

# Energy for Megacities

## Toronto and the Greater Golden Horseshoe DRAFT 4

Energy Council of Canada



## **Energy for Megacities: Toronto and the Greater Golden Horseshoe**

### **Introduction**

Greater Toronto is the fifth largest metropolitan area by population in North America, after New York, Mexico City, Los Angeles and Chicago, and one of the fastest growing large urban areas on the continent, trailing only Calgary and Dallas. Canada's relatively open immigration policy and the ability of the city to attract immigrants has made Toronto one of the most diverse cities in the world. Nearly half of Greater Toronto's population was born outside Canada, a higher proportion than other cosmopolitan centres such as New York, London and Vancouver.

Toronto has been reasonably successful at maintaining its quality of life in the face of continuing growth. The city was recently ranked by the Economist Intelligence Unit as the fourth most livable city in the world out of 140, following Vancouver, Vienna and Melbourne, based on five criteria: stability, health care, culture and environment, education and infrastructure.

Nevertheless, challenges remain. Traffic congestion has worsened and Toronto now rivals Los Angeles as the most congested city in North America. Strong measures have been required to keep urban development from encroaching on prime agricultural land or valuable natural terrain. Air pollution remains a concern. Many of the city's commercial and residential buildings use far too much energy. Productivity growth has been anemic and poverty remains too prevalent. Coordination among governments, both among neighbouring municipalities and between federal, provincial and municipal governments is often less effective than it could be.

These issues are well understood by business and civic leaders, and a wide range of initiatives is underway to address them. This report will examine the Toronto Region's patterns of energy production and use and the range of policies and programs being employed to improve the region's sustainability. Lastly, this report will identify

gaps that need to be filled if Toronto is to achieve its stated goal of becoming “the greenest city region in North America”.

## **I. The Data**

### Demographics

The City of Toronto, with a population of 2.7 million, is surrounded by four regions: Durham, York, Peel and Halton, with a total population of 3.6 million. Together, these 5 municipalities make up the Greater Toronto Area (pop. 6.3 million). The GTA in turn is part of a larger region known as the Golden Horseshoe, which encompasses the GTA plus the City of Hamilton and the Niagara region. The Golden Horseshoe has a population of 7.3 million. Increasingly, planners must also take account of an outer ring of 14 cities and municipalities. With these, the so-called Greater Golden Horseshoe (GGH) has a total population of about 9 million people. This represents about 70% of Ontario's population and 30% of Canada's population. The City of Toronto has a land area of 630 square kilometers and the GTA is 5904 square kilometers. The Greater Golden Horseshoe covers 33,500 square kilometers.

**Figure 1: Toronto and the Greater Golden Horseshoe**



Source: Places to Grow: the Greater Golden Horseshoe Growth Plan

Between the 2001 and 2006 censuses, the Greater Toronto Area grew by nearly 600,000, or 9.3%, with almost all of that growth concentrated in the four outer regions of the Area. The City of Toronto's population grew by only about 30,000 over the same

period. Immigration accounted for 2/3 of GTA population growth, with China and south Asia providing the largest shares of immigrants.

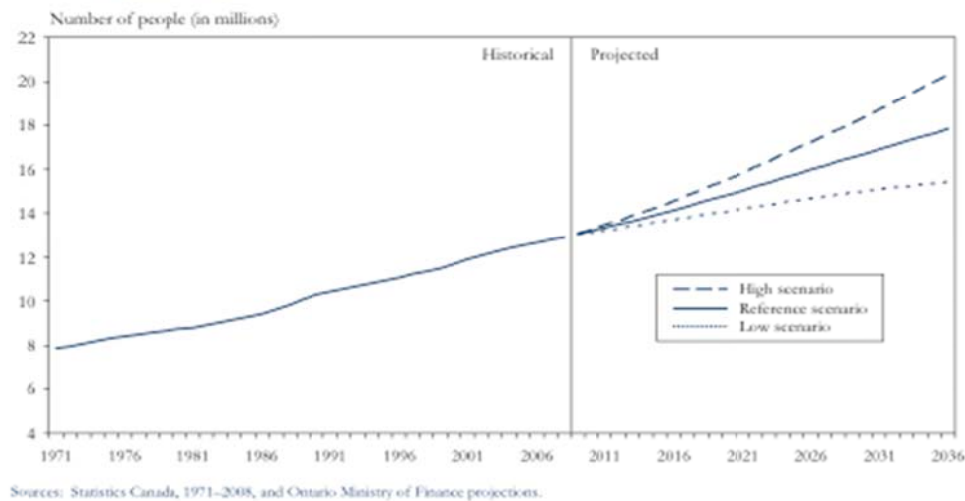
The Greater Golden Horseshoe is expected to continue to grow, reaching 11.5 million by 2031, driven primarily by immigration. Canada's immigration target is equal to about 0.75% of the country's population: providing a quarter million new residents per year. Roughly half of immigrants to Canada settle in the Greater Toronto Area, a pattern that is expected to continue. Visible minorities now account for 43% of the GTA's population. Appendix 1 provides official population and employment growth forecