 stories

keep raising the bar in response to improving design and construction capability and the need for Ontario to reduce overall energy use and emissions.

The Impact of New Technologies and the Limitations of Retrofits

Natural Resources Canada (NRCan) regulates the minimum energy efficiency requirements for a broad range of appliances, office equipment, lighting, HVAC equipment. In addition, they provide both information labelling through the EnerGuide program, and endorsement labelling through the ENERGY STAR program. All of these programs are regularly updated as new and improved products become available on a more cost effective basis, newer technologies achieve a significant market position, or the US regulations change and harmonized regulations must be maintained.

For existing buildings, the market uptake can be dependent on a number of factors, as demonstrated by the following examples:

- **Refrigerators**: the energy efficiency of this appliance has improved dramatically over the past 10 – 15 years, moving from 1200 kWh/yr to 420 kWh/yr for a typical house. The average life of a refrigerator is 20 years, so the rate of uptake of the newer technology has been somewhat slow[45].
- **Commercial Lighting:** T8 lighting systems have been available since 1988 to replace T12 systems, and have been cost effective for retrofit since 1995, having a simple payback of 3 to 5 years while offering better lighting quality. Until the introduction of OBC 2006 in 2007, even new buildings were still being designed to use T12 systems. A recent estimate of the penetration of T8 systems in existing buildings set the level at 60 – 70percent.
- **Centrifugal Chillers:** the energy efficiency of chillers used in larger commercial and institutional buildings has improved from 0.75 kW/ton to 0.50 kW/ton over the past 15 years. Chillers installed in buildings in Toronto tend to remain in place for 20 to 30 years.

Each of these examples has a significant effect on the cooling energy required for houses and buildings, which impacts directly on summer peak demand.

It is not simply the availability of more energy efficient technologies that is expected to result in reduced energy consumption and peak demand, but rather the rate of adoption that could have the greatest effect. Increasing the rate of adoption can be achieved in stages through programs that address specific barriers, including:

- Programs that educate consumers, and provide incentives to encourage faster adoption and expanded markets for suppliers
- Once adequate market readiness and market penetration has been achieved, these gains can be cemented by regulation.

Some technologies and measures are relatively simple to apply in the retrofit case while others are more difficult. TableC-2 provides an indication of the degree of complexity and

[45] *Technology Assessment Study and TRC Analysis for the Ontario Power Authority*, Dec. 2005. SeeLine Group Inc.

difficulty in their application. This can also be viewed as having a significant impact on the simple payback of the retrofit.

Table C- 2: Relative Complexity of Retrofits

Building Component or System	Simplicity of Retrofit (1 = Simple;10 = Difficult)
Appliance/Office Equipment	1
Lighting Retrofit	3
Lighting Redesign	4
HVAC Equipment Retrofit	5
HVAC System Redesign	6
Roof Insulation/Green Roof	7
Window Replacement	8
Wall Insulation	9
Basement Floor Insulation	10

This illustrates the propensity for buildings owners and managers to select those measures that are easier to implement, how this tendency works against the Load, Systems, Plant approach, and why it is so important to design the building envelope to be energy efficient when the building is newly designed and constructed.

In developing the Energy Efficient case, the project team has used assumptions about both the availability and market readiness of new technologies and acceleration in the rates of adoption that can be achieved for each building type.

The Importance of Addressing New Buildings

The design of a new building represents the best opportunity to implement both energy efficiency and renewable energy. The building envelope, lighting, mechanical systems and electrical systems can be design and constructed to achieve higher levels of energy efficiency that will remain in place for a time frame ranging from 15 years for lighting, 25 years for HVAC systems, to the lifetime of the building for the envelope.

From a renewable energy perspective, the design and construction stage is the right time to apply these design features and technologies. They can be integrated into the building design, and replace systems and components, either partially or fully, that use conventional energy sources. The Integrated Design Process that is being adopted more widely offers the opportunity to incorporate passive features such as building orientation, natural ventilation and passive solar energy, with significant reductions in energy use.

In Toronto, a number of large and high profile projects[46] present an excellent opportunity to demonstrate the potential for using the integrated design approach, and to achieve significant levels of energy efficiency and building integrated renewable energy.

[46] Notably the Toronto Waterfront Redevelopment, Downsview Park and Regent Park

Energy Projections

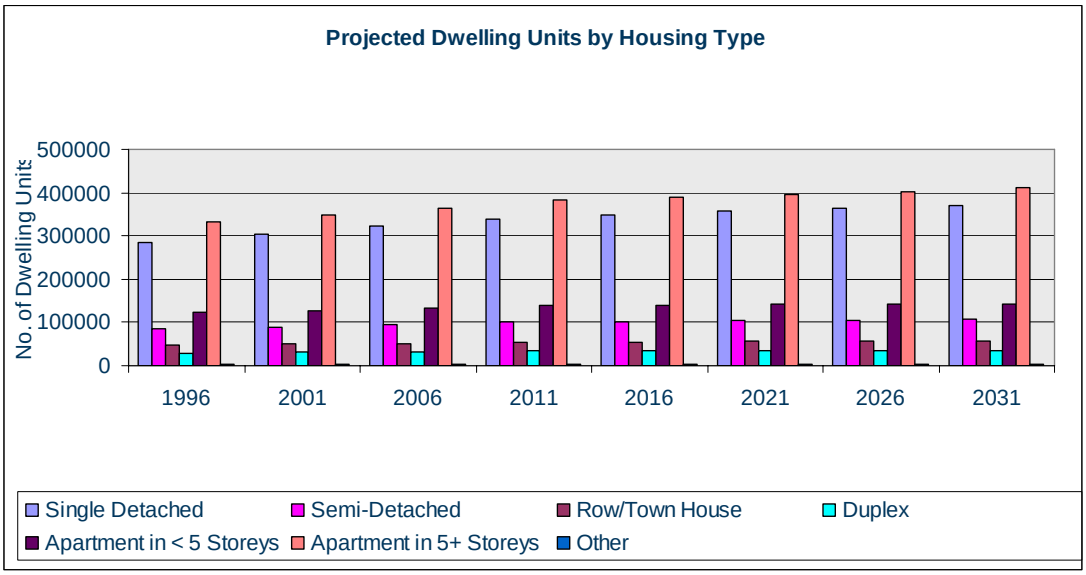
The energy projections started from the establishment of an accurate baseline within the model, and then proceeded with the development of the projections as described above. By considering each building type individually, and by reviewing new buildings and existing buildings separately in five-year increments, energy impacts and rates of adoption for new technologies in both retrofit and new building applications could be accommodated, thereby improving the accuracy of the projections.

Housing Energy Projections

Dwelling Unit Projections[47]

The City of Toronto Economic Development Department has provided a forecast of growth in dwelling units by housing type. These are summarized in Figure C-1.

Figure C- 1: Projected Dwelling Units by Housing Type

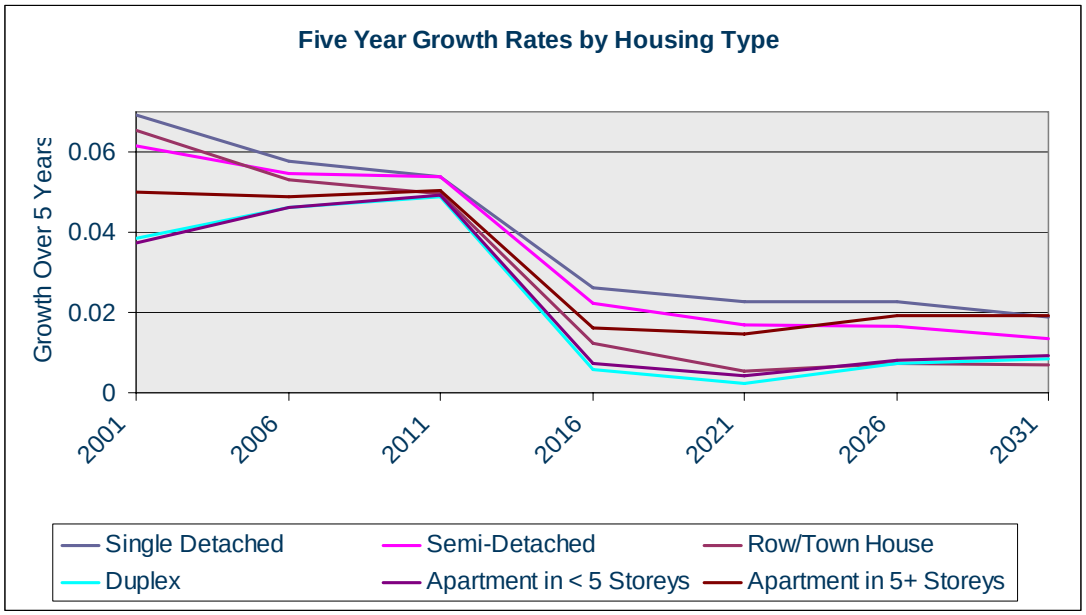


Overall, the number of dwelling units in the City is expected to grow from 903,235 in 1996 to 1,127,843 in 2031, a total gain of 24.8percent over 35 years.

[47] Flashforward: Projecting Population and Employment to 2031 in a Mature Urban Area, Addendum. July 2006. Toronto City Planning, Policy and Research

Growth by dwelling unit type for each 5 year period is presented in Figure C-2. Note that the "Other" category is not included due to its very small size.

Figure C- 2: Growth in Dwelling Units by Housing Type



These dwelling unit projections constitute an important data source for the energy projections as they define the types and amounts of additional residential space.

The City also provided total floorspace by building type. The project team used these data to match the existing dwelling unit figures to the floorspace as a check on the accuracy of the assumptions.

Baseline Estimates

The development of the baseline estimates required two different approaches, one for Part 9 buildings and one for Part 3 buildings. From the housing projections, it was assumed that dwelling units in single-detached, semi-detached, row/town houses, duplexes and apartments in less than 5 storeys were all Part 9 buildings, and apartments in 5 or more storeys were Part 3 buildings.

From the previous discussion on energy sources and LDC rates, the rate classifications for Enbridge can be applied in the same manner as the building code (i.e., the Residential rate for Part 9 buildings and the Apartment rate for Part 3 buildings.)

The rate classifications are not as straightforward for Toronto Hydro as its Residential rate applies to individually metered residential dwelling units, regardless of the building type. This means that a Part 3 residential building with individually metered dwelling units is expected to have the Residential rate applied to the dwelling units, and the General Service rate applied to the common area uses. An industry estimate suggested that only about 10percent of high-rise residential buildings have individual metering. Therefore, the Residential rate has been used for all Part 9 buildings and the General Service rate for Part 3 buildings. This resolved the issue of differentiating between the two rates for this sector, however the electricity used in the high-rise residential sector had to be deducted from the portion of the commercial, institutional and industrial sector also billed under the General Service Rate.

Based on an industry estimate, we have assumed that 8.5percent of the space heating market and 5percent of the water heating market for Part 9 buildings was supplied by fuel oil, and 10percent of the space heating market for Part 3 buildings was supplied by electricity. No other information was found to further improve the accuracy of these estimates.

The final step in the determination of energy use for the base year was to convert dwelling units to floorspace as a check against the accuracy of the model.

Table C-3 shows the energy use by fuel type for the model compared to the energy consumption acquired for the LDCs. It also shows the comparison between the floorspace estimates from the model and floorspace data provided by the City.

Table C- 3: Comparison of Model and Target Baseline Data – Residential Sector

	Part 9 Buildings		Part 3 Buildings	
	Model	Target	Total	Target
No. of Dwelling Units	634,202	* Note 1	132,894	* Note 1
Total Floorspace, sq ft.	972,449,500	941,727,881	544,855,200	699,530,849
Electricity, GWh/yr	5,796	5,724	3,249	* Note 1
Natural Gas, 1,000s of cu m./yr	1,356,596	1,322,327	866,250	867,781
Fuel Oil, 1,000s of L/yr	105,464	* Note 1	0	* Note 1

* Note 1: No target data available

Figure C- 3: Electricity Projections for Residential Sector Buildings

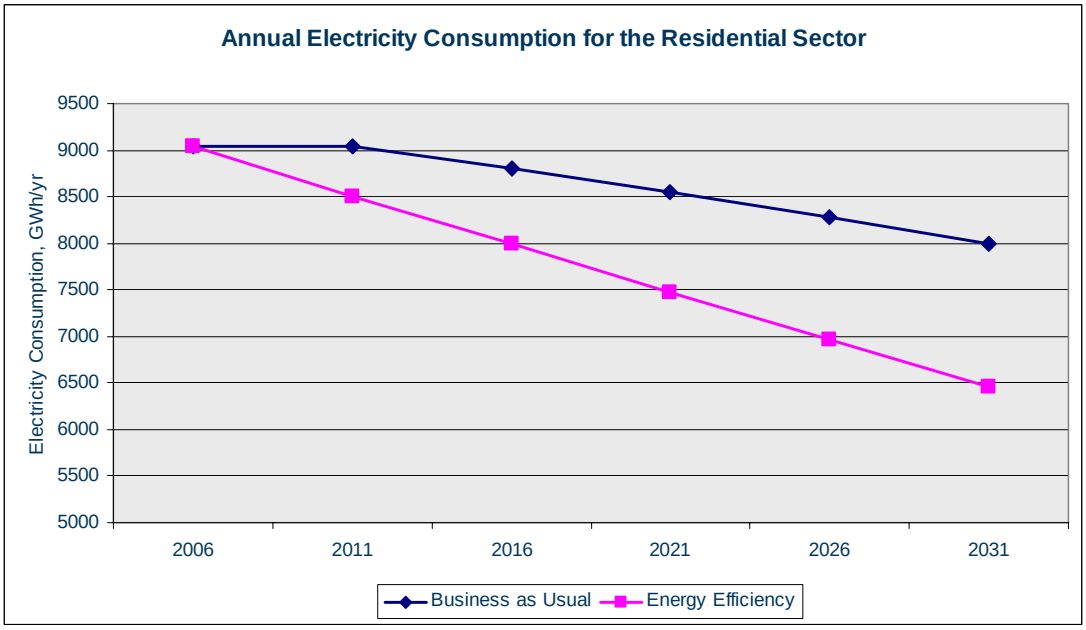
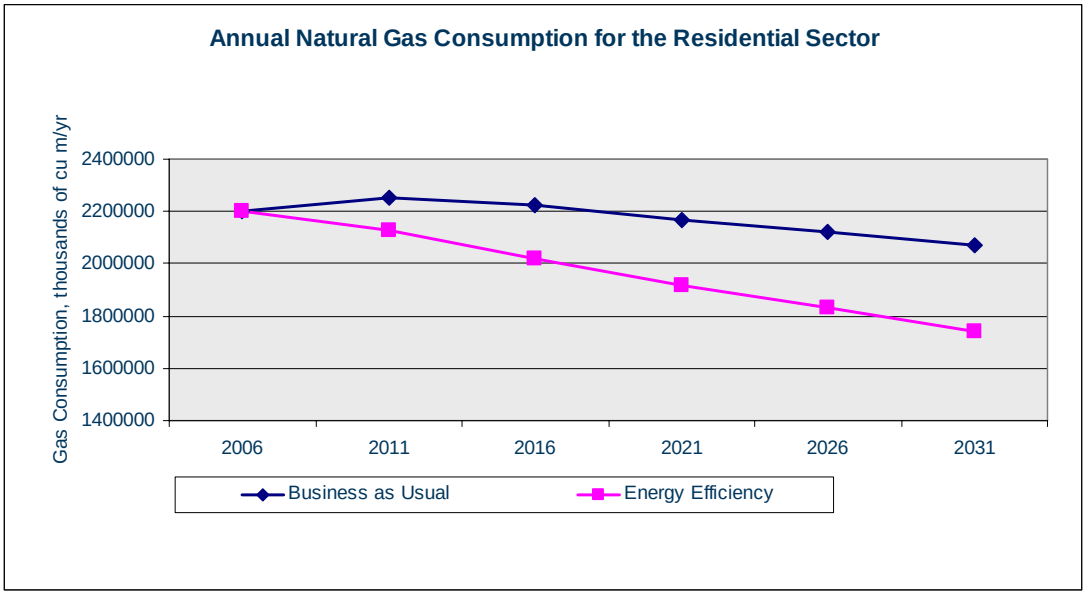


Figure C- 4: Natural Gas Projections for Residential Sector Buildings



Institutional, Commercial and Industrial Building Energy Projections

The development of the energy projections ICI sector has followed the methodology used for the residential building projections, with the following differences.

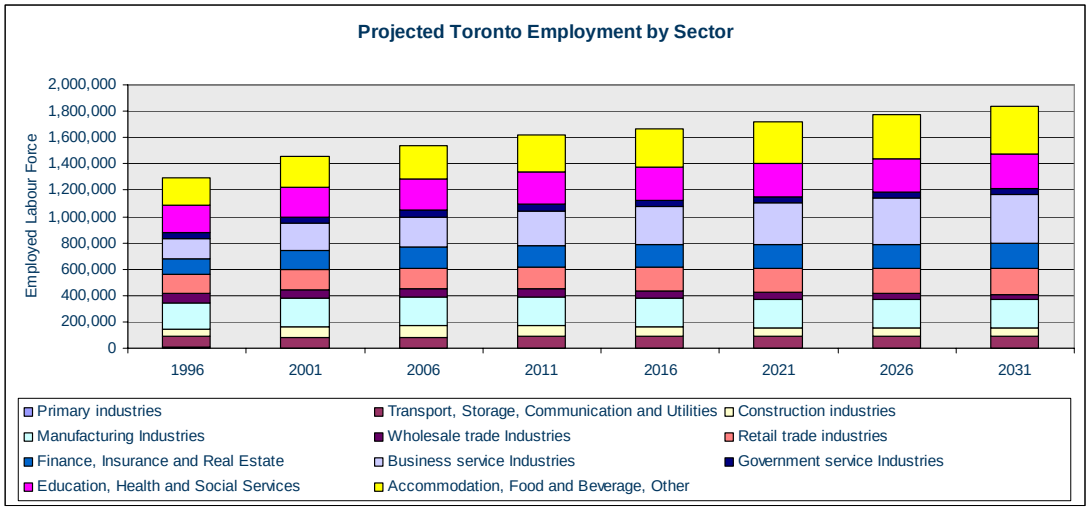
- ICI Building projections use floorspace rather than dwelling units as the base unit of evaluation; and
- The variety of building types is much greater than the six residential building types, having a total of 20 individual building types and sizes.

Floor Space Projections

Floorspace projections have been developed from employment projections provided by the City and from baseline data on current building floorspace by building type. Employment projections are presented in Figure C-5.[48]

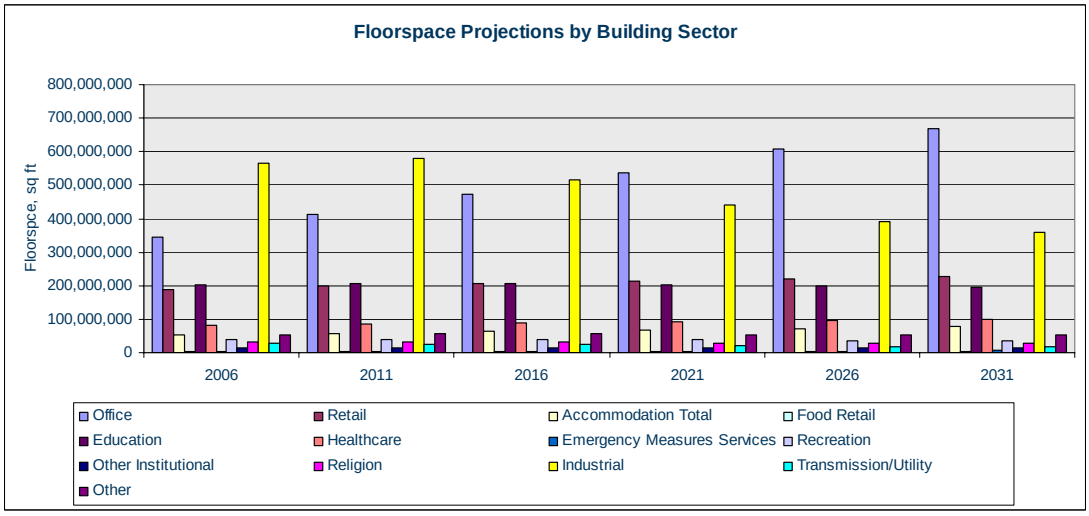
[48] *Flashforward: Projecting Population and Employment to 2031 in a Mature Urban Area*. 2002

Figure C- 5: Employment Projections for Toronto



The floorspace projections, developed from the employment projections, are presented in Figure C-6.

Figure C- 6: Floorspace Projections by ICI Sector for Toronto



Baseline Estimates

The development of the baseline estimates required that separate energy impacts for each building sector be determined for the new buildings added to the building stock during each five year period. In the case of Part 9 non-residential buildings and Part 3 buildings, the OBC treats these in the same manner (i.e., the energy codes apply to both size ranges).

From the previous discussion of energy sources and LDC rate classifications, the Enbridge rates that apply to this sector are Commercial and Industrial. This simplified the determination of energy used for the Industrial sector, as energy use in this sector is often driven by the process rather than the building that houses it.

The rate classifications are not as straightforward for Toronto Hydro as its General Service rate applies to all non-residential buildings (as well as some residential buildings) in the City except for the 49 accounts that have a monthly peak demand of 5,000 kW or more, which therefore fall within the Large User rate. In order to identify accounts in the Large User category, a potential list of the 49 accounts was developed from a variety of sources, and then allocated into segments. The Toronto Transit Commission was included in this list and therefore a significant portion of its annual electricity use was deducted from the Large User category to separate the transportation component from the building category.

Table C-4 shows the energy use by fuel type for the model compared to the energy consumption acquired for the LDCs.

Table C- 4: Comparison of Model and Target Baseline Data – ICI Sector

	Model	Target
Electricity		
- General Service	19,224	18,084
- Large User	2,621	2,563
Natural Gas, 1,000 of cu m/yr		
- Commercial	1,156,633	1,324,987
- Industrial	738,246	748,639

Energy Projections

The final results of this analysis are presented in Figures C-7 and C-8 for electricity and natural gas, respectively.

Figure C- 7: Electricity Projections for ICI Sector Buildings

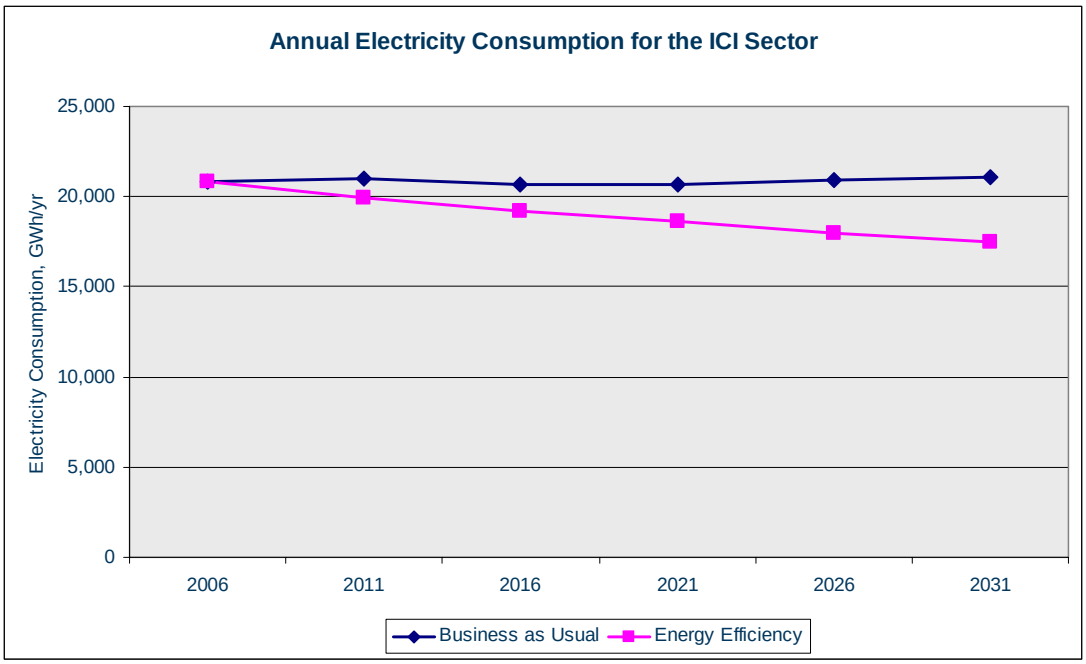
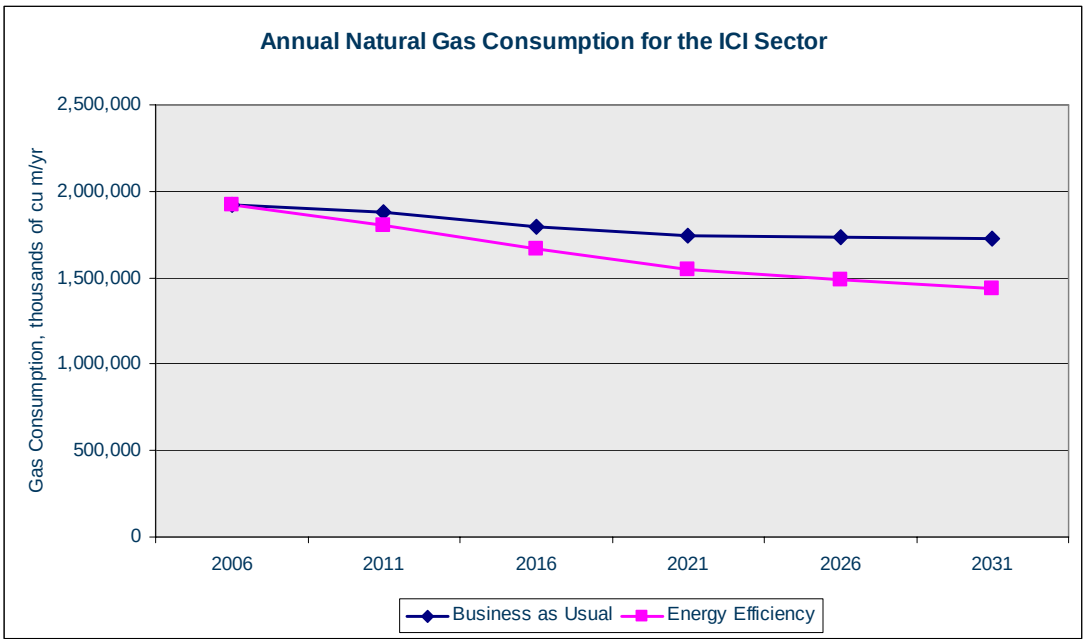


Figure C- 8: Natural Gas Projections for ICI Sector Buildings



Summer Peak Demand of Electricity

The difficulty in projecting, or even allocating summer peak demand, has been outlined in Section 3, in this report, especially in the absence of any detailed information from Toronto Hydro. Nevertheless, electricity demand by sector has been evaluated and an estimate prepared of the contribution to peak demand, and the potential for reducing this peak.

Figure C-9 presents an estimate of the share of current summer peak demand by sector.

Figure C- 9: Estimate of Summer Peak Demand Contribution by Sector

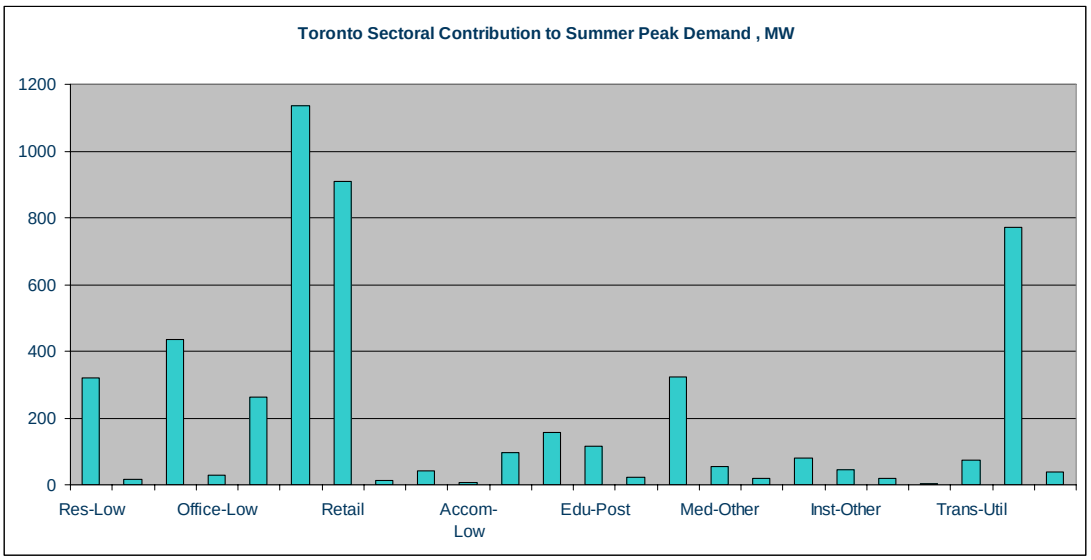
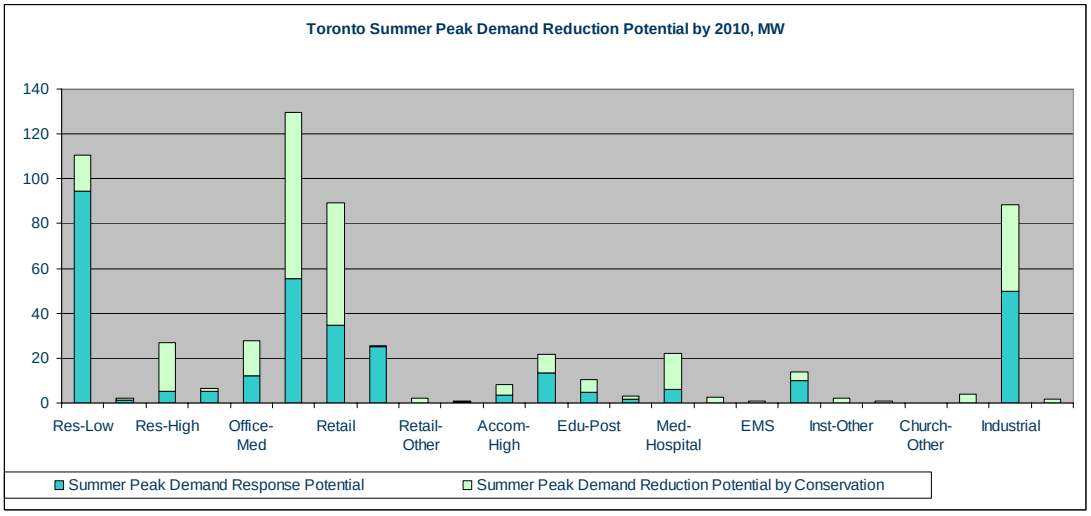


Figure C-10 presents an estimate of the potential to reduce this demand within the period from 2010 to 2015.

Figure C- 10: Estimate of Summer Peak Demand Reduction Potential by Sector



Appendix D: Overview of energy efficiency and renewable energy programs

Objective

The objective of the review of the existing and developing initiatives was to attempt to identify all energy efficiency and renewable energy programs currently available in the City of Toronto. This includes both City Corporate and City Municipal. The findings of the review were consolidated with those of the jurisdictional scan and used as the basis for the identification of preferred program options.

Methodology

The review of existing and developing initiatives was conducted in three phases:

1. Research
2. Review by Stakeholders
3. Ranking of initiatives

The sections below describe these three phases in more detail.

Research

The review relied chiefly on secondary internet based research, augmented by information and reports provided by the two energy utilities (Enbridge Gas Distribution and Toronto Hydro) and the City. It included a review of activities at all three levels of government plus an examination of specific initiatives sponsored or operated by a variety of non-government organizations and member supported organizations.

Over 90 programs were reviewed and filtered. While comprehensive, the list is not exhaustive. More importantly, there are a variety of new initiatives that are either currently being contemplated or about to be announced. For instance, the OPA is about to launch new programs in the Province of Ontario and Toronto Hydro is contemplating adding to its already impressive list of programs. As such, a list of program will never be complete and must always be considered as dynamic. As well, some of the new programs will undoubtedly impact programming efforts currently being considered by the City.

As indicated, over 90 were researched as part of this exercise. For each program examined, the following basic information was identified:

- Initiative Name
- Delivery Agent
- Basic program description
- Program type
- Jurisdiction

- Target sector or sub-sector
- Source of information

Some programs were dropped from the list as they were either deemed to be irrelevant (in particular, those focused on transportation) or have recently been cancelled (in particular, programs offered by Natural Resources Canada).

Review by Stakeholders

The preliminary list of existing and developing initiatives was provided to the City for review during an Internal Stakeholder Consultation meeting held on April 18, 2007.

The City of Toronto's Energy Efficiency Office and other departments provided feedback and the list of existing and developing initiatives was accordingly updated.

The final list of existing and developing initiatives contains a total of 84 initiatives.

Ranking of initiatives

The objective of this final phase was to determine how successful each initiative was in achieving energy conservation.

The initiatives were ranked using the following criteria:

	City-wide energy conservation impact	Ease of initiative implementation	Actual use of initiative or technology by target audience
Description	How much impact has the initiative (or the technology supported by the initiative) in conserving energy in the city as a whole? Assume the initiative will be used by the target audience (note: use other criterion to rank the potential use of the program)	How easy is to implement the initiative? Factors to consider: * Government support * Investment required * Infrastructure in place	Has the initiative received buy in from the community (or has the community implemented the technology it supports)?
Criteria	H = high impact (i.e. large energy conservation potential) M = medium impact L = low impact	H = easy to implement M = average L = difficult to implement	H = high acceptance M = medium acceptance L = low acceptance

Each of the above criteria was assigned a value that reflects its importance in comparison to the other ranking criteria. These values were:

1	▪ Ease of initiative implementation
2	▪ City-wide energy conservation impact ▪ Actual use of initiative or technology by target audience

Based on these criteria, each initiative was ranked and awarded a low (L), medium (M-, M, & M+) or high (H-, H, & H+) grade. The higher the grade obtained by an initiative, the more successful it is or was and the more relevance it might have in a program development exercise.

Limitations

The reader should consider the following limitations when evaluating the results of the ranking of the initiatives:

- The information gathered was obtained from readily available public information.
- PwC has not undertaken an independent audit or verification of the information.
- The ranking of initiatives is based purely on the information available from public sources and the project team's knowledge and experience.
- Budgetary limitation prevented a more exhaustive review and ranking.
- The information presented is current as of April 2007. Program offerings change continuously and thus, any list of initiatives should always be considered dynamic. In particular, program offered by the federal government through have and can be expected to change significantly in the near future.

Research and Ranked Initiatives

Please see Appendix G.

Appendix E: Energy Plan outline for City owned buildings

An outline of the City Owned Buildings Energy Plan has been prepared as a guide to assist with the incorporation of the concepts and issues presented in this report. The outline is as follows:

1 Objectives
- 1.1 Supply Management
- 1.2 Energy Management
- 1.3 Best Practice
- 1.4 Demonstration

2 Supply Management
- 2.1 Electricity
- 2.2 Natural Gas
- 2.3 Enwave
- 2.4 Renewable Energy (external)

3 Asset Management Issues
- 3.1 Alignment of Energy Efficiency measures with Capital forecast
- 3.2 Economic criteria for retrofits and life cycle costing

4 Energy Management
- 4.1 Audits
- 4.2 Retrofits
- 4.3 Training and Technology Transfer
- 4.4 Communication and Demonstration
- 4.5 Monitoring and Verification
- 4.6 Building Automation and Real Time Metering
- 4.7 O&M documentation

5 Renewable Technologies
- 5.1 Renewable Strategy and Goals
- 5.2 Retrofit Projects
- 5.3 New Building Projects

6 New Buildings
- 6.1 Policy
- 6.2 New Building Design Process
- 6.3 Commissioning

Appendix F: Jurisdictional Research and Ranked Initiatives

Energy Plan for Toronto
Jurisdictional Scan

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Limitations

The reader should consider the following limitations when evaluating the results of the jurisdictional research and analysis:

1. The information gathered was obtained from readily publicly available information.
2. No interviews were carried out with representatives from the selected cities.
3. PwC has not undertaken an independent audit or verification of the information gathered.
4. As our research has been primarily based on publicly available secondary research, we have not been able to capture many of the internal programs that many municipalities may currently support.
5. Reasonable time based on time and budgeted requirements was allocated to research each city and their initiatives.
6. Language constrains existed for performing a more in depth research of cities other than those located in English, Spanish or German speaking countries.
7. The information presented is up-to-date as of February 2007. Cities change and update their initiative offering continuously and thus, a list of best-in-class initiatives should be always considered dynamic.

City Selection Criteria

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	City (click on the city below to see its list of initiatives)	Country	RFP	Kick-off meeting	Clinton Climate Initiative	Cities for Climate Protection - International Council for local Environmental Initiatives	SustainLane 2006 US city rankings of the 50 largest cities - Energy and Climate change Policy ranking	Economist Intelligence Unit - best place to live (2005)	PwC's cities of the future	The World's Greenest Cities	Review of Env Best Practices in Cities around the World - Toronto Env Office (January 2007) - ENERGY SECTION	Sustainable Cities Initiative - National Round Table on the Environment and Economy CANADA
-	Toronto, ON	Canada			✓	✓	-	9	✓		-	
1	Austin, TX	US				✓	50+			✓	-	
2	Barcelona	Spain				✓	-		✓	✓	-	
3	Berlin	Germany			✓	✓	-		✓		Innovative/Implementable x 2	
4	Calgary, AL	Canada				✓	-	10			Innovative	
5	Chicago, IL	US	✓		✓	✓	5			✓	Implementable	
6	Copenhagen	Denmark										
7	Freiburg	Germany	Additional city recommened by the City of Toronto									
8	Gothenburg	Sweden	Additional city recommened by the City of Toronto									
9	London	UK	✓		✓	✓	-		✓		Implementable	
10	Los Angeles, CA	US	✓		✓	✓	4				-	
11	Malmo	Sweden					-		✓	✓	Implementable	
12	Markham, ON	Canada		✓		✓	-				-	
13	Melbourne	Australia			✓	✓	-	2	✓		Innovative/Good to know	
14	New York City, NY	US	✓		✓	✓	5				-	
15	Oxford	UK	Additional city recommened by the City of Toronto									
16	Portland, OR	US				✓	1			✓	Implementable	
17	Rizhao	China	Additional city recommened by the City of Toronto									
18	San Francisco, CA	US	✓				1				Good to know	
19	Seattle, WA	US				✓	1				Innovative/Good to know	
20	Sydney	Australia				✓	-	7	✓	✓	Good to know	
21	Vancouver, BC	Canada	✓			✓	-	1	✓	✓	-	

22	Adelaide	Australia				✓	-	6			Good to know	
23	Buenos Aires	Argentina			✓	✓	-				Good to know	✓
24	Curitiba	Brazil					-					
25	Denver, CO	US				✓	10					
26	Freiburg	Germany				✓	-			✓		
27	Hamilton, ON	Canada	✓	✓		✓	-					
28	Madrid	Spain			✓		-		✓			
29	Minneapolis, MN	US				✓	10				Implementable	
30	Oakland, CA	US	✓			✓	12				Innovative	
31	Oslo	Norway					-		✓			
32	Peterborough, ON	Canada		✓		✓	-					
33	Philadelphia, PA	US			✓	✓	5				Innovative	
34	Porto Alegre	Brazil				✓	-					
35	Reykjavik	Ireland					-			✓		
36	Sudbury, ON	Canada		✓			-					

Ranking criteria of initiatives

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	City Criteria		
	Area	**Population**	**Climate**
Description	Area comparable to Toronto's 620 km2	Population comparable to Toronto's 2.5 million (5 million in the GTA)	Climate comparable to Toronto's -- humid continental
Criteria	H = 620 km2 ± 50 km2 M = 620 km2 ± 200 km2 L = other	H = 2.5 million ± 0.5 million M = 2.5 million ± 1 million L = other	H = similar climate L = tropical M = other

	Initiative Criteria				
	City-wide energy conservation impact	**Ease of initiative implementation**	**Potential use of initiative or technology by target audience**	**Applicable to key sectors**	**Ranking**
Description	How much impact would the initiative (or the technology supported by the initiative) have in conserving energy in the city as a whole? Assume the initiative will be used by the target audience (note: use other criterion to rank the potential use of the program)	How easy is to implement the initiative? Factors to consider: * Government support * Investment required * Infrastructure in place	What is the probability that the initiative will be accepted in Toronto and will it receive buy in from the community (or will it implement the technology it supports)?	Is the initiative applicable to the following key sectors?: * Residential-low * Commercial-retail * Industrial (Not included in criteria, butother sectors include: res-high, Edu-ele&sec, Com-office-high, com-office-med)	Criteria valued as: * Area --> 0.5 * Population --> 0.5 * Climate --> 1 * City energy conserv. --> 1 * Ease of implem. --> 0.5 * Potential use --> 0.5 * Applicae to sectors --> 1
Criteria	H = high impact (large potential of energy conservation) M = medium impact L = low impact	H = easy to implement M = average L = difficult to implement	H = high acceptance M = medium acceptance L = low acceptance	H = 3 key sectors included M = 2 key sectors included L = 1 key sector included	H+ = 8.01 - 9 H = 7.01 - 8 H- = 6.01 - 7 M+ = 5.01 - 6 M = 4.01 - 5 M- = 3.01 - 4 L = 0.01 - 3 Not Applicable

Selected initiatives: Initiatives with ranking H-, H or H+

Austin, TX, USA

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	City Description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**City of Austin** **http://www.ci.austin.tx.us/**	*Austin is the capital of the U.S. state of Texas. It is the fourth-largest city in Texas and the 16th-largest in the United States. Area: 669.3 km² of which 651.4 km² is land and 17.9 km² is water. *Population in 2005: City 690,252; Density 1,007.9 persons/km²; Metro 1,412,271 *Climate: humid subtropical climate, characterized by hot summers and mild winters. On average, Austin receives 850mm of rain per year, with most of the precipitation coming in the spring. Summer is hot and typically humid, with average temperatures above 32 degrees Celsius from June until September. Winter is mild and dry relative to the rest of the year. For the entire year, Austin averages only 24 days where the minimum temperature falls below freezing. Snowfall is rare in Austin. * Growth and environmental protection are the main hot-button issues in city politics.	http://en.wikipedia.org/wiki/Austin,_Texas	**H**	**L**	**M**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**Austin Energy**	Austin Energy is the nation's 10th largest community-owned electric utility. They serve 360,000 customers and a population of more than 800,000. As a publicly owned power company and a city department, Austin Energy returns profits to the community annually. Austin Energy powers through a diverse generation mix: nuclear, coal, natural gas and renewable energy sources. That is just over 2,600 megawatts (MW) of total generation. "We created the top performing renewable energy program in the nation. We own the nation's first and largest green building program. And, we're home to one of the nation's most comprehensive residential and commercial energy efficiency programs"	http://www.austinenergy.com	-	-	-	-	**Not Applicable**	2.4
3	**Austin Energy's Strategic Plan**	[Austin Energy's] first measure is to achieve a renewable portfolio standard of 20% by 2020. For our second measure, we intend to achieve an energy efficiency target of 15% also by 2020. As a tangible indication of our solar commitment, we have set a goal of 100MW by 2020.	http://www.austinenergy.com/About%20Us/Newsroom/Reports/strategicPlan.pdf	-	-	-	-	**Not Applicable**	2.4
4	**Home Performance with ENERGY STAR® Rebate Program**	Rebate up to 20% of the cost of certain improvements, up to $1400: Air conditioner or heat pump (14 SEER/11.5 EER or greater); Duct repair and sealing; Additional attic insulation; Solar screens, window film or Low-E glass; Caulking and weather stripping; Attic radiant barrier/reflective material	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Residential/Home%20Performance%20with%20Energy%20Star/index.htm	**M**	**H**	**H**	**L**	**M+**	6.0
5	**Air Conditioner Rebates**	We offer rebates to customers who install high efficiency HVAC equipment, and do not require you to have an energy audit to qualify.Rebate Items: Central Split Systems and Package Air Conditioners and Heat Pumps (14 SEER/11.5 EER or greater); Window Air Conditioners Solar Water Heaters; Heat Pump Water Heaters (all-electric homes only); Heat Recovery Water Heaters (all-electric homes only)	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Residential/Air%20Conditioner/index.htm	**M**	**H**	**H**	**H**	**H**	7.2
6	**Solar Rebate Program**	Austin Energy offers customers one of the highest solar rebates in the country at $4.50 per watt. This rebate level will pay between 45-75% of the cost of installation of a solar system. For a residence, the cost of installation of a 1-kilowatt (1,000 watts) solar system, the smallest considered practical, is expected to cost between $6,000 and $10,000. The Austin Energy rebate ($4.50 x 1,000 watts) will pay $4,500 toward the installation.	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Solar%20Rebates/index.htm	**M**	**H**	**L**	**M**	**M+**	6.0
7	**Solar Water Heater Program**	Based on a typical system, you can expect these savings: Rebates from $450 to $650 + a 30% tax credit of $750 to $1,000 = total net savings of $1,200 to $1, 650	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Solar%20Rebates/Solar%20Water%20Heater/index.htm	**L**	**H**	**L**	**L**	**M**	4.8
8	**Rebates & Incentives** (Commercial Energy Management Services)	Commercial rebates and incentives are offered to Austin Energy customers as part of our Commercial Rebate Program. These programs are designed to help you implement energy efficiency measures that can reduce your electric demand by offering financial incentives to offset your initial investment.	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Commercial/Commercial%20Energy/index.htm	**M**	**H**	**M**	**M**	**H-**	6.3

	Initiative			City-wide energy conservation impact	Ease of program implementation	Potential use of program / tech.	Applicable to key sectors	Ranking	
9	**Small Business Rebates & Incentives** (Commercial Energy Management Services)	Designed to help qualified small-to-midsize and not-for-profit businesses implement a variety of energy efficiency measures.	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Commercial/Commercial%20Energy/smallBusiness.htm	M	H	M	M	H-	6.3
10	**SmartVendor** (Commercial Energy Management Services)	The VendingMiser®, CoolerMiser™, and SnackMiser™ family of products are a breakthrough in the power management of cold beverage and snack vending machines. Let Austin Energy provide you with these free, energy-saving devices, complete with free installation - a $200 value!	http://www.austinenergy.com/Energy%20Efficiency/Programs/Energy%20Miser/index.htm	L	H	L	M	M+	5.4
11	**Power Partner** (Commercial Energy Management Services)	Free Thermostat Program - As a Power Partner, we provide you with a free programmable thermostat plus free installation and warranty (valued at $200-$280). You agree to allow us to cycle off your air conditioner briefly during peak demand -- when demand for electricity is at its highest.	http://www.austinenergy.com/Energy%20Efficiency/Programs/Power%20Partner/index.htm	M	H	L	M	M+	6.0
12	**Thermal Energy Storage Program** (Commercial Energy Management Services)	The Thermal Energy Storage program is designed to help you reduce electric demand by offering financial incentives to offset your initial investments in Feasibility Studies and project implementation. Companies that install Thermal Energy Storage (TES) to shift chilled water production for air conditioning to night hours can receive as much as $100,000 in rebates specifically for TES.	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Commercial/Commercial%20Energy/thermalEnergyStorage.htm	M	M	L	M	M+	5.7
13	**Load Cooperative Program** (Commercial Energy Management Services)	Demand-rate customers may be eligible to receive cash incentive for curtailing unnecessary load during certain peak demand periods. Participating companies may see a reduction in their electric bill from June through September, due to reduced electric usage.	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Commercial/Commercial%20Energy/loadCooperative.htm	M	L	M	M	M+	5.7
14	**Building Tune-up Program** (Commercial Energy Management Services)	Eligible building owners can receive the benefit of an AE-funded buy-down for implementing the Continuous Commissioning® program offered by the Texas Engineering Experiment Station's Energy Systems Laboratory located at Texas A&M University.	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Commercial/Commercial%20Energy/buildingTuneup.htm	M	M	M	M	M+	6.0
15	**Multi-Family Energy Efficiency Program**	Cash rebates for making energy efficiency improvements to apartment and other multi-family properties	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Commercial/Multi-Family%20Properties/index.htm	M	M	M	L	M+	5.4
16	**Small Business Lighting Program**	Discounts for upgrading interior lighting systems with high efficiency equipment	http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Commercial/Small%20Business%20Lighting%20Discount/index.htm	M	M	M	M	M+	6.0
17	**Austin Energy Loan Programs**	Residential Loans: * Home Performance with ENERGY STAR® – home weatherization and air conditioning improvements * Solar Loan - purchase and install solar electric power systems Commercial Loans: * Commercial Energy – 0% financing for lighting upgrades	http://www.austinenergy.com/Energy%20Efficiency/Programs/Loans/index.htm	M	M	M	L	M+	5.4
18	**Solar Loan Program**	We contracted with Velocity Credit Union to offer a current Market Interest Rate loan to install solar photovoltaic power systems.	http://www.austinenergy.com/Energy%20Efficiency/Programs/Loans/Residential/Solar/index.htm	M	M	L	L	M+	5.1

	Initiative			City-wide energy conservation impact	Ease of program implementation	Potential use of program / tech.	Applicable to key sectors	Ranking	
19	**Free Home Energy Improvements**	Free home energy improvements to customers with a low-to-moderate income.	http://www.austinenergy.com/Energy%20Efficiency/Programs/Free%20Home%20Energy%20Improvements/index.htm	**L**	**L**	**L**	**L**	**M**	4.2
20	**Duct Diagnostic and Sealing**	For $50 per air conditioning system, you will receive a diagnostic test of your home	http://www.austinenergy.com/Energy%20Efficiency/Programs/Duct%20Diagnostic%20and%20Sealing/index.htm	**L**	**H**	**L**	**L**	**M**	4.8
21	**Refrigerator Recycling Program**	Turn in your old refrigerator or freezer and receive up to $50. The refrigerator and freezer recycling program offers a cash incentive, free pick-up and environmentally-friendly disposal of your old appliance. The unit must be in working (cooling) condition.	http://www.austinenergy.com/Energy%20Efficiency/Programs/Refrigerator%20Recycling/index.htm	**L**	**M**	**M**	**L**	**M**	4.8
22	**GreenChoice®**	Austin Energy offers you the option to choose your electricity from clean, renewable sources. GreenChoice is the most successful utility-sponsored green power program in the nation with 665 million kWh in subscriptions.	http://www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Choice/index.htm	**L**	**M**	**M**	**H**	**M+**	6.0
23	**Green Building Program®**	Through consulting, resources, and education, the Green Building Program can help you build a more environmentally-sound home or workplace.		**M**	**M**	**M**	**H**	**H-**	6.6

Barcelona, Spain

BACK to list of cities

	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Barcelona** **http://www.bcn.es/english/ihome.htm**	* Second largest city in Spain. * Land Area 100.4 km², Altitude 12 m * Population 1,673,075; Density 15,969 hab./km² (2006) * The population in the metropolitan area of Barcelona is 3,161,081and the density is: 4,994hab/km * Barcelona has a Mediterranean climate, with mild, dry winters and warm, humid summers. January and February are the coldest months, averaging temperatures of 10 °C. July and August are the hottest months, averaging temperatures of 25 °C * The city's main source of energy is nuclear power	http://en.wikipedia.org/wiki/Barcelona	**L**	**M**	**M**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**Barcelona Energy Agency**	* The Barcelona Local Energy Agency Consortium was organised in 2002. It is formed by the various Administrations that are directly involved in energy and environmental management within its scope of action: the Barcelona Council as the municipal manager, the Metropolitan Body for Hydraulic Services and Waste Treatment because of its relationship with the "real" city, the Catalan Institute for Energy and the Institute for Energy Diversification and Savings because of its responsibility in the Catalan and Spanish spheres, respectively. Likewise, with the aim to increase knowledge and research, the Autonomous University of Barcelona and the Catalan University Technical College, also form part of the Consortium. * The work that is being carried out by the Agency is aimed to improve the city's environmental quality and sustainable development by promoting energy savings, energy efficiency and the use and knowledge of renewable energies, and by optimising the quality of the services connected with this sector.	http://www.barcelonaenergia.com/homeeng.htm	-	-	-	-	**Not Applicable**	2.1
3	**Barcelona Solar Thermal Ordinance (OST)**	*The annex on Solar Thermal Energy Capture in the general environmental ordinance of the Barcelona City Council went into force in August 2000 for the purpose of regulating the incorporation of solar thermal energy capture and use systems for the production of sanitary hot water in the city's buildings. *The Solar Ordinance affects newly built, rehabilitated and fully reformed buildings and those seeking to implement a change of use, with a forecasted volume of sanitary hot water demand equal to an average annual energy consumption of over 292 net megajoules (MJ). * The Barcelona Energy Agency is preparing a new text of the Ordinance with a lower threshold of application in order to make it applicable to almost all the city's new and rehabilitated buildings.	http://www.barcelonaenergia.com/eng/operations/ost.htm	-	-	-	-	**Not Applicable**	2.1
4	**Barcelona Energy Improvement Plan (PMEB)**	* The Barcelona Energy Improvement Plan (PMEB) forms the general framework for the work of the Barcelona City Council in matters of energy policy and its environmental impact on the city. * Within this context, the Energy Plan includes an energy-related and environmental diagnosis of the present-day Barcelona and its future trends (to the year 2010), which allows prediction of the increase of the city's energy consumption and its repercussions according to different scenarios. * As a result of this analysis, the PMEB establishes a set of local action measures addressed to the achievement of a more sustainable city model, while reducing the environmental impact through energy savings, an increase in the use of renewable energies, and energy efficiency.	http://www.barcelonaenergia.com/eng/operations/pmeb.htm	-	-	-	-	**Energy Plan**	2.1

Berlin, Germany ***Note:*** *Most of the information listed in these websites is in German* BACK to list of cities

	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Berlin**	* Berlin is the capital city of Germany. It is the heart of the Berlin-Brandenburg metropolitan region. With a population of 3.4 million, Berlin is the country's largest city, and the second most populous city in the European Union. * Area: 891.82 km² City; 5,370 km² Metro Area * Population in 2006: 3,402,312; 3,675,000 Urban Area and 4,262,480 Metro Area * Density 3,812/km² * Elevation 34 - 115 m * Climate: Berlin has a temperate/mesothermal climate. Its mean annual precipitation totals 578 mm. The warmest months are June, July, and August, with mean temperatures of 17 °C. The coldest are December, January, and February, with mean temperatures of 0°C.	http://en.wikipedia.org/wiki/Berlin	**M**	**M**	**H**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**Environmental Branch of Berlin's Senate**	Climate Protection - Energy Programs, Solar Fund, Conservation, information.	http://www.berlin.de/sen/umwelt/klimaschutz/	**-**	**-**	**-**	**-**	**Not Applicable**	3.0
3	**Landesenergieprogramm 2006-2010**	Energy Plan for Berlin	http://www.berlin.de/sen/umwelt/klimaschutz/landesenergieprogramm/	**-**	**-**	**-**	**-**	**Energy Plan**	3.0
4	**Landesenergieprogramm 2006-2011**	Goals of energy Plan	http://www.berlin.de/sen/umwelt/klimaschutz/berlin_spart_energie/index2.shtml	**-**	**-**	**-**	**-**	**Energy Plan**	3.0
5	**Solaranlagenkataster**	Database to register every solar system installed in the City (http://www.solarkataster.de/)	http://www.berlin.de/sen/umwelt/klimaschutz/solaranlagenkataster/	**H**	**H**	**L**	**H**	**H**	7.8
6	**Campaigns for the protection of climate**	Various campaigns for the conservation of energy. For example " Energy eater wanted"	http://www.berlin.de/sen/umwelt/klimaschutz/kampagnen/	**L**	**H**	**L**	**H**	**H-**	6.6
7	**Solar Roof Exchange**	Solar panel installed in public buildings with financing from the private sector	http://www.berlin.de/sen/umwelt/klimaschutz/solardachboerse/	**M**	**H**	**H**	**L**	**H-**	6.6
8	**Berliner Impulse**	Information and advisory program on energy conservation and GHG reduction	http://www.berliner-impulse.de/	**L**	**H**	**L**	**H**	**H-**	6.6
9	**Heizspiegel (heating mirror)**	A heating calculation tool ("Heizspiegel") determining the energetical quality of centrally heated housing and the corresponding level of renovation required	http://www.heizspiegel-berlin.de/	**L**	**H**	**M**	**L**	**M+**	5.7

Calgary, AB, Canada

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Calgary** **http://www.calgary.ca**	* Area 789.90 km²; Metro area 5,083.00 km² * Population in 2006: 991,759; Metro population 1,107,200 * Population density 1252.3 * Altitude 1048 metres * Climate: Calgary has a highland continental climate with long, but highly variable, winters and short, warm summers. The city is among the sunniest in Canada, with 2,405 hours of annual sunshine, on average. Average temperature in Calgary ranges from a January daily average of−9°C to a July daily average of 16°C.	http://en.wikipedia.org/wiki/Calgary	M	L	H			
	Initiative			City-wide energy conservation impact	Ease of program implementation	Potential use of program / tech.	Applicable to key sectors	Ranking	
2	**Energy Management Office**	The Energy Management Office (EMO) is a joint initiative between The City of Calgary and ENMAX to manage the City's energy use and stimulate the creation of new energy-related initiatives. The City of Calgary and ENMAX have signed a long-term green electricity supply agreement that will see 75 per cent of electricity used to power all City facilities from wind power. The City has a bold corporate climate change target to reduce greenhouse gas emissions by 50 per cent from 1990 levels by 2012. The EMO will help achieve that plan Current projects * green energy - bringing the power of the wind to all City operations by 2007 * landfill gas recovery projects at the East Calagry and Shepher landfill sites * exploring the feasiblity of downtown distict energy system The City of Calgary - ENMAX agreement is the largest single municipal government green electricity supply arrangement in North America.	http://www.calgary.ca/portal/server.pt/gateway/PTARGS_0_2_771_203_0_43/http:/content.calgary.ca/CCA/City%20Living/The%20Environment/Climate%20Change%20and%20Air%20Quality/Climate%20Change/Energy%20Management%20Office.htm	L	H	H	L	M+	5.7
3	**Ride The Wind**	Commencing 2001 September 1, Calgary Transit entered into a partnership with ENMAX and Vision Quest Windelectric Inc. to develop a program (Ride the Wind) that uses wind-generated electricity to power the Ctrains.	http://www.calgarytransit.com/environment/ride_d_wind.html	H	H	M	L	H-	6.6
4	**Green Power Initiative**	The City of Calgary made an unprecedented commitment to increase its green electricity consumption to 75% of total use by January 2007 through an agreement with ENMAX Energy Corporation.	http://www.calgary.ca/portal/server.pt/gateway/PTARGS_0_2_771_203_0_43/http:/content.calgary.ca/CCA/City%20Living/The%20Environment/Climate%20Change%20and%20Air%20Quality/Climate%20Change/What%20The%20City%20is%20Doing%20about%20Climate%20Change/Major%20City%20Accomplishments%20to%20Date.htm	M	H	H	L	H-	6.3
5	**Green Power from Wastewater Methane**	The Bonnybrook Wastewater Treatment Plant is capturing waste methane gas to produce about 11 million kWh per year of "green" power, which is then used to power the plant.		L	L	L	L	M	4.5
6	**Streetlights and Traffic Signals**	* Streetlight Retrofitting: Calgary Roads completed their 'EnviroSmart' streetlight program in 2005. Approximately 37,000 residential streetlights have been retrofitted to more energy efficient lamps. * Light Emitting Diode (LED) Traffic Signals: Calgary Roads is retrofitting its traffic heads and pedestrian signals with Light Emitting Diode (LED) technology. LEDs use 80% less energy.		M	M	H	H	H	7.2
7	**Energy Efficiency in Buildings**	The City of Calgary is designing all new City facilities to meet or exceed the Silver Level Rating of the Leadership in Energy and Environmental Design (LEED®) "green- building" rating system.		L	M	M	L	M+	5.1
8	**Fire Department Energy Challenge**	The Fire Department has initiated an Energy Challenge initiative - an incentive-based awareness and behaviour change program that challenges fire stations to reduce their energy consumption. The program's goal is to reduce energy consumption by 7%. In the first year, a 6.8% decrease in energy consumption was achieved.		L	H	M	L	M+	5.4
9	**ENMAX**	A wholly owned subsidiary of The City of Calgary, headquartered in Calgary. ENMAX Energy provides electricity and natural gas to residential and business customers across Alberta	http://www.enmax.com/	-	-	-	-	Not Applicable	2.7
10	**The Office of Energy Efficiency (OEE)**	Beginning in April 2007, you can take advantage of the Government of Canada's new ecoENERGY Efficiency Initiative to reduce energy use in buildings and houses, industry and through retrofits. We can also help you make energy-efficient transportation choices	http://oee.nrcan.gc.ca/english/index.cfm?Text=N&PrintView=N	-	-	-	-	Not Applicable	2.7

Chicago, IL, USA

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	City description	Description	Link / Sources (some links will need to be copied and pasted on internet explorer)	Applicability					
				Area	Population	Climate			
1	**Chicago** **http://egov.cityofchicago.org**	* Area: City 606.2 km² from which 588.3 km² is land and 17.9 km² is water. Urban 5,498.1 km². Metro 28,163 km². * Elevation 179 m * Population in 2005: City 2,873,518; Density 4,867/km²; Urban 8,711,000; Metro 9,443,356 * Climate: Chicago has a climate that is prone to extreme, often volatile, weather conditions. The city experiences four distinct seasons. In July, the warmest month, high temperatures average 29 °C and low temperatures 17 °C. In January, the coldest month, high temperatures average −7 °C with low temperatures averaging −11 °C	http://en.wikipedia.org/wiki/Chicago	**H**	**H**	**H**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**Mayor's Office - Environmental Initiatives**	List of environmental initiatives Energy-related initiatives are below	http://egov.cityofchicago.org/city/webportal/portalProgramAction.do?BV_SessionID=@@@@0530765079.1170863555@@@@&BV_EngineID=cccdaddkdlegfkecefecelldffhdfgn.0&programId=536884097&channelId=-536879036&topChannelName=Government	-	-	-	-	**Not Applicable**	3.6
3	**Conserve Chicago Together**	Website with links to conservation initiatives, including Energy related.	http://egov.cityofchicago.org/city/webportal/portalEntityHomeAction.do?BV_SessionID=@@@@0530765079.1170863555@@@@&BV_EngineID=cccdaddkdlegfkecefecelldffhdfgn.0&entityName=Conserve+Chicago+Together&entityNameEnumValue=144	-	-	-	-	**Not Applicable**	3.6
4	**2006 Environmental Action Agenda**	Environmental Plan with a section on Energy for public and private sector. Includes accomplishements and future actions	http://egov.cityofchicago.org/city/webportal/portalContentItemAction.do?BV_SessionID=@@@@0530765079.1170863555@@@@&BV_EngineID=cccdaddkdlegfkecefecelldffhdfgn.0&contentOID=536938322&contenTypeName=COC_EDITORIAL&topChannelName=SubAgency&blockName=Conserve+Chicago+Together%2FI+Want+To&context=dept&channelId=-536879036&programId=536884097&entityName=Conserve+Chicago+Together&deptMainCategoryOID=	-	-	-	-	**Energy Plan**	3.6
5	**Chicago's Energy Policies**	* Chicago Energy Conservation Code - Comprehensive information about the City of Chicago's energy conservation code. (Part of Building Code) * Chicago's Energy Plan - Adopted in 2001, the City of Chicago's Energy Plan outlines renewable energy and energy efficiency goals for the City (see below). * Energy Procurement Bureau - Information about the Energy Bureau at the Department of General Services.	http://egov.cityofchicago.org/city/webportal/portalDeptCategoryAction.do?BV_SessionID=@@@@1613352931.1170871565@@@@&BV_EngineID=ccccaddjmkjgkhdcefecelldffhdfhg.0&deptCategoryOID=-536890203&contentType=COC_EDITORIAL&topChannelName=SubAgency&entityName=Conserve+Chicago+Together&deptMainCategoryOID=-536890174	-	-	-	-	**Energy Plan**	3.6
6	**Energy Plan**	Many of the City of Chicago's energy policies and initiatives originated in Chicago's Energy Plan (2001). It sets specific targets for energy production and use, and identifies principles to guide the City of Chicago in responding to energy plans and proposals originating in Washington and Springfield. Consumer protection, economic growth and environmental protection are the underlying principles of the plan.	http://egov.cityofchicago.org/city/webportal/portalContentItemAction.do?contentOID=536910604&contenTypeName=COC_EDITORIAL&topChannelName=Dept&channelId=0&programId=0&entityName=Environment&deptMainCategoryOID=-536887205	-	-	-	-	**Energy Plan**	3.6

	Initiative			City-wide energy conservation impact	Ease of program implementation	Potential use of program / tech.	Applicable to key sectors	Ranking	
7	**Energy Procurement Bureau**	The Bureau purchases natural gas at periods where the cost is most advantageous, using various financial instruments to maximize savings. Electricity, which has been deregulated as well, is purchased based on the best rate for each of the City's facilities. The Bureau is also responsible for the City's renewable energy programs, including the installation of solar PV and solar thermal equipment on City facilities, and purchasing renewable power in the City portfolio. Finally, the Bureau is responsible for developing the City's policy towards electricity and natural gas issues.	http://egov.cityofchicago.org/city/webportal/portalContentItemAction.do?contentOID=536909564&contenTypeName=COC_EDITORIAL&topChannelName=Dept&channelId=-536879037&programId=536879161&entityName=General+Services&deptMainCategoryOID=-536888993	-	-	-	-	**Not Applicable**	3.6
8	**Department of the Environment**		http://egov.cityofchicago.org/city/webportal/portalEntityHomeAction.do?BV_SessionID=@@@@0530765079.1170863555@@@@&BV_EngineID=cccdaddkdlegfkecefecelldffhdfgn.0&entityName=Environment&entityNameEnumValue=13	-	-	-	-	**Not Applicable**	3.6
9	**Energy Efficiency Programs (by DEO)**	* Boiler Efficiency/Motor Master Workshops - two energy-efficiency workshops tailored specifically to building industry professionals * Energy Efficiency in City Buildings - In late 2000, the City of Chicago took two significant steps to improve energy efficiency in City buildings: (i) audit and retrofit 15 million square feet of public buildings and (ii) design new municipal facilities—libraries, police stations and other public buildings—to be more energy-efficient * Industrial Rebuild Program - The City of Chicago DOE, in partnership with ComEd, the University of Illinois at Chicago's Energy Resources Center and the Illinois Waste Management and Research Center (WMRC), developed a program to help the most energy- and waste-intensive industries in Chicago become more energy efficient. Called the Industrial Rebuild Program, it is modeled after the U.S. Department of Energy Industrial Technologies Program, Industries of the Future.	http://egov.cityofchicago.org/city/webportal/portalDeptCategoryAction.do?BV_SessionID=@@@@0804283852.1170880533@@@@&BV_EngineID=ccceaddkdkgfeigcefecelldffhdffn.0&deptCategoryOID=-536890273&contentType=COC_EDITORIAL&topChannelName=Dept&entityName=Environment&deptMainCategoryOID=-536887205	M	M	M	M	H	7.2
10	**Energy Grants & Loans (by DOE)**	* 2006 Solar Thermal Grants Program Application * Energy Grants - From time to time, the City of Chicago DOE has funds available to make grant for projects related to energy-efficiency, renewable energy, cogeneration, distributed generation and other energy areas in which DOE is active * Energy Loans - From time to time, the City of Chicago DOE has funds available to make low- or no-interest loans for projects related to energy efficiency, renewable energy, cogeneration, distributed generation and other energy areas .	http://egov.cityofchicago.org/city/webportal/portalDeptCategoryAction.do?BV_SessionID=@@@@0956342659.1170881059@@@@&BV_EngineID=ccccaddkdeemkhicefecelldffhdfgm.0&deptCategoryOID=-536890675&contentType=COC_EDITORIAL&topChannelName=Dept&entityName=Environment&deptMainCategoryOID=-536887205	M	H	M	H	H+	8.1
11	**Renewable Energy (by DOE)**	* Chicago Solar Partnership - The Chicago Solar Partnership (CSP) is a public-private consortium established, under the organization of the Illinois Solar Energy Association (ISEA), to advance the development of the solar energy industry in the Chicago metropolitan area. (http://www.chicagosolarpartnership.com) * Solar Thermal Technology - hot water or space heating by collecting and concentrating solar radiation * Wind Power: Chicago Prospects - A report detailing how wind power may contribute to Chicago's goal of obtaining 20% of its energy from renewable sources.	http://egov.cityofchicago.org/city/webportal/portalDeptCategoryAction.do?BV_SessionID=@@@@0956342659.1170881059@@@@&BV_EngineID=ccccaddkdeemkhicefecelldffhdfgm.0&deptCategoryOID=-536894093&contentType=COC_EDITORIAL&topChannelName=Dept&entityName=Environment&deptMainCategoryOID=-536887205	M	L	M	H	H	7.5
12	**Residential Energy Assessment Program (REAP) (by DOE)**	An online home efficiency assessment tool which provides homeowners with the ability to assess the efficiency of their home and tips for conserving energy	http://webapps.cityofchicago.org/ERC/	M	H	M	L	H-	6.9

	Initiative			City-wide energy conservation impact	Ease of program implementation	Potential use of program / tech.	Applicable to key sectors	Ranking	
13	**Green Building (by DOE)**	* Chicago Center for Green Technology * Chicago's Green Building Agenda * Green Building Resources * Chicago's Green Building Pilot Projects - In the design and construction of its municipal buildings * The Chicago Standard - to guide the design, construction, renovation, operation and maintenance of municipal facilities * Green Bungalow Initiative - pilot program sponsored by the City of Chicago to determine whether green building principles could be applied affordably to existing homes. * Green Homes for Chicago - pilot project undertaken by the City of Chicago to determine if green building technologies and practices could be incorporated affordably into new residential construction * LEED Accredited Employees - The City of Chicago encourages employees to become LEED accredited by the US Green Building Council.	http://egov.cityofchicago.org/city/webportal/portalDeptCategoryAction.do?BV_SessionID=@@@@0735308186.1170881774@@@@&BV_EngineID=cccfaddkdkgfeiicefecelldffhdffn.0&deptCategoryOID=-536887181&contentType=COC_EDITORIAL&topChannelName=Dept&entityName=Environment&deptMainCategoryOID=-536887205	**H**	**L**	**L**	**L**	**H-**	6.6
14	**Green Roofs**	As of October, 2006, there are more than 250 public and private green roofs totaling more than 1 million square feet that are under design or construction in Chicago (see map attached as a PDF file below). Because it believes so strongly in the benefits of green roofs, the City of Chicago recently adopted a policy that encourages and, in some cases, requires green roofs in developments undergoing Department of Planning and Development review. These include private, not-for-profit and public developments receiving financial or other types of public assistance from the City, as well as Planned Developments and Lakefront Protection Ordinance Developments	http://www.artic.edu/webspaces/greeninitiatives/greenroofs/main.htm	**L**	**L**	**L**	**L**	**M+**	5.4

Copenhagen, Denmark

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Copenhagen**	* Area - City: 88 km²; Urban: 455.61 km² * Population - Municipal: 503,699; Urban: 1,401,883; Density (city/met): 5707/km² / 2659/km² * The weather is mild through all the four seasons. Summers bring temperatures averaging around 20°C, while in mid-winter temperatures hover just above or below zero. Rainfall is moderate too, but spread throughout the year, so showers are possible in any season. Grey skies are the norm rather than the exception in Copenhagen.	http://en.wikipedia.org/wiki/Copenhagen	L	L	M			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**The Main District Heating Network in Copenhagen**	The Metropolitan Copenhagen Heating Transmission Company – is a partnership of the municipalities of Frederiksberg, Gentofte, Gladsaxe, Copenhagen and Taarnby. The company purchases heat from refuse incineration plants and combined heat and power plants in the metropolitan area and transport it – sometimes together with heat from CTR's own peak load units – to delivery points in the municipalities involved. Fully extented it will be possible to supply about 275,000 households	http://www.ctr.dk/images/publikationer/CtrUK.pdf	H	L	L	L	M	4.8
	DENMARK								1.8
3	**Energy Strategy 2025 - Danish Energy Agency**	1. The Government's energy strategy in brief 2. Long-term challenges and goals 3. Securing the future of the Danish energy sector 4. Action plan for the future electricity infrastructure	http://www.ens.dk/sw28961.asp	-	-	-	-	**Energy Plan**	1.8
4	**Energy Policy Statement 2006 - Danish Energy Agency**	Table of Contents: 1. General energy-policy challenges and priorities 2. International challenges facing the energy sector 3. Technology development and trade perspectives 4. Oil and natural-gas extraction 5. Energy supply 6. Energy-saving 7. Conclusion	http://www.ens.dk/graphics/Publikationer/Energipolitik_UK/Energy_policy_statement_2006/index.htm	-	-	-	-	**Energy Plan**	1.8
5	**Energy Savings - Danish Energy Agency**	* Industry: The Green Tax Package for Industry, Voluntary agreements on energy efficiency, Former subsidy scheme for industry * Buildings: EU directive on the energy performance of buildings, Windows * Household appliances	http://www.ens.dk/sw12323.asp	M	M	M	H	M+	6.0
6	**Energy Supply - Danish Energy Agency**	Renewable energy, Electricity, Gas supply, Heating	http://www.ens.dk/sw12303.asp	-	-	-	-	**Not Applicable**	1.8

Freiburg, Germany

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Freiburg** **www.freiburg.de**	* Population 214,716 (2005) * Area 153.06 km² * Population density 1,402 /km² * Elevation 278 m * Freiburg has a sunny microclimate and popular opinion has it that Freiburg is the warmest, sunniest city in Germany.	http://en.wikipedia.org/wiki/Freiburg	L	L	M			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**Main environmental website for the City of Freiburg**		http://www.freiburg.de/servlet/PB/menu/1140682_l1/index.html	-	-	-	-	**Not Applicable**	1.8
3	**Energy conservation initiatives**	* Energy conservation check for households * education * etc	http://www.freiburg.de/servlet/PB/menu/1146066_l1/index.html	L	M	M	M	**M**	4.8
4	**FREIBURG SOLAR CITY**	SolarRegion Freiburg is a long term development vision that the city of Freiburg in southwest Germany has embraced since 1986	http://www.solarregion.freiburg.de/solarregion/freiburg_solar_city.php	H	M	L	H	**H-**	6.3
5	**The City of Freiburg's energy policy**	The Freiburg energy supply concept focuses on: * energy saving projects * use of renewable energy sources * application of innovative energy technologies * extension of on-site and remote district-heating systems In June 1992, the Freiburg city council adopted a resolution to the effect that it would only permit construction of "low energy buildings" on municipal land. All new housing must comply with the low energy guidelines. Low energy housing uses solar power passively and actively. In addition to solar panels and collectors on the roof, providing electricity and hot water, many passive features use the sun's energy to regulate the temperature of the rooms. The whole city is involved in Freiburg's solar policy. Many private companies and public facilities make their roofs available for solar modules. The people of Freiburg buy shares in the panels and are reimbursed when the power is sold to the city electricity scheme.	http://www.tve.org/ho/doc.cfm?aid=657	-	-	-	-	**Energy Plan**	1.8

Gothenburg, Sweden

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Gothenburg** **http://www.goteborg.se**	* Largest city in Sweden, after Stockholm * Area - City 450 km² --- Water 14.5 km² (3.2%) - Urban 199 km² - Metro 3,717 km² * Population (2006) - City 487,627 & Density 1,083/km² - Urban 495,849 & Urban Density 2,491/km² - Metro 884,401 & Metro Density 238/km² * Average temperature: 15C in July (summer) and -3C in January (winter)	http://en.wikipedia.org/wiki/Gothenburg	**M**	**L**	**M**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**Goteborg 2050**	Solar City Göteborg 2050, visions and scenarios for sustainable energy in the Göteborg Region. It was presented at a workshop 18 June 2003 at the international Solar Energy Society (ISES), world congress in Göteborg 2003	http://www.goteborg2050.nu/	**L**	**M**	**L**	**L**	**M**	4.2
3	**Sewage heats the city**	Waste heat from the refineries and the incineration plant at Sävenäs accounts for almost three-quarters of the district heating, together with heat from heat pumps at the Rya sewage treatment works.	http://www.goteborg.se/prod/sk/goteborg.nsf/1/press,mediaservice_(english),about_goteborg.energy_o_environment.sewage_heats_the_city?OpenDocument	**M**	**L**	**L**	**H**	**M+**	5.7
4	**Sewage heats the city**		http://www.goteborgenergi.se/English/Environmental_work_DXNI-273097_.aspx	**M**	**L**	**L**	**H**	**M+**	5.7
5	**Göteborg Study (done by Advanced Local Energy Planning)**	Local energy planning is an ongoing process in Göteborg which has been characterised as advanced (ALEP) since 1987. The case study presented deals with the "Energy Plan 2000", adopted by the Goteborg municipality in 1995.	http://www.iea-alep.pz.cnr.it/8_Goteborg.htm	**-**	**-**	**-**	**-**	**Not Applicable**	2.1

London, UK

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**London** **http://www.london.gov.uk**	* London is the most populous city in the European Union * City of London - Area: 2.6 km²; Population: 9,200; Density: 3,172/km² (8,215/sq mi) * Greater London - Area: 1,579 km²; Population: 7.5 million; Density: 4,761/km² * Metro area - Popultation: 12,524,318 * Climate: London has a temperate climate with regular but generally light precipitation throughout the year. Snow is uncommon.	http://en.wikipedia.org/wiki/London	M	M	M			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**The Mayor's Energy Strategy**	The Mayor's energy strategy, Green light to clean power, aims to minimise the impacts on health and on the local and global environment of meeting the essential energy needs of all those living and working in London. Specifically, it aims to reduce London's contribution to global climate change, tackle the problem of fuel poverty and at the same time promote London's economic development through renewable and energy efficient technologies	http://www.london.gov.uk/mayor/strategies/energy/index.jsp	-	-	-	-	**Energy Plan**	2.4
3	**The London Hydrogen Partnership**	The London Hydrogen Partnership was launched in April 2002, to work towards a hydrogen economy for London and the UK. It aims to: * Produce and implement the London Hydrogen Action Plan * Establish and maintain dialogue among all sectors/actors relevant to the hydrogen economy * Disseminate relevant materials * Provide a platform for funding bids and initiation of projects http://www.lhp.org.uk/	http://www.london.gov.uk/mayor/environment/energy/london-hydrogen-partnership.jsp	H	L	L	H	**H-**	6.6
4	**London Renewables**	Operating from spring 2003 to spring 2005, the London Renewables steering group worked with the London Energy Partnership to enable London to meet its renewable energy targets, as set in the Mayor's Energy Strategy. The London Renewables programme promoted the uptake of renewable energy technology in the capital. In particular, its programme focused on increasing the amount of renewable energy technologies used in new buildings and developments. Activity in this area continues through the work of the London Energy Partnership. London's renewable energy targets aim to generate at least 665GWh of electricity and 280GWh of heat, from up to 40,000 renewable energy schemes by 2010.(http://www.london.gov.uk/mayor/environment/energy/renew_targets.jsp) The Government Office for London's Sustainable Development Unit set up 'London Renewables', a partnership now led by the Mayor of London with DTI match funding.	http://www.london.gov.uk/mayor/environment/energy/london_renew.jsp	M	M	M	H	**H-**	6.6
5	**London Energy Partnership**	Set up by the Mayor to respond to the challenges of climate change, security of energy supply and fuel poverty	http://www.london.gov.uk/mayor/environment/energy/partnership-steering-group/index.jsp	L	H	L	H	**M+**	6.0
6	**Pilot Energy Action Areas**	The London Energy Partnership has been tasked with setting up and delivering the Mayor's Energy Action Areas to act as exemplar showcase low carbon developments in London. These four pilot areas are Merton, Barking, New Wembley, and a joint proposal from Southwark of the Elephant & Castle regeneration area and the Southwark concerto community.	http://www.london.gov.uk/mayor/environment/energy/partnership-steering-group/energy-action.jsp	-	-	-	-	**Not Applicable**	2.4
7	**London Energy Partnership Action Plan**	This is in development and is expected to be available in December 2006 - not yet available		-	-	-	-	**Not Applicable**	2.4
8	**Department of Trade and Industry's Energy Group**	The Department of Trade and Industry's Energy Group deals with a wide range of energy-related matters, from its production or generation to its eventual supply to the customer.	http://www.dti.gov.uk/energy/index.html	-	-	-	-	**Not Applicable**	2.4
9	**Energy Saving Trust**	The Energy Saving Trust, set up by the Government, is one of the UK's leading organisations addressing the damaging effects of climate change. The goal of the Trust is to achieve the sustainable and efficient use of energy, and to cut the carbon dioxide emissions which are mainly to blame for global warming.	http://www.est.org.uk/	M	M	M	H	**H-**	6.6
10	**Big Green Boiler Scheme**	Discounts on condensing boilers - typically 12 per cent more efficient that conventional boilers	http://www.green-boilers.co.uk/	L	H	M	M	**M+**	5.7

	Initiative			City-wide energy conservation impact	Ease of program implementation	Potential use of program / tech.	Applicable to key sectors	Ranking	
11	**Clear Skies initiative**	The Department of Trade and Industry's Clear Skies initiative gives homeowners and communities a chance to use renewable energy by providing grants and advice. Homeowners can obtain grants of between £400 and £5,000 whilst community organisations can receive up to £100,000. Clear Skies can help find out about grants – whether you're eligible, how to apply, which installers are approved and which products qualify for a grant	http://www.clear-skies.org/	**M**	**M**	**M**	**H**	**H-**	6.6
12	**Green Energy Centre**	The Green Energy Centre has been established to help everybody make use of renewable energy technologies in order to reduce the environmental impact of energy use. The website includes information about how you can use renewable energy, including information about the discounts and grants for renewable energy installations.	http://www.greenenergycentre.org.uk/	**L**	**H**	**M**	**H**	**H-**	6.3
13	**Sun Rise Solar Scheme**	Sun Rise Solar Scheme is a scheme for the installation of solar water heating and photovoltaic panels, providing access to bulk discount systems and affordable installation. It is the first scheme to contain these two technologies in the country.	http://www.greenenergycentre.org.uk/sunrise.asp	**H**	**M**	**M**	**M**	**H-**	6.6
14	**EnergySmart**	EnergySmart is a nationwide scheme to provide boilers and solar equipment for installation by the installer of your choice, or installed loft and cavity wall insulation. Saving energy is as good as using renewable energy, and is a good step towards reducing your impact on the environment	http://www.london.gov.uk/london-life/environment/how-to-be-green/energy.jsp	**H**	**M**	**M**	**H**	**H**	7.2
15	**Solar for London**	Initiative aimed at bringing affordable solar water heating systems into London homes.	http://www.solarforlondon.org/	**M**	**M**	**M**	**L**	**M+**	5.4
16	**Carbon Trust**	The Carbon Trust helps business and the public sector reduce energy consumption and contribution to global warming - their free helpline offers advice on saving energy and renewable energy.	http://www.carbontrust.co.uk/default.ct	**M**	**M**	**L**	**M**	**M+**	5.7
17	**Action Energy**	Action Energy is a government-funded programme that helps businesses and public sector organisations save money through energy saving. From simple tips to in-depth advice and on-site support, Action Energy can show you how to make a big difference to both your bottom line and the environment. The free energy saving advice that has been provided by Action Energy is now presented under the banner of the Carbon Trust.	http://www.thecarbontrust.co.uk/energy	**M**	**M**	**L**	**M**	**M+**	5.7
18	**Government office for London**	Government Office for London works closely with the Greater London Authority (GLA) and other regional partners to lead on implementation of the Government's Energy White Paper: Our Energy Future – Creating a Low Carbon Economy	http://www.gos.gov.uk/gol/Environment_rural/Energy/?a=42496	**-**	**-**	**-**	**-**	**Not Applicable**	2.4
19	**Energy White Paper: Our Energy Future - Creating a Low Carbon**	Defines a long-term strategic vision for energy policy combining our environmental, security of supply, competitiveness and social goals. The implementation of the White Paper is being taken forward via the Sustainable Energy Policy Network (SEPN). The Energy White Paper has also set a target for 10% of the UK's energy supply to be derived from renewable sources by 2010 and aspires for this to be doubled by 2020. Given the amount of energy consumed within London, it is imperative that London makes a valuable contribution to the achievement of this UK target and the Mayor's Energy Strategy sets out targets for reduction of carbon dioxide emissions and increased renewable energy generation within London.	http://www.dti.gov.uk/energy/policy-strategy/energy-white-paper-2003/page21223.html	**-**	**-**	**-**	**-**	**Energy Plan**	2.4

Los Angeles, CA, USA

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Los Angeles** **http://www.ci.la.ca.us/**	* City - Area: 1290.6 km² from which 1,214.9 km² is land and 75.7 km² is water. Population: 3,844,829. Density 3,165/km² . * Urban - Area: 4,319.9 km². Population: 12,923,547 * Elevation 0– 1,548 m (0– 5,079 ft) * Climate: The city is situated in a Mediterranean climate, experiencing mild, reasonably wet winters and warm to hot, mildly humid summers. The median temperature in January is 14.6 °C and 23.5 °C in July.	http://en.wikipedia.org/wiki/Los_Angeles	L	M	M			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**SustainLA**	SustainLA is a joint City project encompasing the environmental programs of many different City departments and agencies. Energy links take you to LADWP.	http://www.sustainla.org/	-	-	-	-	**Not Applicable**	2.1
3	**Los Angeles Department of Water and Power (LADWP)**	LADWP, the largest municipal utility in the nation, was established more than 100 years ago to deliver reliable, safe water and electricity supplies to some 3.8 million residents and businesses in Los Angeles.	http://www.ladwp.com/ladwp/areaHomeIndex.jsp?contentId=LADWP_POWER_SCID	-	-	-	-	**Not Applicable**	2.1
4	**Power System Integrated Resource Plan**	The Power System Integrated Resource Plan (IRP) provides a long-term policy framework for how LADWP will meet its power customers' future energy demands. The plan incorporates the LADWP's goal of increasing its portion of renewable energy sales to 20 percent by 2010. It is a draft for consultation	http://www.ladwp.com/ladwp/cms/ladwp005148.jsp	-	-	-	-	**Not Applicable**	2.1
5	**LADWP rebates and programs**	* REfrigerator Turn-In and REcycle Program (RETIRE) * High-Efficiency Clothes Washer Rebate Program * Energy Load Monitoring (ELM) Program - Providing our medium to large commercial and industrial customers with tools to view, modify and analyze their energy load data. * Green Power Program * Home Energy Efficiency Rebates for many appliances (http://www.ladwp.com/ladwp/cms/ladwp000478.jsp?)	http://www.ladwp.com/ladwp/areaHomeIndex.jsp?contentId=LADWP_REBATES_SCID	H	M	M	H	**H-**	6.9
6	**Energy Audit**	The Home Energy Saver Tool is available online.	http://www.ladwp.com/ladwp/cms/ladwp000605.jsp	L	H	M	L	**M**	4.8
7	**Commercial Lighting Efficiency Offer (CLEO) Program**	For business, or represent a non-residential customers	http://www.ladwp.com/ladwp/cms/ladwp000572.jsp	M	H	H	M	**H-**	6.3
8	**Chiller Efficiency Program**	For business, or represent a non-residential customers	http://www.ladwp.com/ladwp/cms/ladwp001108.jsp	M	H	M	M	**M+**	6.0
9	**Solar Power Initiative**	The cost of eligible solar PV systems is reduced with Incentive funds, which function like rebates. LADWP customers, both residential and commercial, may participate.	http://www.ladwp.com/ladwp/cms/ladwp004196.jsp	M	H	M	H	**H-**	6.6
10	**Energy Load Monitoring (ELM) Program**	The ELM Program provides LADWP's medium to large commercial and industrial customers with tools to view, modify and analyze their energy load data.	http://www.ladwp.com/ladwp/cms/ladwp003154.jsp	M	M	H	M	**M+**	6.0
11	**Green Power for a Green LA for Commercial Customers**	LADWP's commercial green power program enables a business to choose to support renewable energy. Commercial customers can designate up to 100% of an electricity bill to green resources, with a minimum of 500 KWh for general services customers or 1,000 kWh for large general service customers.	http://www.ladwp.com/ladwp/cms/ladwp001932.jsp	M	M	M	M	**M+**	5.7
12	**Customer Generation Rebate Program**	Pprovides financial incentive to encourage our commercial or industrial customers to install Distributed Generation at their facilities in Los Angeles.	http://www.ladwp.com/ladwp/cms/ladwp001070.jsp	L	L	L	M	**M**	4.5
13	**Energy Financing Programs**	Whether you are a residential, small business or large commercial or industrial customer, the Los Angeles Department of Water and Power (DWP) can help you find financing to enable you to pay for a variety of energy efficiency upgrades or improvements.	http://www.ladwp.com/ladwp/cms/ladwp001588.jsp	L	M	M	H	**M+**	5.7

	Initiative			City-wide energy conservation impact	Ease of program implementation	Potential use of program / tech.	Applicable to key sectors	Ranking	
14	**Non-Residential New Construction Incentive Program**	LADWP is offering incentives of up to $250,000 for owners wishing to build new energy efficient buildings. These incentives are being offered to encourage property owners to build to higher levels of energy efficiency and environmental awareness.	http://www.ladwp.com/ladwp/cms/ladwp008821.jsp	**H**	**H**	**M**	**L**	**M+**	6.0
15	**Non-Residential Custom Performance Program (CPP)**	The Custom Performance Program offers incentives for the installation of energy saving measures, equipment or systems that exceed Title 24 or minimum industry standards.	http://www.ladwp.com/ladwp/cms/ladwp008836.jsp	**L**	**M**	**M**	**M**	**M+**	5.1
	CALIFORNIA	**See 'San Francisco' for energy initiatives in the state of California**							

Malmö, Sweden

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Malmö** **http://www.malmo.se**	* Malmö is the third largest city in Sweden, situated in the southernmost province of Scania. * It has 272,634 inhabitants (about 605,000 in the metro area). * Malmö was one of the earliest and most industrialized towns of Scandinavia. * It has a temperate climate. Average temperature is above 10 °C (50 °F) in the warmest months, and the coldest month average is above −3 °C.	http://en.wikipedia.org/wiki/Malm%C3%B6	L	L	M			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**Western Harbour / Bo01**	* Bo01 - City of Tomorrow is an entirely new district in the Western Harbour with room for 600 dwellings as well as offices, shops and other services. The aim is for the district to be an internationally leading example of environmental adaptation of a densely built urban environment. It will also be a driving force in Malmö's development towards environmental sustainability. Bo01 is the first development stage of Västra Hamnen (The Western harbour) one of Malmö´s growth areas of the future. * The district is provided exclusively with energy from renewable sources. The energy used in the Western Harbour is generated in or near the area.	The district is provided exclusively with energy from renewable sources. The energy used in the Western Harbour is generated in or near the area.	M	L	M	L	M	4.5
3	**Ekostaden Augustenborg**	* Ekostaden Augustenborg is the collective name for a programme to make Augustenborg into a more socially, economically and environmentally sustainable neighbourhood. Ekostaden Augustenborg, one of Sweden´s largest urban sustainability projects, was supported by the government´s Local Investment Programme and also financed by key local partners within Malmö City and the MKB housing company. * Measures to increase energy efficiency have been undertaken throughout the neighbourhood, optimising heating and hot water systems and cutting electricity use	http://www.malmo.se/servicemeny/cityofmalmo/sustainablecitydevelopment/ekostadenaugustenborg.4.1dacb2b108f69e3b8880002078.html	M	L	M	L	M	4.5

Markham, ON, Canada

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Markham** **http://www.markham.ca**	* Area: 212.47 km² * Population in 2001: 208,615 * Same as Toronto	http://en.wikipedia.org/wiki/Markham%2C_Ontario	**L**	**L**	**H**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**"Environmental Activities" webpage**	No information on energy conservation initiatives. However, there is information on initiatives to reduce GHG.	http://www.markham.ca/markham/channels/stratserv/environment/enviro home.htm	-	-	-	-	**Not Applicable**	2.4
3	**Markham Energy Conservation Office**	In 2005, the Town of Markham made a commitment to conservation demand management and energy efficiency by establishing the Markham Energy Conservation Office (MECO) with funding support from PowerStream.	http://www.markham.ca/markham/Channels/meco/overview.htm	-	-	-	-	**Not Applicable**	2.4
4	**MECO@Work and MECO@Home Employee Awareness Program**	Promotes MECO's purpose and brand across the Town by encouraging staff to engage in energy conservation at work and at home. While at work, Town staff will be encouraged to change their energy consumption patterns.	http://www.markham.ca/markham/Channels/meco/programs.htm	**L**	**H**	**M**	**H**	**H-**	6.3
5	**Energy and Environmental Management System (EEMS)**	MECO has taken the initiative to purchase the Energy and Environmental Management System (EEMS) from the Region of York—a versatile, web based software designed to record and manage energy consumption and expenses of buildings, street lights, and other types of facilities. EEMS has the capability to track electricity, natural gas, water and waste water accounts, and other fuel usage (gasoline, propane, etc.), as well as provide analyses on utility performance		**M**	**H**	**H**	**H**	**H**	7.2
6	**Advancing High Performance Buildings**	This program is focused on new designs, construction and operating methods that will reduce the energy consumption of new infrastructure. The Town of Markham will be considering high performance standards, including energy efficiency in all of its future Town buildings while encouraging local developers to consider the same. Existing benchmarks will be documented and outputs will be measured from new buildings that participate in this program. Pre and post program performance capabilities will be identified to project future cost avoidances while reducing overall consumption.		**M**	**M**	**M**	**M**	**M+**	6.0
7	**Better Building Partnerships**	The Better Buildings Partnership (BBP) is an innovative initiative to be implemented by MECO. The purpose is to promote and implement energy efficiency, water conservation and building renewal enhancement across the Town's facilities including street and traffic lighting, while reducing C02 emissions. The program will involve identifying energy conservation opportunities that may include energy efficient retrofits and building renewal initiatives that will consist of a mix of short and long-term paybacks but will greatly reduce energy demand on the grid and save the Town significant dollars		**M**	**M**	**M**	**M**	**M+**	6.0
8	**Combined Utility Metering Pilot**	The Combined Metering Pilot is specific to Remington Town Homes, a development that will be connected to district energy at the Markham Town Centre location. The purpose of the Pilot is to bring together data from gas, water, electricity and district energy meters into one presentation format that would be accessible to the residents and would assist them in making conservation decisions. The data generated will come from smart meters for electricity and the latest metering technology being deployed by the gas, water and district energy utilities		**L**	**M**	**M**	**L**	**M**	4.8
9	**Cool Shops in Markham**	This program was launched in the summer of 2005 targeting small to medium sized businesses. Cool Shops is a program that was designed to identify appropriate energy saving measures for each retailer by conducting an energy audit that focused primarily on lighting. Over 540 committed retailers in Markham implemented some of these recommendations to reduce demand and consumption	http://www.markham.ca/markham/Channels/meco/coolshops.htm	**M**	**M**	**M**	**L**	**M+**	5.4

	Initiative			City-wide energy conservation impact	Ease of program implementation	Potential use of program / tech.	Applicable to key sectors	Ranking	
10	**Enbridge Gas Distribution's Spray 'N Save Program**	Offers the installation of a low-flow, pre-rinse spray valve available to all full service restaurants and other food service operations providing possible savings of: $546.00 per year of natural gas costs and $630.00 per year of water and sewage costs	https://portal-plumprod.cgc.enbridge.com/portal/server.pt?space=Opener&control=OpenObject&cached=true&parentname=CommunityPage&parentid=0&in_hi_ClassID=512&in_hi_userid=2&in_hi_ObjectID=357&in_hi_OpenerMode=2&	**L**	**H**	**M**	**L**	**M+**	5.1
11	**PowerStream's Freezer Coil Cleaning Pilot**	This initiative is for businesses that have refrigeration systems and cooling equipment. PowerStream is offering this service, free of charge to selected stores.MECO is currently in the process of identifying appropriate candidates to participate in this initiative.	http://www.markham.ca/markham/Channels/meco/freezecoil.htm	**L**	**H**	**H**	**L**	**M+**	5.4
12	**Haul Away Your Energy Hog and Save Money!!**	Between November 1, 2006 and March 1, 2007, the Town of Markham is sponsoring a retirement program for selected appliances. We will collect and recycle your old inefficient refrigerators, window air conditioners and freezers from inside your home, free of charge.		**L**	**M**	**M**	**L**	**M**	4.8
	ONTARIO			**-**	**-**	**-**	**-**	**Not Applicable**	2.4
13	**powerWise**	powerWISE® is a partnership between the Ontario Government and the six participating local electricity distribution companies including powerStream and Toronto Hydro	http://www.powerwise.ca	**H**	**M**	**M**	**H**	**H**	7.2

Melbourne, Victoria, Australia

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Melbourne** **http://www.melbourne.vic.gov.au**	* Population: 3,689,700. Second most populous city in Australia. * Density: 479.6/km² * Area: 8,694 km² * Climate: Melbourne has a temperate climate. Snowfalls are extremely rare. Melbourne is known to have hot, dry summers, with maximum temperatures above 40 degrees Celsius.	http://en.wikipedia.org/wiki/Melbourne	M	M	M			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**Zero Net Emissions by 2020 Strategy**	A stand- alone Energy Plan does not seem to exist. Energy strategies are part of the Zero Net Emissions by 2020 Strategy. A roadmap, known as the Zero Net Emissions by 2020 strategy, has been developed to guide Council, businesses, industry and residents toward the ultimate goal of zero (net) greenhouse gas emissions by 2020. The strategy focuses on achieving economic growth, environmental improvements and social cohesion by influencing a shift in mainstream business investment in buildings, plant and power generation over the next two decades towards superior energy-efficient design.	http://www.melbourne.vic.gov.au/info.cfm?top=218&pa=1612&pg=1618	-	-	-	-	**Energy Plan**	2.4
3	**Sustainable Living in the City program**	Aims to raise environmental awareness, reduce the everyday environmental impact of high-rise residential living, by providing residents and building managers of high-rise apartments with the knowledge, skills and resources to reduce their impact on the environment. The program includes: * building and/or apartment retrofits to reduce water and energy use, and improve waste management; and * practical workshops and information covering waste, water, energy, transport and biodiversity	http://www.melbourne.vic.gov.au/info.cfm?top=218&pa=2582&pg=3341	M	H	M	M	**H-**	6.3
4	**Queen Victoria Market Solar Energy**	1328 solar panels on the roof of the Queen Victoria Market. The solar system , launched in April 2003, is the largest urban grid-connected solar photovoltaic installation in the Southern Hemisphere. It has the capacity to generate 252,000 kilowatt-hours of electricity each year for the Queen Victoria Market - enough to power around 46 average homes a year. This project, funded by the Australian Greenhouse Office and the City of Melbourne, was awarded to BP Solar with Origin Energy.	http://www.melbourne.vic.gov.au/info.cfm?top=218&pa=2582&pg=1614	M	H	M	M	**H-**	6.3
5	**GreenSaver**	The City of Melbourne, with City West Water and easybeinggreen, created the GreenSaver program to help residents cut their water and energy bills and care for the environment. This program has been running since 2004. Under the GreenSaver program, members received: * a water and energy assessment for your home conducted by professional assessors; * a range of energy and water-saving devices free of charge; * a showbag full of advice and information on household environmental actions; and * an invitation to two environmental workshops,	http://www.melbourne.vic.gov.au/info.cfm?top=218&pa=2582&pg=1602	M	M	M	M	**M+**	6.0
6	**Community Power**	Community Power is a partnership of Darebin, Melbourne, Banyule and Yarra City Councils and the Moreland Energy Foundation. The aims of Community Power are to: a) Reduce greenhouse gas emissions through encouraging the purchase of Green Power, b) Achieve lower and more competitive Green Power electricity prices for our residents, and c) Educate the community about saving energy Community Power is one of Australia's largest community based greenhouse gas reduction projects.	http://www.communitypower.org	M	H	L	M	**M+**	6.0
7	**Savings in the City: Greening Melbourne's hotels**	The City of Melbourne recently introduced Savings in the City, an innovative environmental program to help city hotels cut energy, water and waste consumption. The Savings in the City program aims to provide leadership, support, recognition and advice to hotels in three key environmental areas: waste, energy and water	http://www.melbourne.vic.gov.au/info.cfm?top=218&pa=2582&pg=2546	M	H	L	L	**M+**	5.4
8	**Sustainable Melbourne Fund**	Established by the City of Melbourne in 2004, with an initial investment of $5 million, the Sustainable Melbourne Fund seeks to invest in projects that enhance the environment and deliver economic benefits for the people of Melbourne	http://www.melbourne.vic.gov.au/info.cfm?top=218&pg=1611	L	H	M	H	**H-**	6.3
9	**The City of Melbourne's Council House 2**	Awarded a 6 Star Design Rating by the Green Building Council of Australia making it one of the cleanest, greenest buildings on earth.	http://www.melbourne.vic.gov.au/info.cfm?top=171&pg=1933	-	-	-	-	**Not Applicable**	2.4
	VICTORIA								2.4

	Initiative			City-wide energy conservation impact	Ease of program implementation	Potential use of program / tech.	Applicable to key sectors	Ranking	
10	**Department of Sustainability and Environment**	The Department of Sustainability and Environment is Victoria's leading government agency responsible for promoting and managing the sustainability of the natural and built environments	http://www.dse.vic.gov.au/dse/index.htm	-	-	-	-	**Not Applicable**	2.4
11	**Victorian Greenhouse Strategy website**	web site provides information about the comprehensive suite of actions led by the Victorian Government to address climate change	http://www.greenhouse.vic.gov.au/greenhouse/index.htm	-	-	-	-	**Not Applicable**	2.4
12	**Renewable Energy Action Plan**	The Victorian Government's Renewable Energy Action Plan (REAP) was lauched in August 2006 to complement the government's sustainability framework detailed in the Sustainability Action Plan 2006. The plan will accelerate the development of renewable energy in the state, while helping Victoria to lower greenhouse gas emissions. REAP builds on existing measures, while also introducing a range of new actions. For example: * The Victorian Renewable Energy Target (VRET) scheme to ensure at least 10% of Victoria's electricity consumption comes from renewables by 2016. * Showcasing the integration of renewable energy into the next generation of sustainable energy supply in 'smart energy zones'; * Ensuring the Government leads the way through its purchase of Green Power * Assisting Water Authorities to develop cost-effective renewable energy solutions for their energy needs.	http://www.greenhouse.vic.gov.au/greenhouse/index.htm	-	-	-	-	**Energy Plan**	2.4
13	**Renewable Energy Action Plan**	The Energy Efficiency Action Plan takes energy efficiency in Victoria to the next level. It builds on important achievements to date, including the introduction of 5 star standards for all new homes and energy efficiency requirements for EPA licensees.	http://www.greenhouse.vic.gov.au/greenhouse/index.htm	-	-	-	-	**Not Applicable**	2.4
14	**Sustainable Victoria**	Sustainability Victoria is a lead government agency focused on demonstrating how to use resources more efficiently to reduce everyday environmental impacts.	http://www.sustainability.vic.gov.au	-	-	-	-	**Not Applicable**	2.4
15	**You have the power. Save energy**	The 'You have the power. Save energy' campaign is encouraging all Victorians to save energy at home to cut greenhouse gas emissions and reduce the impact of climate change.	http://www.sustainability.vic.gov.au/www/html/1525-you-have-the-power-save-energy.asp?intSiteID=3	**M**	**H**	**M**	**H**	**H-**	6.9
16	**Rebates**	Rebates are available on the following items through the Victorian and Federal Governments to help households use energy more sustainably: * AAA shower heads - Rebate of up to $10 available. * Solar hot water systems - Rebates of up to $1500 available. * High efficiency gas heaters - Rebates of up to $1000 available. * High efficiency gas hot water systems - Rebates of up to $700 available. * Photovoltaic energy systems - Rebates of up to $4000 available.	http://www.sustainability.vic.gov.au/www/html/1538-rebates.asp	**M**	**H**	**M**	**H**	**H-**	6.9
17	**Environment Protection Authority Victoria**		http://www.epa.vic.gov.au/	-	-	-	-	**Not Applicable**	2.4
18	**Energy and Greenhouse Management Toolkit**	The Energy and Greenhouse Management Toolkit provides Victorian business with the necessary information, tools, case studies and guidance to achieve real cost savings, improved productivity and reduced emissions of greenhouse gases.	http://www.epa.vic.gov.au/greenhouse/toolkit.asp	-	-	-	-	**Not Applicable**	2.4
	AUSTRALIA								2.4
19	**GreenPower**	GreenPower is a national accreditation program that sets stringent environmental and reporting standards for renewable energy products offered by electricity suppliers to households and businesses across Australia. If you choose a government accredited GreenPower product, your energy supplier agrees that the equivalent amount of energy you nominate is produced from renewable sources, avoiding the use of coal-derived power.	http://www.greenpower.gov.au	**M**	**M**	**M**	**H**	**H-**	6.6

New York, NY, USA

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**New York** **http://www.nyc.gov**	* New York City has a population of 8.1 million within a land area of 830 km², making it the most densely populated city in North America (10,316/km²). With a population of 18.7 million, the New York metropolitan area is one of the largest urban areas in the world * Area - City 1,214.4 km² from which land is 785.5 km² and water 428.9 km². Urban 8,683.2 km². Metro 17,405 km². * Elevation 10 m * Climate: New York has a humid continental climate resulting from prevailing wind patterns that bring cool air from the interior of the North American continent. New York winters are typically cold with moderate snowfall averaging a total of about two feet (60 cm) annually.	http://en.wikipedia.org/wiki/New_York_City	**M**	**M**	**H**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**PlanNY2030**	Outlines sustainability challenges and goals for the City of New York through the year 2030. It includes Energy and Climate Change.	http://www.nyc.gov/html/planyc2030/html/home/home.shtml	-	-	-	-	**Energy Plan**	3.0
3	**NY department of Environmental Protection (DEP)**	Mainly water issues.	http://www.nyc.gov/html/dep/home.html	-	-	-	-	**Not Applicable**	3.0
4	**Green Buildings**	Managed by the Office of Environmental Coordination (OEC)	http://www.nyc.gov/html/oec/html/sustain/green_build.shtml	**M**	**M**	**M**	**L**	**M+**	6.0
5	**NY energy policy**	To ensure reliability, to promote economic growth, and to address environmental issues, the Task Force concludes that the City needs 2,600 MW of new electricity resources by 2008.	http://www.nyc.gov/html/om/pdf/energy_task_force.pdf	-	-	-	-	**Not Applicable**	3.0
	NEW YORK STATE								3.0
6	**New York State Department of Environmental Conservation**	No info on Energy	http://www.dec.state.ny.us/	-	-	-	-	**Not Applicable**	3.0
7	**Energy Plan - New York State Energy Research and Development Agency**	New York State Energy Plan - June 2002: encompasses policies designed to keep New York at the forefront among the states in providing its citizens with fairly priced, clean, and efficient energy resources.	http://www.nyserda.org/Energy_Information/energy_state_plan.asp	-	-	-	-	**Energy Plan**	3.0
8	**Programs - New York State Energy Research and Development Agency**	NYSERDA's principal goal is to help all New York State utility customers solve their energy and environmental problems while developing new, innovative products and services that can be manufactured or commercialized by New York State firms.	http://www.nyserda.org/programs/Default.asp	**H**	**M**	**M**	**H**	**H**	7.8
9	**Programs - New York State Energy Research and Development Agency**	* New York Energy $martSM Loan Program * FlexTech * Peak Load Reduction Program - PON 1097 etc	http://www.nyserda.org/programs/Default.asp	**H**	**M**	**M**	**H**	**H**	7.8

Oxford, UK

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Oxford** **http://www.oxford.gov.uk/**	* Area: 45.59 km² * Population: 149,800 (2005 est.) & Density 3,286 / km²	http://en.wikipedia.org/wiki/Oxford	**L**	**L**	**M**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**Energy and fuel programs**	Insulation Heating systems Grants and offers Fuel poverty Fuel Bills and Tariffs Building regulations Appliances Lighting No cost and low cost tips Renewable energy Climate Change Levy Ventilation, damp and condensation Water efficiency Windows	http://www.oxford.gov.uk/environment/energy-efficiency.cfm	**H**	**M**	**M**	**H**	**H-**	6.6
3	**Low Carbon Buildings Programme**	Grants for Solar hot water, Photovoltaics, Wind power, Small scale hydro electricity, Ground source heat pumps, Room heaters/stoves with automated wood pellet feed, Wood fuelled boiler systems	http://www.lowcarbonbuildings.org.uk/	**M**	**M**	**L**	**M**	**M+**	5.1
4	**Climate Change Levy**	The CCL is a national tax on non-domestic energy use, established to promote energy efficiency and to help the UK meet a commitment to reduce greenhouse gas emissions by 20% by the year 2010	http://www.oxford.gov.uk/environment/levy.cfm	**H**	**H**	**M**	**H**	**H-**	6.9
5	**Various conservation programs**	Insulation discount scheme, Warm Front grants, Free Home Energy Checks, Free Energy Audits for Businesses	http://www.oxford.gov.uk/environment/grants.cfm	**M**	**M**	**M**	**H**	**M+**	6.0
6	**Climate Change Action Plan**		http://www.oxford.gov.uk/files/meetingdocs/32031/item%207%20part%202.pdf	**-**	**-**	**-**	**-**	**Not Applicable**	1.8
7	**Oxford Solar Initiative**	The Oxford Solar Initiative is a not-for-profit partnership that helps households and organisations in Oxford financially and technically to install SOLAR ENERGY SYSTEMS and a range of ENERGY EFFICIENCY MEASURES in buildings. Our objective is to significantly reduce greenhouse gas emissions from the area, which lead to pollution and global climate change, and to make Oxford a greener city	http://www.oxfordsolar.org.uk/	**M**	**M**	**M**	**H**	**M+**	6.0

Portland, OR, USA

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Portland** **http://www.portlandonline.com/**	* City Area: 376.5 km² from which land is 347.9 km² and water 28.6 km². It's elevation is 15 m * Population in 2005: 556,000 (Metropolitan area: 2,095,861) * Density 1,533/km² * Portland is often cited as an example of a city with strong land use planning controls. This is largely the result of statewide land conservation policies adopted in 1973. Portland's urban growth boundary, adopted in 1979, separates urban areas (where high-density development is encouraged and focused) from traditional farm land (where restrictions on non-agricultural development are very strict). * Portland's climate is temperate and seasonal. The city has mild wet winters, and hot, dry summers. Snowfall is rather uncommon.Winter low temperatures hover around 2 °C and summer highs average around 27 °C.	http://en.wikipedia.org/wiki/Portland,_Oregon	**M**	**M**	**M**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**Office of Sustainable Development**	The Office of Sustainable Development: * Provides energy conservation advice and assistance to residents and businesses . * Partners with the Energy Trust of Oregon to help multifamily property owners and managers take advantage of tax credits and incentives for weatherization. * Leads energy efficiency and renewable energy programs for City operations , saving more than $2.2 million a year. * Provides expertise and leadership in the implementation of the City's new biofuels program.	http://www.portlandonline.com/osd/	-	-	-	-	**Not Applicable**	2.4
3	**Solar Now!**	Solar Energy Options for Homes and Businesses: * Solar Now! Commercial Options * Solar Now! Water Heating Options * Solar Now! Electric System Options	http://www.portlandonline.com/osd/index.cfm?c=43478&	**H**	**M**	**M**	**M**	**H-**	6.6
4	**Green Building Program**	It has a section on "Alternative energy, conservation and heating/cooling options"	http://www.portlandonline.com/osd/index.cfm?c=41617	**H**	**M**	**L**	**L**	**M+**	5.7
5	**Energy Conservation and Renewable Energy for the City (corporate)**	* City Energy Challenge - Since 1991, the City of Portland has saved more than $2 million a year in energy costs * 100% Renewable by 2010 - All energy for City Facilities will come from new clean sources * Waste Methane Used for Fuel and Power Generation - As part of the sewage treatment process a significant amount of waste methane is produced * Energy Efficient Traffic Signals - All red and green traffic signals now use LED technology * Powered by the Sun and Wind! - Parking meters, trucks and more use solar and wind energy	http://www.portlandonline.com/osd/index.cfm?c=42399	**H**	**M**	**M**	**H**	**H**	7.2
6	**Various reports on Energy plan achievements**	Prepared by Office of Sustainable Development	http://www.portlandonline.com/osd/index.cfm?c=41888	-	-	-	-	**Not Applicable**	2.4
	OREGON								2.4
7	**Energy Trust Oregon**	* Energy Trust of Oregon, Inc., began operation in March 2002, charged by the Oregon Public Utility Commission (OPUC) with investing in cost-effective energy conservation, helping to pay the above-market costs of renewable energy resources, and encouraging energy market transformation in Oregon. * As part of its oversight of Energy Trust, the OPUC has adopted performance measures against which to benchmark Energy Trust's performance. For 2006, among other these measures are:(i) Save at least 20 average megawatts of electricity, computed on a three-year rolling average basis at a levelized cost of no more than 2 cents per kilowatt-hour; (ii) Save at least 700,000 therms of gas, computed on a three-year rolling average basis at a levelized cost of no more than 30 cents per therm. * Energy Trust serves Oregon customers of Pacific Power, Portland General Electric, NW Natural and Cascade Natural Gas	http://www.energytrust.org/	**H**	**L**	**M**	**H**	**H-**	6.9

	Initiative			City-wide energy conservation impact	Ease of program implementation	Potential use of program / tech.	Applicable to key sectors	Ranking	
8	**Energy Trust Oregon - Program Incentives**	Home Energy Solutions * Existing homes, Home Performance with ENERGY STAR, manufactured homes and multifamily buildings * ENERGY STAR® new homes, manufactured homes and multifamily buildings * ENERGY STAR clothes washers and compact fluorescent lightbulbs * Solar electric and water heating systems Business Energy Solutions * Existing buildings * New buildings * Industrial buildings and processes * Energy from renewable sources such as solar, organic waste and wind Renewable Energy Programs * Solar electric and solar water heating using the power of the sun * Wind generation from utility scale to single turbines, and loaned anemometers * Biopower from wood waste, landfill and wastewater gas, manure and other organic sources	http://www.energytrust.org/library/Program_Incentives/index.html	**H**	**L**	**M**	**H**	**H-**	6.9
9	**Energy Trust Oregon - Reports on cases and performance**	Reports on cases and performance	http://www.energytrust.org/library/index.html	-	-	-	-	**Not Applicable**	2.4
10	**Oregon Department of Energy**	Incentives and information for energy conservation.	http://oregon.gov/ENERGY/CONS/BUS/bushome.shtml	**H**	**M**	**M**	**H**	**H**	7.2
11	**Oregon Business Energy Tax Credit**	Oregon offers a tax credit of up to 35 percent of the incremental cost of a solar energy system. The tax credit is claimed over 5 years: 10 percent the first two years and 5 percent the remaining three years. If the eligible project costs are $20,000 or less, the tax credit may be taken in one year	http://www.oregon.gov/ENERGY/RENEW/Solar/Support-BETC.shtml	**M**	**H**	**M**	**H**	**H-**	6.9

Rizhao, China

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Rizhao** **http://www.rizhao.gov.cn**	* Port city * Area 5,310 km² * Coastline 100 km * Population 2.78 million * Average temperature: 0C in January (winter) and 26C in August (summer). Its annual average temperature is 12.7℃, annual sunshine of 2516 hours, annual frost free period of 213 days	http://en.wikipedia.org/wiki/Rizhao	**L**	**H**	**M**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**National Model City of Environmental Protection**		http://www.rizhao.gov.cn/en/rizhao6.asp	-	-	-	-	**Not Applicable**	2.4
3	**Environment Protection**		http://en.rz.gov.cn/overview07.htm	-	-	-	-	**Not Applicable**	2.4
4	**Rizhao, China: Solar-Powered City**	case - World 2007: Our Urban Future	http://www.worldwatch.org/node/4752	-	-	-	-	**Not Applicable**	2.4

San Francisco, CA, USA

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**San Francisco** **http://www.ci.sf.ca.us/**	* The City and County of San Francisco is the fourth most populous city in California and the fourteenth-most populous in the United States * Area of the city is 122 km² and of the metropolitan area is 8,869.3 km². * Elevation 16 m * Population in 2005: City 739,426; Urban 3,385,000 and Metro 4,152,688 * Density 6,111/km² * Climate: mild wet winters and warm dry summers. Average summertime high temperatures peak at 21 °C. Lows almost never reach freezing temperatures. San Francisco is fairly sunny, with an average of 160 clear days, and only 105 cloudy days per year	http://en.wikipedia.org/wiki/San_Francisco	L	L	M			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**San Francisco Department of the Environment**	SF Environment's mission is to improve, enhance, and preserve the environment and to promote San Francisco's long-term environmental well being.	http://www.sfenvironment.com/aboutus/energy/solarsf/	-	-	-	-	**Not Applicable**	1.8
3	**Electricity Resource Plan (revised December 2002)**	The California Independent System Operators (ISO) requires that some amount of San Francisco's power be generated within the City boundaries to meet local reliability needs. The City wants to close Hunters Point Power Plant as soon as possible. Transmission lines are necessary to bring power from outside the City. Active implementation of energy efficiency and development of renewable energy are needed. The Electricity Resource Plan considers these issues, and presents a set of recommendations to address them. Public input was critical in shaping this plan	http://www.sfenvironment.com/aboutus/energy/policy.htm	-	-	-	-	**Energy Plan**	1.8
4	**Sustainability Plan for San Francisco - October 1996**	It addresses "Energy, Climate Change and Ozone Depletion"	http://www.sfenvironment.com/aboutus/policy/sustain/	-	-	-	-	**Energy Plan**	1.8
5	**Generation Solar**	Information on how to instal a solar system	http://www.sfenvironment.com/aboutus/energy/solarsf/	M	H	L	M	**M+**	5.4
6	**San Francisco Green Business program**	Green Business Program is a voluntary program that encourages businesses to take proactive actions that are good for their bottom line and the environment.	http://www.sfenvironment.com/greenbiz/	L	H	L	H	**M+**	5.4
7	**San Francisco Peak Energy Program**	"The 2003-2005 San Francisco Peak Energy Program is currently closed"	http://www.sfenvironment.com/aboutus/energy/pep/	M	M	M	M	**M+**	5.4
8	**Pacific Gas and Electric Company**	Pacific Gas and Electric Company is one of the largest combination natural gas and electric utilities in the United States. The company, a subsidiary of PG&E Corporation, serves approximately 15 million people in northern and central California	http://pge.com/	-	-	-	-	**Not Applicable**	1.8
9	**PG&E - Providing Clean Energy**		http://pge.com/about_us/environment/features/clean_energy.html	M	M	M	H	**M+**	6.0
10	**PG&E - Self-Generation Incentive Program**	Financial incentives to its customers who install certain types of distributed generation facilities to meet all or a portion of their energy needs.	http://pge.com/selfgen/	M	L	L	M	**M**	4.8
11	**PG&E - Championing Energy Efficiency**		http://pge.com/about_us/environment/features/energy_efficiency.html	L	M	M	M	**M**	4.8
	CALIFORNIA								1.8
12	**California Energy Commission**	The California Energy Commission is the state's primary energy policy and planning agency	http://www.energy.ca.gov/	-	-	-	-	**Not Applicable**	1.8
13	**California Energy Commission Plan**	* State of California's energy action plan. * In 2002, California established its Renewable Portfolio Standard Program, with the goal of increasing the percentage of renewable energy in the state's electricity mix to 20 percent by 2017. The California Energy Commission has recommended accelerating the goal of 20 percent by 2010 and increasing the target of 33 percent electricity from renewable energy by 2020. The state's Energy Action Plan supported this goal.	http://www.energy.ca.gov/energy_action_plan/index.html	-	-	-	-	**Energy Plan**	1.8

	Initiative			City-wide energy conservation impact	Ease of program implementation	Potential use of program / tech.	Applicable to key sectors	Ranking	
14	**Renewable Energy Program**	In 2002, California established its Renewable Portfolio Standard Program, with the goal of increasing the percentage of renewable energy in the state's electricity mix to 20 percent by 2017. The Energy Commission's 2003 Integrated Energy Policy Report recommended accelerating that goal to 2010, and the 2004 Energy Report Update further recommended increasing the target to 33 percent by 2020.	http://www.energy.ca.gov/renewables/index.html	-	-	-	-	**Not Applicable**	1.8
15	**Consumer Energy Center of the California Energy Commission**	The Consumer Energy Center went on line in 1995 to offer the public a one-stop site on the Internet for the latest information about energy resources and how to use them wisely in our home, work and vehicles.	http://www.consumerenergycenter.org/index.html	**M**	**H**	**M**	**H**	**H-**	6.3
16	**California's Rebate Program for Wind & Fuel Cell Renewable Energy Electric-Generating Systems**	The California Energy Commission is offering cash rebates on eligible grid-connected small wind and fuel cell renewable energy electric-generating systems through its Emerging Renewables Program (ERP). Effective January 1, 2007, the technologies eligible for ERP funding are: * Small Wind Turbines - small, electricity-producing, wind-driven generating systems with a rated output of 50 kilowatts or less * Fuel Cell - the conversion of sewer gas, landfill gas, or other renewable sources of hydrogen or hydrogen-rich gases into electricity by a direct chemical process	http://www.consumerenergycenter.org/erprebate/index.html	**H**	**M**	**L**	**L**	**M+**	5.1
17	**Go Solar California!**	This website is a joint effort of the California Energy Commission and the California Public Utilities Commission. This site provides consumers a "one-stop shop" for information on rebates, tax credits, and incentives for solar electricity systems in California. I has programs for new houses, existing houses, non-residential buildings, low income housing, & municipal utility consumers	http://www.gosolarcalifornia.ca.gov/index.html	**M**	**H**	**M**	**H**	**H-**	6.3
18	**California Solar Initiative - CSI**	As part of Governor Arnold Schwarzenegger's Million Solar Roofs Program, California has set a goal to create 3,000 megawatts of new, solar-produced electricity by 2017 - moving the state toward a cleaner energy future and helping lower the cost of solar systems for consumers. The California Solar Initiative Offers: * Photovoltaic incentives starting at $2.50 per watt for systems up to one megawatt in size. * Funds for solar installations for existing and new low-income and affordable housing. * A pay-for-performance incentive structure to reward high-performing solar projects	http://www.gosolarcalifornia.ca.gov/csi/index.html	**H**	**M**	**M**	**H**	**H-**	6.6
19	**New Solar Homes Partnership**	The California Energy Commission will manage a 10-year, $350 million program to encourage solar in new home construction, known as the New Solar Homes Partnership (NSHP).	http://www.gosolarcalifornia.ca.gov/nshp/index.html	**H**	**H**	**M**	**M**	**H-**	6.3

Seattle, WA, USA

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Seattle** **http://www.seattle.gov/**	* City - Area: 369.2 km² from which 217.2 km² is land and 152.0 km² is water. Population: 578,700. Density 2,665/km² * Metro - Area: 21,202 km². Population: 3,919,624 * Elevation 0–158 m (0–520 ft) * Climate: Seattle has a warm, mild temperate marine climate. It is cloudy (not rainy) an average of 226 days per year. As for temperature, winters are cool, wet and mild, but not cold, with average lows around 2-4 °C on mid-winter nights. Summers are dry, warm, and usually not too hot, with average highs around 24-27 °C on mid-summer days	http://en.wikipedia.org/wiki/Seattle	**M**	**M**	**M**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**Seattle City Light's energy efficiency programs and services**	* Seattle City Light's energy efficiency programs and services for residential and business customers are nationally and internationally recognized for innovation and excellence. Since 1977, conservation has been Seattle's energy resource of choice. Our mission is to provide a full-range of cost-effective energy efficiency service to our customers, in partnership with our communities to sustain our environment for future generations. * Browse by Who You Are: Renters, Homeowners, Small Business Customers, Multifamily Building Owner, Industrial Customer, Commercial Customer and Developer, Architect, Builder	http://www.seattle.gov/light/conserve/	-	-	-	-	**Not Applicable**	2.4
3	**Seattle City Light's energy efficiency programs and services**	* Conservation Services For Your Business * Conservation Services For Your Home - Conservation information and services including information about weatherization, efficient lighting and appliances, and tips for saving energy. * Customer Generation - generating electricity on their premises using solar or other technologies. Includes information on net metering, permitting and new financial incentives. * Energy Smart Services - Financial incentives and technical assistance to help medium to large businesses reduce electricity use and costs. * Neighborhood Power Project * Lighting Design Lab - Efficient lighting assistance for commercial customers and lighting designers	http://www.seattle.gov/light/conserve/	**H**	**M**	**M**	**H**	**H**	7.2
4	**Seattle's (Building) Energy Code**	Energy Code requirements are subdivided by occupancy type: Residential Energy Code (single family, multi-family, hotel and motel guest rooms, both low-rise and high-rise), Nonresidential Energy Code.	http://www.seattle.gov/DPD/Codes/Energy_Code/Overview/default.asp	**M**	**L**	**M**	**H**	**H-**	6.3
5	**City Green Buildings**	Green Building tools: Energy Star, LEED, etc	http://www.seattle.gov/dpd/GreenBuilding/	**M**	**M**	**M**	**L**	**M+**	5.4
6	**SeaGreen Affordable Housing Guide**	SeaGreen Affordable Housing Guide was developed to promote energy conservation, operational savings and sustainable building practices in affordable multifamily housing projects	http://www.seattle.gov/housing/SeaGreen/Default.htm	**L**	**H**	**L**	**L**	**M**	4.8

Sydney, Australia

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	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Sydney** **http://www.cityofsydney.nsw.gov.au/**	* Sydney is the most populous city in Australia * Population: 4,254,900 and Density: 345.7/km² * Area: 12,144.6 km² * Climate: Sydney has an oceanic climate with warm summers and mild winters, with rainfall spread throughout the year. The warmest month is January, with an average of 14.6 days a year over 30 °C The winter is mildly cool, with temperatures rarely dropping below 5 °C in coastal areas.	http://en.wikipedia.org/wiki/Sydney	**M**	**M**	**L**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**Energy Savings Action Plan**	The City of Sydney has prepared its Energy Savings Action Plan (ESAP) for the Department of Energy, Utilities and Sustainability. The plan has identified energy savings measures within the twelve sites of 11,900 gigajoules, equivalent to 3,200 tonnes of greenhouse gas emissions. The cost to implement these measures is $1,016,000 with annual savings of $198,000 (5 year payback). A further saving of 8,000 gigajoules (2,300 tonnes) has been identified for street lighting and fleet measures. Street lighting efficiency upgrades, in accordance with the City's Public Domain Lighting Strategy, are estimated to save $800,000 per year in energy costs. Combined, these measures represent an 11% reduction of the City's total energy consumption and a 15% reduction in greenhouse emissions . Most initiatives are scheduled for implementation this financial year or 2007/08.	http://www.cityofsydney.nsw.gov.au/Environment/GreenhouseAndAirQuality/WhattheCityisdoing/GreenhouseActionPlan.asp	-	-	-	-	**Energy Plan**	1.8
	NEW SOUTH WALES								1.8
3	**Department of Energy, Utilities and Sustainability (DEUS)**	Among other issues, they work in the areas of: * Electricity and gas network regulation and performance monitoring. * National Electricity Market reform and policy. * Residential and business energy and water efficiency. * Renewable energy development. * Energy supply and demand forecasting.	http://www.deus.nsw.gov.au/energy/energy.asp	-	-	-	-	**Not Applicable**	1.8
4	**Energy Savings Action Plans**	High energy users in NSW are required to prepare Energy Savings Action Plans	http://www.deus.nsw.gov.au/energy/Energy%20Savings%20Action%20Plans/Energy%20Savings%20Action%20Plans.asp	-	-	-	-	**Not Applicable**	1.8
5	**Energy Rebates**	* Energy blackout rebates * Pensioner Energy Rebates * Life Support Electricity Rebates * Energy Accounts Payment Assistance (EAPA)	http://www.deus.nsw.gov.au/Energy/Information%20for%20Consumers/Energy%20Rebates.asp#TopOfPage	**M**	**H**	**M**	**H**	**H-**	6.3
6	**Government Energy Management Policy**	The Government Energy Management Policy (GEMP) is NSW's response to the National Greenhouse Strategy requirement for all Australian governments to reduce greenhouse gas emissions from their own operations. Improving the energy efficiency of government buildings is one important measure in the strategy. Announced in November 1998, GEMP established targets to reduce state-wide total energy consumption in Government buildings by 15% by 2001/02 and 25% by 2005/06 (from 1995/96 levels), where cost-effectively feasible.	http://www.deus.nsw.gov.au/energy/Government%20Programs/Government%20Energy%20Management%20Policy/Government%20Energy%20Management%20Policy.asp#TopOfPage	-	-	-	-	**Not Applicable**	1.8
	AUSTRALIA								1.8
7	**GreenPower**	GreenPower is a national accreditation program that sets stringent environmental and reporting standards for renewable energy products offered by electricity suppliers to households and businesses across Australia. If you choose a government accredited GreenPower product, your energy supplier agrees that the equivalent amount of energy you nominate is produced from renewable sources, avoiding the use of coal-derived power.	http://www.greenpower.gov.au	**M**	**H**	**M**	**H**	**H-**	6.3

Vancouver, BC, Canada

BACK to list of cities

	City description	Description	Link / Sources	Applicability					
				Area	Population	Climate			
1	**Vancouver** **http://vancouver.ca/**	* City - Area: 114.67 km². Population 587,891. * Metro - Area: 2,878.52 km². Population: 2,180,737. Density 5,252/km² * Altitude Sea level to 167 metres * Climate: Vancouver's climate is unusually temperate by Canadian standards. Vancouver has daily minimum temperatures falling below 0 °C on an average of 46 days per year and below -10 °C on only two days per year. The average annual precipitation is about 1,219 millimetres.	http://en.wikipedia.org/wiki/Vancouver	**L**	**M**	**M**			
	Initiative			**City-wide energy conservation impact**	**Ease of program implementation**	**Potential use of program / tech.**	**Applicable to key sectors**	**Ranking**	
2	**The Climate-Friendly City: A Corporate Climate Change Action Plan for the City of Vancouver**	Energy Performance Contract Energy Efficient Purchasing Policy Supporting Alternative Energy Green Design for New and Replacement Civic Buildings	http://vancouver.ca/sustainability/coolvancouver/	-	-	-	-	**Energy Plan**	2.1
3	**Community Climate Change Action Plan**	The plan and report focus is on the city taking action to reduce climate changing greenhouse gases, to reduce our energy consumption and to create a more sustainable city.	http://vancouver.ca/sustainability/coolvancouver/	-	-	-	-	**Not Applicable**	2.1
4	**Greater Vancouver Regional District**	The Greater Vancouver Regional District (GVRD) is a partnership of 21 municipalities	http://www.gvrd.bc.ca/sustainability/	-	-	-	-	**Not Applicable**	2.1
5	**Power Smart at Home - BC Hydro**	* Fridge Buy-Back Program. * Lighting Rebates. * Windows Rebate Program. * Analyze My Home.	http://www.bchydro.com/powersmart/	**H**	**H**	**M**	**M**	**H-**	6.6
6	**Power Smart for Business - BC Hydro**	* High-Performance Building Program for Small to Medium Commercial Buildings * High-Performance Building Program for Large Commercial Buildings * New Home Program * Compressed Air Initiative * Refrigeration Initiative * Power Smart Partner Program, for our largest business customers * Green Power Certificates * Power Smart Success Stories	http://www.bchydro.com/business/	**H**	**M**	**M**	**M**	**H-**	6.3
7	**Green Buildings and Clean Energy - Vancouver 2010**	Energy and Environmental Design (LEED) design principles to all new facilities	http://www.vancouver2010.com/en/Sustainability/EnvironmentalPerformance/GreenBuildings	**M**	**M**	**L**	**M**	**M+**	5.4

Appendix G: Research and Ranked Initiatives

Energy Plan for Toronto
Review of existing and developing initiatives

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Limitations

The reader should consider the following limitations when evaluating the results of the jurisdictional research and analysis:

1. The information gathered was obtained from readily available public information.
2. PwC has not undertaken an independent audit or verification of the information.
3. The ranking of initiatives is based purely on the information available from public sources and the project team's knowledge and experience.
4. Budgetary limitation prevented a more exhaustive review and ranking.
5. The information presented is current as of April 2007. Program offerings change continuously and thus, any list of initiatives should always be considered dynamic. In particular, program offered by the federal government through have and can be expected to change significantly in the near future.

Ranking criteria of initiatives

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	Ranking Criteria			
	City-wide energy conservation impact	**Ease of initiative implementation**	**Actual use of initiative or technology by audience**	**Ranking**
Description	How much impact has the initiative (or the technology supported by the initiative) had in conserving energy in the city as a whole?	How easy is to implement the initiative? Factors to consider: * Government support * Investment required * Infrastructure in place	Has the initiative received buy in from the community (or has the community implemented the technology it supports)?	Criteria valued as: * City energy conserv. --> 2 * Ease of implem. --> 1 * Actual use --> 2 The final ranking determines how successful the initiatives was/is.
Criteria	H = high impact (large potential of energy conservation) M = medium impact L = low impact	H = easy to implement M = average L = difficult to implement	H = high acceptance M = medium acceptance L = low acceptance	H+ = 8.01 - 9 H = 7.01 - 8 H- = 6.01 - 7 M+ = 5.01 - 6 M = 4.01 - 5 M- = 3.01 - 4 L = 0.01 - 3 Not Applicable

Organized by jurisdiction (i.e., Federal, Provincial, Municipal and other)

	Initiative	Delivery Agent	Description	Program Type	Jurisdiction	Target Sector	Weblink	City-wide energy conservation impact	Ease of initiative implementation	Actual use of initiative or technology by audience	Ranking	
1	**Energy Efficient Housing Initiative - New Housing**	Office of Energy Efficiency Natural Resources Canada Louis Marmen Housing & Equipment Division 1 Haanel Drive Ottawa, ON K1A 1M1 T 613 996 7512	The Energy Efficient Housing initiative offers a suite of programs for New Homes that promote energy efficiency through guidelines that enable new homes to be approximately 30 percent more energy efficient than those built to minimum provincial building codes. The increased efficiency of these homes translates into reduced energy costs for homeowners.	**Education, Standards (Voluntary or Regulated), Training Technical Assistance**	**Federal**	**Residential, Single-Detached Homes/ Single-Attached Homes/ New buildings**	http://oee.nrcan.gc.ca/residential/personal/index.cfm	**L**	**M**	**L**	**M-**	3.6
2	**Switch and Save**	NRCan Office of Energy Efficiency 580 Booth St. 18th floor Natural Resources Canada Ottawa ON K1A 0E4 Toll free 800 387 2000	Public education/awareness program. Using the theme "Change a light, change your world," the campaign promotes the energy savings and environmental benefits of ENERGY STAR-qualified CFLs. The long-term goal of the campaign is for every Canadian household to switch over at least two incandescent bulbs to CFLs.	**Public Education/Outreach**	**Federal**	**Residential**	http://energystar.gc.ca	**L**	**M**	**L**	**M-**	3.6
3	**Commercial Building Incentive Program (CBIP)**	Natural Resources Canada Pierre Guèvremont Chief, New Buildings Program 1 Haanel Drive Ottawa, ON K1A 1M1 T 613 996 6722	CBIP promotes the design and construction of new, energy-efficient commercial, institutional and multi-unit residential buildings and facilities by supporting the integrated design process that makes MNECB a baseline minimum standard. Design assistance and funding of up to $60,000 for buildings that qualify is based on software tools and verified in CBIP's review process. CBIP's incentive funding has been cancelled; however other non-incentive elements of the program remain in place. www.oee.nrcan.gc.ca/commercial/newbuildings.cfm	**Education, Incentive, Research and Development, Standards (Voluntary or Regulated), Training/ Technical Assistance**	**Federal**	**Multi-Residential, Commercial, and Institutional New buildings**	www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/Groups/clean_electric_power_generation_e.htm	**L**	**M**	**M**	**M**	4.8
4	**Emerging Technologies Program**	Natural Resources Canada Claude Barraud Renewable Energy Technologies Program 1 Haanel Drive Ottawa, ON K1A 1M1 T 613 996 6087	The Emerging Technologies program provides cost-sharing and technical assistance in support of technology research, development, field trials and infrastructure support in order to support Canadian industry's efforts to develop renewable energy technologies such as hydraulic, wind, and active solar energy.	**Research and Development**	**Federal**	**Residential, Industrial, Commercial, and Institutional**	www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/Groups/Funding%20Programs/fundprog_emerging_technologies_e.htm	**L**	**L**	**L**	**L**	3.0
5	**RET Screen International Clean Energy Decision Support Centre**	Natural Resources Canada RET Screen International 1615 Lionel-Boulet Blvd., P.O. Box 4800 T 450 652 4621 F 450 652 5177 rets@nrcan.gc.ca	The objective of the centre is to help planners, decision-makers and industry to implement renewable energy and energy efficiency projects by developing decision-making tools that reduce the cost of pre-feasibility studies; disseminating knowledge to help people make better decisions; and by training people to better analyze the technical and financial viability of possible projects. The program offers the RETScreen International Clean Energy Project Analysis Software to facilitate this process with capability to compare energy production, life cycle costs and greenhouse gas emission reductions with conventional energy projects through its standardized and integrated project analysis process. It significantly reduces the cost and increases the precision of pre-feasibility studies and contributes to the formulation of more fully informed decisions prior to project implementation.	**Training & Technical Assistance**	**Federal**	**Residential, Industrial, Commercial, and Institutional**	http://www.retscreen.net/ang/home.php	**L**	**M**	**L**	**M-**	3.6

	Initiative	Delivery Agent	Description	Program Type	Jurisdiction	Target Sector	Weblink	City-wide energy conservation impact	Ease of initiative implementation	Actual use of initiative or technology by audience	Ranking	
6	**Sustainable Buildings and Communities (SBC) Group**	Natural Resources Canada Mark Riley Chief, Building Energy Technologies 1 Haanel Drive Ottawa, ON K1A 1M1 T 613 996 8151	CANMET Energy Technology Centre's (CETC) SBC program is designed to accelerate the research, development and deployment of energy efficient and renewable energy technologies for houses, buildings and communities. The Centre collaboratively undertakes projects with other organizations, prioritizing emerging technologies in areas such as district heating and cooling, HVAC and energy systems, and renewable energy. The group also focuses on simulation R&D and software tools. Its activities are designed to address the technology and information gaps that inhibit the adoption of energy efficient technologies.	**Energy Management and Monitoring, Research and Development, Standards (Voluntary or Regulated), Technical Assistance**	**Federal**	**Residential, Industrial, Manufacturing, Commercial, Institutional, and Agriculture**	http://www.sbc.nrcan.gc.ca/renewable_energy/renewable_energy_e.asp	**L**	**L**	**L**	**L**	3.0
7	**ecoENERGY Retrofit Incentive for Buildings**	Buildings Division Office of Energy Efficiency Natural Resources Canada 580 Booth Street C/O Observatory #3 Ottawa ON K1A 0E4 Fax: (613) 947-4121	Natural Resources Canada's Office of Energy Efficiency offers the ecoENERGY Retrofit Incentive for Buildings, a component of the ecoENERGY Retrofit financial incentives for homes, buildings and industrial processes. Interest parties could receive $10 per gigajoule of energy saved, up to 25 percent of eligible project costs. The first call for proposals will start on June 15 with a deadline of September 15, 2007. The OEE is no longer accepting applications for previous incentives such as Energy Retrofit Assistance for Planning Activities (ERA-P) and Energy Retrofit Assistance for Project Implementation (ERA-I).	**Energy Management and Monitoring Incentive**	**Federal**	**Commercial, Institutional**	http://www.oee.nrcan.gc.ca/commercial/financial-assistance/existing/retrofits/index.cfm?attr=20	**L**	**M**	**L**	**M-**	3.6
8	**Refrigeration Program for Buildings (RAPB)**	Natural Resources Canada Sophie Hosatte Buildings 580 Booth Street Ottawa, ON K1A 0E4 T 450 652 5331	The Refrigeration Action Program for Buildings (RAPB) was designed to help implement technologies in new or renovated building's refrigeration systems in the commercial, institutional, and industrial sectors. Traction is accomplished through education, R&D and incentives. The main focus is on supermarkets and ice and curling rinks and the reduction of energy consumption and of synthetic refrigerant leaks in these sectors.	**Education, Energy Management/ Monitoring, Research and Development, Technical Assistance**	**Federal**	**Industrial, Commercial, and Institutional**	http://cetc-varennes.nrcan.gc.ca/en/b_b/parb_rapb.html	**L**	**L**	**L**	**L**	3.0
9	**Technology Early Action Measures (TEAM): Climate Change Technology**	Natural Resources Canada Ottawa T 613 996 7252	TEAM finances late stage development and first demonstration of new technologies. TEAM and its partners explore partnering opportunities under five key technology themes: advanced end-use efficiency, biotechnology, decentralized energy production, cleaner fossil fuels and the hydrogen economy. TEAM works with governments, institutions and private R&D activities to support demonstration of innovative technologies that may reduce greenhouse gas emissions.	**INCENTIVE, R&D**	**Federal**	**Manufacturing**	http://www.team.gc.ca/english/contacts.asp	**L**	**M**	**L**	**M-**	3.6
10	**Technology Partnerships Canada: Hydrogen Early Adopters (h2EA)**	Industry Canada 300 Slater Street, 10th Floor Ottawa, Ontario K1A 0C8 Toll free 800 391 3363 F 613 954 9117 E h2ea@ic.gc.ca	h2EA supports initiatives that demonstrate useful integrated hydrogen and hydrogen-compatible technologies. Working pilot-scale versions of a hydrogen economy enable companies to test and showcase technologies and help increase investor and consumer awareness of Canadian capabilities and of the many benefits and uses of hydrogen-powered applications. Projects include concepts such as "hydrogen highways" and "hydrogen villages" now in development by industry and governments in several parts of the country.	**Incentive or Tax Measure Research and Development**	**Federal**	**Industrial, Manufacturing, Mining, Petroleum/ petrochemicals**	http://www.tpc.ic.gc.ca/h2/	**L**	**L**	**L**	**L**	3.0
11	**Industrial Research Assistance Program (IRAP) – Industrial Technology Advisors (ITA)**	National Research Council Industrial Research Assistance Program 55 St. Clair Avenue East Suite 903, Toronto, ON M4T 1M2 T 416 973 4484 F 416 973 4303	SME technical and research needs, and sustainable development issues are identified by Industrial Technology Advisors (ITAs) at each stage of the R&D process and the innovation cycle. They offer technology expertise and advisory services.	**Education, Research and Development**	**Federal**	**Industrial, Manufacturing, Mining, Petroleum/ petrochemicals**	http://irap-pari.nrc-cnrc.gc.ca/itas_e.html	**L**	**L**	**L**	**L**	3.0

	Initiative	Delivery Agent	Description	Program Type	Jurisdiction	Target Sector	Weblink	City-wide energy conservation impact	Ease of initiative implementation	Actual use of initiative or technology by audience	Ranking	
12	**Industrial Research Assistance Program (IRAP) – Technology Partnerships Canada (TPC)**	National Research Council Industrial Research Assistance Program 55 St. Clair Avenue East Suite 903, Toronto, ON M4T 1M2 T 416 973 4484 F 416 973 4303	Financial assistance is offered through the IRAP-TPC Program to companies as support to the various activities required to improve their technological competitiveness. The Environmental Technologies component promotes the development of sustainable alternatives including energy, water, and non-renewable resources conservation.	**Incentive, Research and Development**	**Federal**	**Industrial, Manufacturing, Mining, Petroleum/ petrochemicals**	http://irap-pari.nrc-cnrc.gc.ca/main_e.html	**L**	**L**	**L**	**L**	3.0
13	**CANMET Energy Technology Centre (CETC)**	Natural Resources Canada Roy Prokopuk Business Development, Marketing & Communications 1 Haanel Drive Ottawa, ON K1A 1M1 T 613 996 8693 F 613 943 0127 E Roy.Prokopuk@nrcan-rncan.gc.ca	With world-class laboratory facilities, CETC works with Canadian companies to develop and deploy advanced technologies that will reduce the environmental consequences associated with conventional practices. CETC-Ottawa, CETC-Varennes and CETC-Devon offer a list of energy-efficient programs.	**Incentive, Research and Development**	**Federal**	**Industrial, Manufacturing, Mining, Petroleum/ petrochemicals**	www.cetc.nrcan.gc.ca	**L**	**L**	**L**	**L**	3.0
14	**Canadian Industry Program for Energy Conservation (CIPEC)**	Office of Energy Efficiency Natural Resources Canada Michael Burke Director T 613 996 6872	CIPEC is a government-industry partnership that focuses on barriers to planning, implementing and tracking energy efficiency projects at the sector and company levels. Direct company involvement occurs through the Industrial Energy Innovators (IEI) component of CIPEC. The program offers information sharing, training, and technical assistance.	**Education, Training/ Technical Assistance**	**Federal**	**Industrial, Manufacturing, Mining, Petroleum/ petrochemicals**	www.oee.nrcan.gc.ca/cipec	**M**	**H**	**M**	**H-**	6.6
15	**Government Purchases of Electricity from Renewable Resources (PERR)**	Natural Resources Canada Deirdre Hetherington Policy Advisor 1 Haanel Drive Ottawa, ON K1A 1M1 T 613 996 2596	The goal of this initiative is to redirect 20% of the federal electricity purchases from GHG emission intensive energy to emerging renewable sources that are certified by a third party as having low environmental impact with the objective of reducing greenhouse gas and other air pollution emissions associated with federal electricity consumption. The program is intended to expand the renewable energy industry in Canada by supporting promising climate-friendly technologies in the expectation that their total costs will come down as a result of the expanding market created by the federal leadership. Electricity from emerging renewable energy sources (ERES), include wind, water, biomass and the sun.	**Alternative Energy**	**Federal**	**Institutional, Renewable Energy Sources**	www.reed.nrcan.gc.ca	**L**	**L**	**L**	**L**	3.0
16	**ecoENERGY for Renewable Heat**	ecoENERGY for Renewable Heat Renewable and Electrical Energy Division Natural Resources Canada 615 Booth Street, Room 150, Ottawa, Ontario, K1A 0E9 e-mail: ecoenergyrhp@nrcan.gc.ca	ecoENERGY for Renewable Heat will invest $36 million over four years to: increase the use of renewable thermal energy; help develop renewable thermal energy industry capacity; and contribute to cleaner air by displacing fossil fuel-based energy use for space heating and cooling, and water heating in Canadian buildings. ecoENERGY for Renewable Heat will offer an incentive to purchasers of solar heating systems in the industrial, commercial and institutional sectors. The incentive will be set at 25 percent of the purchase, installation and certain other costs of a qualifying system.	**Incentive**	**Federal**	**Industrial, commercial, institutional**	http://ecoaction.gc.ca/ecoenergy-ecoenergie/heat-chauffage/index-eng.cfm	**L**	**H**	**L**	**M**	4.2
17	**ecoENERGY for Renewable Power**	ecoENERGY for Renewable Power Renewable and Electrical Energy Division Natural Resources Canada 580 Booth Street, 11th Floor Ottawa, Ontario K1A 0E4 e-mail: ecoenergyrp@nrcan.gc.ca	ecoENERGY for Renewable Power will invest $1.48 billion to increase Canada's supply of clean electricity from renewable sources such as wind, biomass, low-impact hydro, geothermal, solar photovoltaic and ocean energy. It will encourage the production of 14.3 terrawatt hours of new electricity from renewable energy sources. ecoENERGY for Renewable Power will provide an incentive of one cent per kilowatt-hour for up to 10 years to eligible low-impact, renewable electricity projects constructed over the next four years, April 1, 2007 to March 31, 2011.	**Incentive**	**Federal**	**utilities, businesses, municipalities, institutions and organizations**	http://ecoaction.gc.ca/ecoenergy-ecoenergie/power-electricite/index-eng.cfm	**L**	**L**	**L**	**L**	3.0

	Initiative	Delivery Agent	Description	Program Type	Jurisdiction	Target Sector	Weblink	City-wide energy conservation impact	Ease of initiative implementation	Actual use of initiative or technology by audience	Ranking	
18	**Clean Electric Power Generation (CEPG) Program**	Natural Resources Canada Michael Burke Director 1 Haanel Drive Ottawa, ON K1A 1M1 T 613 996 6872	CEPG helps the industry develop cleaner and more energy-efficient combustion processes. Its research on combustion processes focuses on optimizing the performance of stationary equipment and evaluating and developing new products, fuels and retrofit technologies. Processes under study use conventional fuels: oil, coal, and natural gas, as well as biomass and specialty fuels.	**Research and Development**	**Federal**	**Electricity Generators**	www.nrcan.gc.ca/es/etb/cetc/cetc01/htmldocs/Groups/clean_electric_power_generation_e.htm	**L**	**L**	**L**	**L**	3.0
19	**Dollars to $ense Energy Management Workshops**	Office of Energy Efficiency Natural Resources Canada 580 Booth St., 18th Floor Ottawa ON K1A 0E4 T 613 995 2943 F 613 740 3114	NRCan offers a series of workshops that provide opportunities for companies to cut operating costs by adopting energy-saving tips offered through Spot the Energy Savings Opportunities, Energy Monitoring and Tracking, and Energy Master Plan. Workshops can also be designed and delivered to specific industrial sectors and companies.	**Education, Training/ Technical Assistance**	**Federal**	**Industrial, Manufacturing, Mining, Petroleum/ petrochemicals**	http://www.oee.nrcan.gc.ca/industrial/training-awareness	**L**	**H**	**M**	**M+**	5.4
20	**ecoENERGY Retrofit**	Office of Energy Efficiency of Natural Resources Canada (NRCan)	$220 million targeted financial incentive program to help Canadians retrofit their homes, buildings and industrial processes	**Incentive**	**Federal**	**Residential, industrial**	http://oee.nrcan.gc.ca/residential/personal/home-improvement.cfm	**L**	**H**	**M**	**M+**	5.4
21	**Federal House in Order Initiative (FHIO)**	Office of Energy Efficiency, Natural Resources Canada Jim Comtois Federal House in Order 1 Haanel Drive Ottawa, ON K1A 1M1 T 613 943 0225	As part of the national environmental effort, FHIO is the federal government's plan to reduce GHG emissions within its own operations. The federal GHG emission reduction target is to achieve a 31% below 1990 federal emissions level by 2010	**Education, Standards (Voluntary or Regulated)**	**Federal**	**Commercial, Institutional DISCONTINUED ?**	http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/policy_e/details.cfm?searchType=default&sectoranditems=all|0max=10&pageId=26&categoryID=all&regionalDeliveryId=all&programTypes=all&keywords=&ID=1456&attr=0	**L**	**H**	**H**	**H-**	6.6
22	**EnerGuide for Industry**	Office of Energy Efficiency Isabelle Saint-Laurent Industrial Sector 580 Booth St., 18th Floor Ottawa ON K1A 0E4 T 613 996 6748 F 613 740 3114	EnerGuide for Industry encourages the use of more energy-efficient off-the-shelf industrial equipment. Its goal is to strengthen Canada's economic competitiveness while reducing GHG emissions.	**Education, Standards (Voluntary or Regulated), Training/ Technical Assistance**	**Federal**	**Industrial, Manufacturing, Mining, Petroleum/ petrochemicals, Commercial/ Institutional**	www.oee.nrcan.gc.ca/egi	**L**	**M**	**L**	**M-**	3.6
23	**Accelerated Capital Cost Allowance for Efficient and Renewable Energy Generation Equipment**	Canada Revenue Agency Ted Harris Resources Industry Section T 613 957 2114	This program provides an accelerated rate of write-off (50 %/year, on a declining balance basis) investments in the production of heat for industrial process or electricity by using fossil fuel efficiently or by using renewable energy sources.	**Incentive/ Tax Rebate**	**Federal**	**Industrial, Manufacturing, Mining, Petroleum/ petrochemicals, commercial**	http://laws.justice.gc.ca/en/notice/index.html?redirect=%2Fen%2FI-3.3%2FC.R.C.-c.945%2F138555.html	**M**	**H**	**M**	**H-**	6.6

	Initiative	Delivery Agent	Description	Program Type	Jurisdiction	Target Sector	Weblink	City-wide energy conservation impact	Ease of initiative implementation	Actual use of initiative or technology by audience	Ranking	
24	**Canada Renewable and Conservation Expense**	Canada Revenue Agency Ted Harris Resources Industry Section T 613 957 2114	The Canadian Renewable and Conservation Expense (CRCE) promotes the development of energy conservation and renewable and alternative energy projects, by allowing investors to fully write-off certain, mostly intangible, costs, such as feasibility and resource assessment studies, associated with investments in renewable energy and energy conservation projects.	**Incentive/ Tax Rebate**	**Federal**	**Industrial, Manufacturing, Mining, Petroleum/ petrochemicals**	http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/policy_e/details.cfm?searchType=default&sectoranditems=all|0max=10&pageId=4&categoryID=all&regionalDeliveryId=all&programTypes=all&keywords=&ID=974&attr=0	**M**	**H**	**M**	**H-**	6.6
25	**Excise Tax Exemption For Ethanol And Methanol**	Canada Revenue Agency Bill Gray Excise Taxes & Special Levies T 613 941-1933	This program encourages the development and marketing of ethanol and methanol made from biomass through the exemption from the excise tax for ethanol and methanol made from biomass when it is blended with gasoline or diesel fuel.	**Incentive/ Tax Rebate**	**Federal**	**Industrial, Manufacturing, Chemicals, Transportation**	http://www.cra-arc.gc.ca/E/pub/et/etsl47/etsl47-e.html	**M**	**H**	**M**	**H-**	6.6
26	**Wind Power Production Incentive (WPPI)**	Canada Revenue Agency Denis Zborowski Project Manager 580 Booth Street Ottawa, ON K1A 0E4 T 613 947 9815 Toll free 877 722 6600 F 613 947 0373 wppi@nrcan.gc.ca www.canren.gc.ca/wppi	The objective of this incentive is to establish 4000 megawatts of new wind energy production in Canada. An incentive payment of one cent per kilowatt-hour (kWh) for the first 10 years of operation will be made to eligible wind-power projects commissioned before April 1, 2010. Payment of the incentive begins when a wind farm has been commissioned.	**Incentive**	**Federal**	**Wind Developers, Producers and Utilities**		**L**	**M**	**M**	**M**	4.8
27	**Canadian Textiles Program (CANtex)**	Industry Canada Service Industries and Consumer Products Branch (SICPB) – CANtex C.D. Howe Building, East Tower, 6th Floor 235 Queen Street Ottawa, ON K1A 0H5 Toll free: 888 268-0453 F 613 954 3107	CANtex helps eligible textile manufacturers lower costs, enhance productivity, improve company efficiency and diversify textiles products through financial assistance and/or tax rebates.	**Financial Incentive or Tax Measure**	**Federal**	**Industrial, Manufacturing, Mining, Petroleum/ petrochemicals**	http://strategis.ic.gc.ca/epic/internet/inctp-ptc.nsf/en/Home	**L**	**L**	**L**	**L**	3.0
28	**Energy Efficiency Assistance Program For Houses**	OPA Conservation Bureau 120 Adelaide Street West Suite 1600 Toronto, ON M5H 1T1 T 416 967 7474 F 416 967 1947 www.conservationbureau.on.ca	The Energy Efficiency Assistance Program for Houses pilot program is designed to give low-income homeowners and tenants the tools they need to make more effective energy decisions, while at the same time putting money back into the pockets of those who need it most. The pilot program was launched in Ottawa on November 9, 2006, and was launched on January 25, 2007 to other parts of the province. Delivered in the Toronto Area by: Green Communities Canada, Box 928, Peterborough, ON K9J 7A5, 1 888 661 0000 or 705 415 9183 www.greencommunitiescanada.org	**Education, Incentive**	**Provincial**	**Residential Low Income**	www.greencommunitiescanada.org	**L**	**M**	**L**	**M-**	3.6

	Initiative	Delivery Agent	Description	Program Type	Jurisdiction	Target Sector	Weblink	City-wide energy conservation impact	Ease of initiative implementation	Actual use of initiative or technology by audience	Ranking	
29	**Affordable Housing Energy Efficiency Program**	OPA Conservation Bureau 120 Adelaide Street West Suite 1600 Toronto, ON M5H 1T1 T 416 967 7474 F 416 967 1947	Phase One of the Affordable Housing Energy Efficiency Program will offer affordable housing providers up to $850 per unit to help offset the incremental cost of purchasing ENERGY STAR qualified products. Municipal Service Managers will also deliver an education and awareness campaign to affordable housing stakeholders to raise awareness among housing providers, builders, architects, developers and residents of energy efficiency and energy-efficient product choices. Co-funded with NRCan and delivered through: Ministry of Municipal Affairs and Housing (MMAH)	**Education, Incentive**	**Provincial**	**Residential Low Income**	www.conservationbureau.on.ca	**L**	**L**	**L**	**L**	3.0
30	**Green Light Initiative**	OPA Conservation Bureau 120 Adelaide Street West, Suite 1600, Toronto, ON M5H 1T1 T 416 967 7474 www.conservationbureau.on.ca SHSC 390 Bay Street, Suite 710 Toronto, ON M5H 2Y2 T 416 594 9325 Toll Free: 866 268 4451 F: 416 594 9422 E: feedback@shscorp.ca	The social housing segment of the OPA's Low Income & Social Housing initiative is managed by Social Housing Services Corporation (SHSC) as part of its Green Light initiative, a province-wide initiative to help social housing providers take action to reduce energy use in their buildings. The initial phase was available to the 5,000 units who undertook an energy audit in summer 2005 through the Social Housing Services Corporation Energy Management Program. It focused on end-use products such as energy-efficient lighting and appliance replacement upgrades. The next phase will be rolled out in 2007 and will focus on building envelope improvements. The program also contains an educational component. It is expected to have delivered a 10MW reduction in energy consumption by the end of 2006.	**Audit, Incentive, & Education**	**Provincial**	**Residential (Social Housing, Multi-residential)**	http://www.shscorp.ca/content.aspx?file=Energy/AboutTheProgram.htm	**L**	**L**	**L**	**L**	3.0
31	**HOT SAVINGS REBATE**	OPA Conservation Bureau 120 Adelaide Street West Suite 1600 Toronto, ON M5H 1T1 T (416) 967-7474 F (416) 967-1947 www.conservationbureau.on.ca and participating HRAI contractors: Heating, Refrigeration and Air Conditioning Institute of Canada 2800 Skymark Avenue, Building 1, Suite 201, Mississauga, ON L4W 5A6 T 905 602-4700 F: 905 602-1197 Toll Free 800 267 2231	Ontario residents with existing heating or central air conditioning systems are encouraged to purchase energy efficient heating and cooling systems when replacing their existing systems by rebates of $75 for a programmable thermostat, $100 for updating furnace, and $500 for new central air conditioning or ENERGY STAR heat pump. To be eligible for the rebates, services must be performed by a program-registered HRAI contractor.	**Incentive**	**Provincial**	**Residential**	http://www.hotsavingsrebate.com/	**L**	**M**	**L**	**M-**	3.6
32	**Every Kilowatt Counts**	OPA Conservation Bureau 120 Adelaide Street West Suite 1600 Toronto, ON M5H 1T1 T (416) 967-7474 F (416) 967-1947	Public education/awareness program.	**Public Education/ Outreach**	**Provincial**	**Residential**	www.conservationbureau.on.ca	**M**	**H**	**H**	**H**	7.8
33	**Demand Response Program**	OPA Conservation Bureau 120 Adelaide Street West Suite 1600 Toronto, ON M5H 1T1 T (416) 967-7474 F (416) 967-1947	The DRP is a voluntary program that allows participants to receive compensation for curtailing the electricity demand of their project/business activities.	**Incentive**	**Provincial**	**Industrial/ Commercial/ Institutional**	www.conservationbureau.on.ca	**L**	**L**	**L**	**L**	3.0

	Initiative	Delivery Agent	Description	Program Type	Jurisdiction	Target Sector	Weblink	City-wide energy conservation impact	Ease of initiative implementation	Actual use of initiative or technology by audience	Ranking	
34	**Energy Efficiency Act and Regulations**	Ontario Ministry of Energy Ed Grzesik Manager, Standards and Technical Support (416) 325-7065	The purpose of this program is to prohibit the sale or lease of specified inefficient energy-using appliances or products from the Ontario marketplace by regulation under Ontario's Energy Efficiency Act (EEA).	**Standards (Voluntary or Regulated)**	**Provincial**	**Residential (Single-Detached Homes, Single-Attached Homes, Mobile Homes), Commercial, and Institutional New buildings**	http://www.energy.gov.on.ca	**H**	**H**	**H**	**H+**	9.0
35	**Doors Closed Campaign**	Conservation Council of Ontario 215 Spadina Ave, Suite 132 Toronto, ON M5T 2C7 T 416 533 1635 ext 2	Public education/awareness program that gleans voluntary participation from small businesses across Ontario.	**Education**	**Provincial**	**Small Commercial**	http://weconserve.ca/doorsclosed/?page_id=3	**M**	**M**	**M**	**M+**	6.0
36	**Toronto Community Housing Corporation Appliance Renewal Program**	The Toronto Community Housing Corporation and Green Municipality Fund, Centre for Sustainable Community Development, Federation of Canadian Municipalities 24 Clarence Street, Ottawa, ON K1N 5P3 T 613 241 5221 F 613 244 1515	The Toronto Community Housing Corporation's energy management plan began with an appliance renewal program. Old refrigerators and ranges in 28,500 low-income rental units are being upgraded to energy-efficient ones.	**Equipment Replacement**	**Municipal**	**Social Housing (Multi-Residential)**	http://www.sustainablecommunities.fcm.ca/GMF/	**M**	**M**	**H**	**H**	7.2
37	**WATERSAVER PROGRAMS: Washing Machine Rebate Program**	City of Toronto Toronto Water Efficiency Program 1530 Markham Road, 4th Floor Toronto, ON M1B 3G4 T 416 338 0338 F 416 338 0685	The City of Toronto offers residents $60 cash back on the purchase of a new high-efficiency, front-loading washer. Purchase of a high-efficiency front-loading washer enables participants to apply for the City of Toronto rebate and get $20 in savings on Tide HE detergent. Tide HE is offering this special savings opportunity to all City of Toronto residents who receive a washer rebate in 2007. (Tide HE savings are five (5) coupons of $4.00 each, redeemable towards the purchase of 32-load bottles of Tide HE detergent. Offer expires December 31, 2007.)	**Incentive**	**Municipal**	**Residential**	http://www.toronto.ca/watereff/washer/index.htm	**M**	**M**	**M**	**M+**	6.0
38	**City of Toronto Residential Outreach Program**	City of Toronto Energy Efficiency Office (EEO) Heinrich Feistner Senior Energy Consultant, Metro Hall, 2nd floor 55 John Street Toronto, ON M5V 3C6 T 416 392 1501 F 416 392 1456 E eeo@toronto.ca	The 45 Environment Days of the City of Toronto are the main outreach activity. These are supplement by approximately 20 other trade and community events annually, including all the City of Toronto Reno-Forums.Active Solar & Photovoltaics. This program promotes awareness of renewable energies such as Biomass, Geothermal, Passive Solar, Small Hydro, and Wind.	**Public Education/ Outreach**	**Municipal**	**Residential Single-Detached Homes, Single-Attached Homes**	http://www.toronto.ca/energy/green.htm	**L**	**H**	**M**	**M+**	5.4
39	**WATERSAVER PROGRAMS: ICI Multi-unit Toilet Replacement Program**	City of Toronto Toronto Water Water Efficiency Program 1530 Markham Road, 4th Floor Toronto, ON M1B 3G4 T 416 338 0338 F 416 338 0685	Toronto Businesses are eligible for a rebate of $60 to $150 to replace leaky toilets with a City-selected toilet.	**Incentive**	**Municipal**	**Multi- residential, Industrial, Commercial, and Institutional**	http://www.toronto.ca/watereff/flush/index.htm	**M**	**M**	**H**	**H**	7.2

	Initiative	Delivery Agent	Description	Program Type	Jurisdiction	Target Sector	Weblink	City-wide energy conservation impact	Ease of initiative implementation	Actual use of initiative or technology by audience	Ranking	
40	**Better Buildings New Construction Program**	The City of Toronto Eleanor McAteer Senior Engineer T (416) 392-1453	Through energy management and monitoring, and training/technical assistance, the BBNC promotes higher energy efficiency in the construction of new buildings in the industrial/commercial/institutional (ICI) and multi-residential sectors. The Better Buildings New Construction Program builds on the features of the federal incentive program for higher energy efficiency standards in new construction provided through Natural Resources Canada's Office of Energy Efficiency. Promotes Geothermal Passive Solar.	**Energy Management/ Monitoring, Technical Training/ Assistance**	**Municipal**	**Multi-Residential, Industrial, Commercial, and Institutional**	www.city.toronto.on.ca/bbp	**L**	**M**	**L**	**M-**	3.6
41	**Better Buildings Partnership**	The City of Toronto Energy Efficiency Office T (416) 392-1454 With: Enbridge Gas Distribution, Toronto Atmospheric Fund, Toronto Hydro, and various Energy Management Firms.	A public-private partnership that promotes and implements building renewal and energy-efficiency retrofits of industrial, commercial, institutional and multi-residential buildings through energy management and monitoring, financial incentive or tax measures, and training/technical assistance.	**Energy Management/ Monitoring, Incentive, Technical Training/ Assistance**	**Municipal**	**Multi-Residential, Industrial, Commercial, and Institutional Exiting Buildings**	www.torontobbp.on.ca	**L**	**M**	**L**	**M-**	3.6
42	**WATERSAVER PROGRAMS: Multi-unit Washer Rebate Program**	City of Toronto Toronto Water Water Efficiency Program 1530 Markham Road, 4th Floor Toronto, ON M1B 3G4 T 416 338 0338 F 416 338 0685 http://www.toronto.ca/watereff/business_washer/index.htm	Customers can receive up to $125 rebate on the next washer purchase or lease. A water-efficient washer can lower the cost of annual water and energy bills by at least $860 per washing machine. It also helps to reduce water use.	**Incentive**	**Municipal**	**Multi- residential, Industrial, Commercial, and Institutional**		**L**	**M**	**L**	**M-**	3.6
43	**Green Roofs Program**	City of Toronto Green Roofs Metro Hall, 22nd floor 55 John Street Toronto, ON M5V 3C6 E greenroofs@toronto.ca T 416 392 0191 F 416 392 3821	The City of Toronto is one of the first cities in Canada to actively promote green roofs. It offered a short-term pilot program - The Green Roof Incentive Pilot Program – last year. It was developed to support residential, commercial and institutional construction of a variety of types of green roofs (deadline for applications was October 15, 2006).	**Incentive**	**Municipal**	**Multi-Residential, Commercial, and Institutional DISCONTINUED ?**	http://www.toronto.ca/greenroofs/index.htm	**L**	**M**	**M**	**M**	4.8
44	**The Employee Energy Efficiency at Work Program (E3@work)**	City of Toronto Energy Efficiency Office T 416 392 1454	The Employee Energy Efficiency at Work (E3@Work) Program originated as a City of Toronto corporate energy savings initiative designed to promote in-house energy efficiency practices by managing office equipment power loads to reduce electricity costs and carbon dioxide emissions by encouraging employees to turn off computer monitors, task lights, printers and copiers at nights and on weekends. It is currently adopted by the City of Toronto and Toronto Hydro-Electric Systems Corporation and is available to other City ABC's and the private sector.	**Education**	**Municipal**	**Commercial, Institutional**	www.torontobbp.on.ca	**M**	**H**	**H**	**H**	7.8
45	**Lights Out Toronto**	City of Toronto Metro Hall, 2nd floor 55 John Street Toronto, ON M5V 3C6 T 416 392 1501 F 416 392 1456	Although this was not developed as an energy efficiency program, but as an educational program to save birds, it has major energy reduction benefits.	**Education**	**Municipal**	**Commercial, Institutional**	http://www.toronto.ca/lightsout/	**L**	**M**	**L**	**M-**	3.6

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46	**Green power, renewable/ clean energy development**	City of Toronto Office of Energy Efficiency Metro Hall, 2nd floor 55 John Street Toronto, ON M5V 3C6 T 416 392 1110 F 416 392 1456 E eeo@toronto.ca	The Energy Efficiency Office provides technical, policy and administrative expertise towards the City's goals of using a 25% green energy supply. The EEO provides project reviews and assessments of green energy and electricity projects. Proposals under consideration are vetted against technological and financial feasibility. Some project examples include a solar residential domestic hot water, biogas green energy recovery with the City of Toronto at landfill sites and treatment plants and the Fuel Cell Demonstration Project at Exhibition Place.	**Alternative Energy -- Technical Assistance, Financial Partnership**	**Municipal**	**Residential, Internal, Industrial, Commercial, and Institutional**	http://www.toronto.ca/energy/green.htm	**L**	**M**	**M**	**M**	4.8
47	**Deep Lake Water Cooling**	City of Toronto and Enwave Energy Corporation 181 University Ave. Suite 1710, P.O. Box 105 Toronto, Ontario M5H 3M7 T 416 392 6838 F 416 363 6052 E Info@enwave.com	This system uses the cool energy in cold water to air-condition high-rise buildings in downtown Toronto. The system benefits the City by reducing energy consumption by up to 90 per cent (compared to conventional chillers), reducing carbon dioxide emissions, improving the water supply by using new intake pipes that are deeper, and investing in a corporation in which the City is a shareholder. There are 46 buildings signed on to the project, and 27 already connected.	**Alternative Energy**	**Municipal**	**Industrial, Commercial, and Institutional**	http://www.enwave.com/enwave/	**H**	**H**	**H**	**H+**	9.0
48	**GTA Hydrogen Village**	City of Toronto Office of Enegy Efficiency Metro Hall, 2nd floor 55 John Street Toronto, ON M5V 3C6 T 416 392 1110 F 416 392 1456 E eeo@toronto.ca	The GTA Hydrogen Village is the first of its kind in Canada. It was designed to help bolster the commercialization of hydrogen and fuel cell technologies and is a 5 year project that demonstrates various hydrogen production and delivery technologies. The GTA H2V has over 40 members.	**Education**	**Municipal**	**Hydrogen & Fuel Cell Technologies**	http://www.toronto.ca/energy/green.htm	**L**	**M**	**L**	**M-**	3.6
49	**Energy Retrofit Program**	City of Toronto Energy & Waste Management Office Metro Hall, 2nd floor 55 John Street Toronto, ON M5V 3C6 T 416 392 1110 F 416 392 1456	An Energy Retrofit Strategy for City owned Facilities which includes a direction to sole-source 30 to 40 percent of this work to Toronto Hydro Energy Services Inc. Low-interest loans are used to fund the projects, which are repaid with energy savings, using a maximum eight year simple payback period.	**Incentive**	**Municipal**	**City owned community centres, fire halls, arenas, etc.**	http://www.toronto.ca/environment/initiatives/energy_retrofits.htm	**M**	**H**	**M**	**H-**	6.6
50	**Green Tbiz**	Toronto Association of Business Improvement Areas (TABIA) 2257 Bloor Street West Toronto, ON M6S 1N8 T 416 889 4111 E info@toronto-bia.com	Member education/awareness, profile enhancing program. Green T Biz offers a variety of assistance and advisory services encouraging members to undertake EE retrofits. LED pedestrian lighting and PV solar panels have been used in pedestrian and decorative lighting applications. Gree Tbiz also assisted Toronto Hydro in the "Cavalcade of Lights" decorative light exchange program.	**Education, Incentive**	**Municipal**	**Commercial**	www.toronto-bia.com	**L**	**M**	**M**	**M**	4.8
51	**20/20 The Way to Clean Air**	Toronto Public Health (Jill McDowell, Health Promotion Consultant, Environmental Protection Office, Toronto Public Health, Tel: 416-392-4882, Fax: 416-392-7418, jmcdowe@toronto.ca). In collaboration with GTA health units and the Clean Air Partnership	20/20 The Way to Clean Air is a social marketing campaign launched in June 2002 by Toronto Public Health and GTA health units with the aim of engaging residents in actions to reduce smog and lessen climate change. The campaign provides residents with tools to help them reduce home energy use and vehicle use by 20%; this includes a 20/20 Planner, information hot line, prizes and links to incentives, and a 20/20 Connector to other programs & services that can help them achieve their energy reduction goals. It has succeeded in encouraging participants to reach approximately 28% in home energy use reductions and 18% reductions in vehicle kilometers travelled.	**Public Education/Outreach**	**Municipal**	**Residential**	http://www.toronto.ca/health/2020	**L**	**M**	**M**	**M**	4.8
52	**LED Retrofit for Traffic Lights**	Toronto Hydro 14 Carlton Street Toronto, Ontario M5B 1K5 T 416 542 3100 in partnership with the City of Toronto.	This initiative involves replacing traffic signals at intersections to the more energy efficient LED technology.	**Incentive**	**Municipal/Toronto Hydro**	**Municipalities**	www.torontohydro.com	**H**	**H**	**H**	**H+**	9.0

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53	**Smart Meters**	Toronto Hydro 14 Carlton Street Toronto, Ontario M5B 1K5 T 416 542 3100	A pilot program for residential SMART meters will enable the assessment of metering, communications, settlement, load control and other technologies for future applications.	**Education, Incentive**	**n/a**	**Residential and Small Commercial (<50KW)**	www.torontohydro.com	**L**	**M**	**L**	**M-**	3.6
54	**Residential /commercial 10/10 Program**	Toronto Hydro 14 Carlton Street Toronto, Ontario M5B 1K5 T 416 542 3100	This program provides a 10% rate reduction incentive to any customer that decreases there average summer load by 10% over the previous year's use.	**Peak and energy reduction Incentive Program**	**n/a**	**Residential and Small Commercial (<50KW)**	www.torontohydro.com	**H**	**H**	**H**	**H+**	9.0
55	**Festival Light Exchanges**	Toronto Hydro 14 Carlton Street Toronto, Ontario M5B 1K5 T 416 542 3100	Customers returned old inefficient Christmas lights in exchange for strings of high efficiency LED lights.	**Exchange**	**n/a**	**Residential and Small Commercial (<50KW)**	www.torontohydro.com	**M**	**H**	**M**	**H-**	6.6
56	**Keep Cool**	Toronto Hydro 14 Carlton Street Toronto, Ontario M5B 1K5 T 416 542 3100 and The Clean Air Foundation 201-1216 Yonge St. Toronto, ON M4T 1W1 T 416 922 9038 ext. 242 F 416 922 1028	A retail exchange program run by the Clean Air Foundation and funded by Toronto Hydro, Keep Cool invites customers to drop off their old RACs at participating stores in exchange for a $25 gift card to The Home Depot in return.	**Retail Incentive**	**n/a**	**Residential, Small Commercial**	www.torontohydro.com	**M**	**H**	**M**	**H-**	6.6
57	**Peaksaver ac**	Toronto Hydro 14 Carlton Street Toronto, Ontario M5B 1K5 T 416 542 3100	Designed to help reduce the demands on the electricity system, a switch can be installed on residential and commercial central air conditioners. During peak times, Toronto Hydro will send a signal to cycle the system off and on to reduce the amount of electricity needed by the province. In addition to energy savings, a $25 sign-up incentive is being offered.	**Incentive**	**n/a**	**Residential and Small Commercial (<50KW)**	https://www.torontohydro.com/electricsystem/powerwise/peaksaver/residential/registration/index.cfm	**L**	**H**	**M**	**M+**	5.4
58	**Load Displacement Program**	Toronto Hydro 14 Carlton Street Toronto, Ontario M5B 1K5 T 416 542 3100	Load displacement technologies provide increased efficiency, when employed with an existing or new district heating distribution system this technology facilitates the development of sustainable energy networks. Technologies such as micro-turbines, wind, biomass fuels and solar provide further options to meet energy needs. Financial incentives will be considered based on the project's viability.	**Incentive**	**n/a**	**Residential, Commercial, Industrial, and Institutional**	www.torontohydro.com	**M**	**M**	**M**	**M+**	6.0
59	**Fall Bright Ideas**	Toronto Hydro 14 Carlton Street Toronto, Ontario M5B 1K5 T (416) 542.3100	This is an exchange program that invites customers to return inefficient and potentially unsafe halogen floor lamps and old inefficien seasonal lights for recycling over one weekend. In exchange, customers receive a $30 rebate on CFLs and a $5 coupon towards seasonal LED lights.	**Incentive**	**n/a**	**Residential and Small Commercial (<50KW) DISCONTINUED ?**	http://www.torontohydro.com/electricsystem/powerwise/conservation_programs/index.cfm	**M**	**H**	**M**	**H-**	6.6
60	**Fridge Bounty**	Toronto Hydro 14 Carlton Street Toronto, Ontario M5B 1K5 T (416) 542.3100 www.torontohydro.com Ontario Power Authority, Conservation Bureau 120 Adelaide Street West Suite 1600 Toronto, Ontario M5H 1T1 T (416) 967-7474 F (416) 967-1947	Secondary refrigerators were removed from service in the joint Toronto Hydro/Conservation Bureau pilot Fridge Bounty program. HRAI Contractors were engaged to pick up the retired refrigerators, remove the gas, and prepare the refrigerators for recycling.	**Incentive**	**n/a**	**Residential and Small Commercial (<50KW) PILOT**	http://www.conservationbureau.on.ca/Page.asp?PageID=122&ContentID=1688	**L**	**H**	**M**	**M+**	5.4

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61	**Cool Shops**	Toronto Hydro 14 Carlton Street Toronto, Ontario M5B 1K5 T (416) 542.3100 and Clean Air Foundation 201-1216 Yonge St. Toronto, ON M4T 1W1 T 416 922 9038 ext. 242 F 416 922 1028	Public education/awareness program targeting street-facing retailers in neighbourhoods across Ontario. The purpose of the program is to identify and implement in-store energy management measures that encourage the small-business commercial sector to save on utility costs and reduce energy consumption. This program has been completed.	**Education, Incentive, Energy Audit**	**n/a**	**Small Commercial**	www.torontohydro.com	**M**	**M**	**M**	**M+**	6.0
62	**Tankless Water Heater Program**	Enbridge Gas Distribution Toll Free 866 844 9994 F 416 495 8350 E energyservices@enbridge.com With funding from Natural Resources Canada OEE.	Enbridge and NRCan, in cooperation with 5 participating manufacturers are providing incentive rebates of up to $450 for the installation of energy efficient natural gas tankless water heaters to restaurant and other small commercial customers between August 1, 2006 and March 31, 2007.	**Incentive**	**n/a**	**Hospitality, Small Commercial**	www.enbridge.com/business	**L**	**M**	**L**	**M-**	3.6
63	**Design Assistance Program**	Enbridge Gas Distribution Toll Free 866 844 9994 F 416 495 8350 E energyservices@enbridge.com And DAP advisor – a list of pre-approved engineering firms.	The program offers a fixed incentive of $4,000 for design activities aimed at improving a building's energy and environmental performance – whether it is a new building, an addition to an existing building or a major renovation. Customers are recommended to consult with a preapproved DAP advisor – a list of engineering firms is available on the Enbridge website.	**Incentive, Technical Assistance**	**n/a**	**Commercial, Industrial**	www.enbridge.com/business	**L**	**H**	**M**	**M+**	5.4
64	**Monitoring & Targeting**	Enbridge Gas Distribution Toll Free 866 844 9994 F 416 495 8350 E energyservices@enbridge.com	Enbridge works with commercial and industrial clients to determine if this program will work for them, in which case, it assists them in contacting an experienced energy management firm and provides incentives of up to a) half the cost of an energy analysis (up to $5,000), and b) a rate of $0.05/m3 saved based on 12 months of operational improvements (up to $30,000)	**Technical Assistance, Incentive**	**n/a**	**Commercial, Industrial**	www.enbridge.com/business	**L**	**H**	**L**	**M**	4.2
65	**Steam Saver Program**	Enbridge Gas Distribution Robert Griffin Energy Solutions Manager T 416 495 5298	The Steam Saver program is actually several programs put together, each focusing on different ways to save steam energy. The programs are: The Steam Plant Performance Test and Audit; New Boiler Installations; The Steam Trap Survey; The Boiler Combustion Tune–Up Program; and, Metering and Energy Management in Boiler Plants. Basically, All steam traps are tested, and their individual status and defects are logged. Customers are provided with a report outlining the defects and estimated energy savings associated with repairing or replacing the defective traps.	**Education, Incentive, Technical, Assistance**	**n/a**	**Industrial, Commercial, Institutional, Agriculture**	https://portal-plumprod.cgc.enbridge.com/portal/server.pt?space=communitypage&cached=true&parentname=communitypage&parentid=4&in_hi_userid=2&control=setcommunity&communityid=364&pageid=0	**H**	**H**	**H**	**H+**	9.0
66	**Higher Efficiency Boiler Program**	Enbridge Gas Distribution Adrian St Kitts Program Manager (416) 495-5263 And Robert Griffin Energy Solutions Manager (416) 495-5298	This program is designed to promote the upgrade to higher efficiency heating and domestic hot water boilers. In addition to incentives of up to $30,000, the program delivers Awareness/Information, Energy Management and Monitoring, Research and Development, and Training/Technical Assistance. Upgrades to High Efficiency Boilers must be 84%+ combustion efficiency and condensing boilers must be 90%+ combustion efficiency.	**Education, Incentive, Energy Management, R&D, and Technical Assistance**	**n/a**	**Industrial, Commercial, Institutional, and Agriculture**	www.enbridge.com	**L**	**H**	**M**	**M+**	5.4

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67	**HVAC Program**	Enbridge Gas Distribution Robert Griffin Energy Solutions Manager (416) 495-5298	An awareness/information program with financial incentives program which provides for inspection of medium and large steam plants' components such as piping and fittings. A report provides details of estimated annual energy and heat loss and the costs to insulate the where needed to reduce the heat loss and save on operating costs.	**Education, Incentive**	**n/a**	**Industrial, Commercial, Institutional, and Agriculture**	www.enbridge.com	**M**	**H**	**M**	**H-**	6.6
68	**Pre-Rinse Spray Valve Program**	Enbridge Gas Distribution Walter Matias Manager, Residential Programs T 416 496 7157	Reduce natural gas fired hot water consumption through the installation of low flow, high density Pre-Rinse Spray valves to commercial kitchens at no cost.	**Education, Incentive**	**n/a**	**Commercial, Institutional,**	https://portal-plumprod.cgc.enbridge.com/portal/server.pt?space=CommunityPage&cached=true&parentname=CommunityPage&parentid=0&in_hi_userid=2&control=SetCommunity&CommunityID=357&PageID=0	**L**	**M**	**L**	**M-**	3.6
69	**Industrial HVAC Audit Program**	Enbridge Gas Distribution Harold Hayashi Program Manager, Business Markets T 416 495 5796	The Industrial HVAC Program is in the process of being redeveloped, but its main function is to help offset Enbridge's customer's cost in obtaining a detailed cost/benefit analysis on energy retrofit opportunities. Enbridge offers incentives totaling half of the cost of an HVAC Audit up to $5,000. Natural Gas energy saving measures that are installed as a result of the audit may also be eligible for a 5¢ per cubic metre incentive.	**Education, Incentive, Technical Assistance**	**n/a**	**Industrial**	www.egd.enbridge.com/B/B18-02-02_hvac.asp	**M**	**H**	**M**	**H-**	6.6
70	**Industrial Steam Saver Program**	Enbridge Gas Distribution T 416 495 5796	This program encourages energy savings through steam plant tests and audits, steam trap surveys, insulation surveys, and implementation of energy-efficient measures. Incentives are provided for the audits and surveys and for assistance to implement energy-efficient measures.	**Energy Management and Monitoring Incentive**	**n/a**	**Industrial, Manufacturing, Mining, Petroleum, Petrochemicals**	https://portal-plumprod.cgc.enbridge.com/portal/server.pt?space=CommunityPage&cached=true&parentname=CommunityPage&parentid=0&in_hi_userid=2&control=SetCommunity&CommunityID=364&PageID=0	**H**	**H**	**H**	**H+**	9.0
71	**Envision**	Ontario Power Generation 700 University Avenue Toronto, Ontario Canada, M5G 1X6 T 416 592 2555	Through the application of EnVision, OPG's energy efficiency software, large industrial customers can reduce their internal energy consumption. It allows companies to join together and compare themselves to find how they can buy energy and use utilities more efficiently. The software accurately calculates utility costs per item or unit of production. Production line efficiencies can be compared by location, time of day, utility type and more.	**Education, Energy Management and Monitoring**	**n/a**	**Industrial, Manufacturing, Mining, Petroleum/ petrochemicals**	www.envision.opg.com	**L**	**M**	**M**	**M**	4.8
72	**Commercial Audit Incentives**	Enbridge Gas Distribution Toll Free 866 844 9994 F 416 495 8350 E energyservices@enbridge.com	Designed to help offset costs in obtaining detailed cost/ benefit analysis in those buildings which have the greatest potential for savings. The Audit provides incentives for applicants whose audit scope is pre-approved by Enbridge and meets its material requirements of Enbridge's Report Outline. Audits focus on HVAC, Control, Energy Consumption and Energy Intensity, Energy and Water Savings, Fuel Conversion, To be eligible for the incentive, the report must materially meet the requirements of Enbridge's "HVAC Building Energy Audit Report Outline".	**Audit/ Incentive**	**n/a**	**Multi-Residential, Commercial (For multi-residential, a minimum of 25% of the savings identified must be implemented to receive the incentive).**	www.enbridge.com/business	**M**	**H**	**M**	**H-**	6.6

	Initiative	Delivery Agent	Description	Program Type	Jurisdiction	Target Sector	Weblink	City-wide energy conservation impact	Ease of initiative implementation	Actual use of initiative or technology by audience	Ranking	
73	**New Building Construction Program**	Enbridge Gas Distribution Toll Free 866 844 9994 F 416 495 8350 E energyservices@enbridge.com (partial partnership with Toronto Hydro)	The NBCP program is designed to help customers the expense of designing more energy efficient buildings by offering an incentive of $0.075/m³ of projected annual natural gas savings to a maximum of $15,000. Customers are also invited to apply for the Toronto Hydro Incentive, electrical savings of $25 per peak KW of power demand reduced. This incentive is administered by Enbridge Gas Distribution on behalf of Toronto Hydro.	**Incentive, Technical Assistance**	**n/a**	**Multi-residential, Commercial, Institutional**	www.enbridge.com/business	**L**	**M**	**L**	**M-**	3.6
74	**MultiCHOICE Conversion Program**	Enbridge Gas Distribution Adrian St Kitts Program Manager T 416 495-5263 and a qualified Energy Management Firm, either independent or part of the TEAM Energy Network	The purpose of this program is to drive energy and cost saving gas conversion choices in existing multi-residential buildings. The program looks at all fuel conversion opportunities, such as space heating, water heating, make-up air, ramp heating, clothes dryers, ranges, cogeneration and pool and whirlpool heating, as well as water conservation measures.	**Education, Energy Management/Monitoring, Incentive, Technical Assistance**	**n/a**	**Multi-residential, Commercial, and Industrial Existing buildings**	http://www.enbridge.com	**M**	**M**	**M**	**M+**	6.0
75	**New Building Construction Program (NBC)**	Enbridge Gas Distribution Michelle Parker Program Manager T 416 495-5697	Enbridge Gas Distribution's New Building Construction program (NBC) helps offset the costs of designing more energy-efficient buildings for commercial, institutional or multi-family use through incentives of $0.075/m³ of annual projected natural gas savings up to $15,000.	**Incentive**	**n/a**	**Multi-residential Commercial, Institutional, New buildings**	www.egd.enbridge.com/B/B05-11_building_design.asp	**L**	**M**	**M**	**M**	4.8
76	**Peaksaver ad**	Toronto Hydro 14 Carlton Street Toronto, Ontario M5B 1K5 T (416) 542.3100	Distributed energy is energy that you generate at your business site to reduce your energy demands on the electricity grid. It's an important part of the conservation and demand management that is needed to ensure a reliable energy supply in Ontario for the future. Distributed energy can strengthen your back-up power plans and provide you with energy cost savings. To encourage distributed energy initiatives, Toronto Hydro-Electric System has up to $10-million in incentives available for projects started before 2007	**Incentive**	**n/a**	**Industrial, commercial**	http://www.torontohydro.com/electricsystem/business/distributed_energy/index.cfm	**L**	**M**	**L**	**M-**	3.6
77	**Equipment Conversion**	Enbridge Gas Distribution Toll Free 866 844 9994 F 416 495 8350 E energyservices@enbridge.com	One-time incentives are calculated on the basis of the annual projected cubic meter volume of natural gas added to the address at the rate of $0.05/m³ up to $30,000 per address Higher efficiency equipment and systems conversions will qualify for the higher efficiency incentive (Enbridge pre-approval required). Additionally, $100 incentive per gas dryer conversion is available.	**Incentive**	**n/a**	**Multi-Residential**	www.enbridge.com/business	**M**	**H**	**H**	**H**	7.8
78	**Water Conservation Program**	Enbridge Gas Distribution Maria Mascall Program Analyst T 416 495 5273	Enbridge provides showerheads and faucet aerators for qualifying Multi-Residential buildings with the objective of generating water and gas savings in existing residential and multi-residential buildings.	**Education, Incentive**	**n/a**	**Multi-residential, Single-Attached Homes, Existing buildings**	http://www.enbridge.com	**H**	**H**	**H**	**H+**	9.0
79	**Residential Efficient Space Heating (R-4)**	Enbridge Gas Distribution Energy Efficiency Programs T 416 495 5356	The purpose of this program is to increase the installation of high-efficiency heating systems through customer education/ information programs and financial incentives to both the customer and HVAC contractors, to overcome existing market barriers.	**Incentive**	**n/a**	**Residential**	http://www.egd.enbridge.com	**H**	**H**	**H**	**H+**	9.0
80	**Residential Efficient Water Heating - Conservation Retrofits (R-3)**	Enbridge Gas Distribution Energy Efficiency Programs T 416 495 5356	This program is designed to reduce water heating gas consumption by installing low-flow water conservation devices in the home. Low-flow devices include showerheads, faucet aerators and water heater pipe wrap. Taps Partner Contractors deliver this program.	**Education**	**n/a**	**Residential**	http://www.egd.enbridge.com	**H**	**H**	**H**	**H+**	9.0
81	**Residential Programmable Thermostat**	Enbridge Gas Distribution Energy Efficiency Programs T 416 495 5356	Customers are offered a rebate for installing programmable thermostats in order to reduce space heating gas consumption and to overcome market barriers.	**Incentive**	**n/a**	**Residential**	http://www.egd.enbridge.com	**H**	**H**	**M**	**H**	7.8

Appendix H: Summary of Sector Templates

This section summarizes the information presented in Section 6 of this report. The information is presented in tables to facilitate the comparison of information within sectors. The following tables are presented:

- **Table 1:** Sector Analysis, which contains information on floorspace, energy intensity and recommended partners.
- **Table 2:** Existing Programs with best correlation, which outlines the programs available in Toronto that have best correlation to the sector.
- **Table 3:** Barriers, which outlines the factors that may hinder the achievement of the desired energy conservation objectives.
- **Table 4:** Options, which outline incentives options to be considered in each sector.
- **Table 5:** Policy Implications, which outlines the policies to be considered in each sector.

Table 1: Sector Analysis

Sector	Floor space percent	Energy Intensity for 2005 ekWh/ft^2/yr	Recommended Partners	Comments
Office	11percent	33.5	▪ BOMA	For information on **existing programs with best correlation, barriers, incentive options** and **policy implications** please see summary table below
Retail	6percent	36.7	▪ BOMA ▪ RCC	
MURB	22percent	25.1	▪ TCHC ▪ ACMO ▪ OLA	
Low-Rise	27percent	19.7	▪ Toronto Hydro ▪ Enbridge ▪ EECN	
Industrial	18percent	26.6	▪ Enbridge	
Schools	3percent	19.0	▪ TDSB ▪ TCDSB	
Colleges & Universities	3percent	26.6	▪ College Energy Secretariat ▪ OAPPA ▪ Directly to Universities	
Healthcare	3percent	31.7	▪ OHA Chapter ▪ CHES	
Municipal	2percent	28.4	▪ n/a	
Other	5percent	19.7	▪ n/a	

The share of floorspace, energy intensity and recommended partners for the principal sectors in the City are summarized in Table 1. The Low-Rise Residential sector has the largest share of floorspace at 27 percent, but the lowest energy intensity. The Multi-Unit Residential sector has a significant share of floorspace, and a higher energy intensity. The Commercial Office and Commercial Retail sectors have a significant amount of the total floorspace, and also a relatively high energy intensity. The Industrial sector has a significant share of floorspace, and a higher energy intensity.

Table 2: Existing programs with best correlation

	Office	Retail	MURB	Low Res	Industrial	Schools	Colleges & Universities	Healthcare	Municipal
BBP- training and technical assistance	✓	✓	✓			✓	✓	✓	✓
BOMA – GoGreen labelling program has an energy component	✓	✓							
City of Toronto – Water saving measures			✓	✓		✓	✓	✓	✓
Enbridge – a complete suite of residential programs targeting both new and existing homes				✓					
Enbridge – Industrial audit and Steam Saver programs, high efficiency boiler incentive					✓				
Enbridge – Design assistance, audit incentive, high efficiency boiler incentive	✓	✓							
Enbridge – Conversion incentive, audit incentive, high efficiency boiler incentive			✓			✓	✓	✓	
Enbridge and City of Toronto new building programs						✓	✓	✓	✓
NRCan – EcoEnergy program up to 25percent of project costs	✓	✓	✓		✓	✓	✓	✓	✓
NRCan's new ecoEnergy program using a home audit and target incentives				✓					
OPA – 150MW program through BOMA with incentives of $ 400 per kW	✓	✓			✓		✓	✓	✓
OPA – 90MW program through City of Toronto			✓	✓		✓			
OPA Standing Offer Program for renewable energy						✓	✓	✓	✓
TABIA – energy efficiency programs for small retailers		✓							
Toronto Hydro – A combination of facilitated OPA programs and its own offerings targeting the residential sector. Notable programs include "Summer Savings," "Peak Saver, "and "Refrigerator Roundup"				✓					

Table 3: Barriers

	Office	Retail	MUR	Low Res	Industrial	Schools	Colleges & Universities	Healthcare	Municipal
Misplaced or split incentives	✓	✓	✓	✓	✓	✓	✓	✓	✓
High information or search costs	✓	✓	✓	✓	✓	✓	✓	✓	✓
Organizational practices or customs	✓	✓	✓						✓
Delivery channels for leverage									✓

Table 4: Options

	Office	Retail	MUR	Low Res	Industrial	Schools	Colleges & Universities	Healthcare	Municipal
Audit incentives using existing programs	✓	✓	✓	✓	✓	✓	✓	✓	✓
Implementation using existing incentives	✓	✓	✓	✓	✓		✓	✓	✓
New conservation fund loan option	✓	✓	✓	✓			✓	✓	✓
New metering program	✓	✓	✓	✓					
New website applications for sector	✓	✓	✓	✓	✓				
New website application for energy management							✓	✓	✓
New website application for energy learning						✓			
Modified BBP training and support for O&M personnel	✓	✓	✓						
New workshop for O&M personnel						✓	✓	✓	✓
New workshop for property managers and owners			✓						

Table 5: Policy Implications

Sector	Policy Implication
Office	The policy implications for the Office building sector involve the issues of net leases and tenant metering. Many landlords in this sector have already developed leases that address the net lease barrier. The lease language provides for the ability of the landlord to expense investments in energy efficiency provided they are in the tenants interest. The conservation fund option of a loan may allow the investments to be expensed within the energy account (subject to an accounting opinion). The City of Toronto could consider a by-law relating to office lease structure. The by-law could dictate the treatment of energy efficiency investment in buildings to avoid the net lease barriers. The City could investigate the legal aspects of a by-law that would require sub-metering of office tenants. Alternately, if a by-law is not possible, the City could work with BOMA to encourage sub-metering of tenants behind the main electrical meter. Sub-metering can benefit building owners by reducing common area costs and eliminating any disputes about energy allocations. The main issues will be the structuring of tenant meters. Toronto Hydro could provide the revenue metering but the costs are likely to be high and the implementation timeframe long (5 years). The most likely option will be to leave the bulk meter in place and provide sub-metering certified by Measurement Canada.
Retail	The policy implications for the Retail sector involve the issue of implementing interval metering. Most retail stores already have individual meters as bulk metering is being phased out, which will assist in moving the sector to the next level, interval meters.
MURB	The policy implications for the Multi-Unit Residential sector involve the issues of smart metering and condominium by-laws dealing with large energy retrofits. The City of Toronto is not involved directly in the Ontario legislation from the Ministry of Energy or the Ministry of Municipal Affairs and Housing. Legislative issues should be resolved in 2007 before the provincial election. The condominium by-law issue will require more review with the sector partner. ACMO can provide guidance on possible policy options in Toronto
Low-Rise	The policy implication for the Low Residential sector relate to the difficulty of obtaining building permits for renewable installations such as PV systems in building roofs.
Industrial	The policy implications for the Industrial sector are limited to the application of renewable technologies to existing industrial buildings.
Schools	The policy issues for the Schools sector relate directly to the Ministry of Education funding formulae. Technically, school boards are accountable for the school buildings. Accountability implies both responsibility and authority. The board is responsible but lacks any authority over the funding formulae. The school board can use the capital forecast and the energy plan to optimize capital spending on school facilities. Energy savings and operating cost savings can be capitalized to provide additional spending for school building renewal. The Ministry of Education must bear the

Sector	Policy Implication
	ultimate responsibility for building depreciation, if the capital funding formulae provides too little funding. There are no known City of Toronto policy impediments to energy efficiency projects in schools.
Colleges & Universities	The policy issues for the Colleges and Universities sector relate to the capital funding issues for an aging building infrastructure. The lack of sufficient capital funds has led to deferral of capital projects for building renewal. There are no known City of Toronto policy impediments to energy efficiency projects in Colleges and Universities.
Healthcare	The policy issues for the Healthcare sector relate directly to the Ministry of Health funding formulae. Technically, the Hospital Board is accountable for the hospital buildings. Accountability implies both responsibility and authority. The Hospital Board is responsible but the Board lacks any authority over the funding formulae. Hospitals have turned to local community fundraising to address budget issues and new building requirements. There are no known City of Toronto policy impediments to energy efficiency projects in hospitals.
Municipal	The policy implications for the City will involve new building guidelines, use of renewable technologies in existing buildings, and the development of best practices in the integration of energy management with asset management.

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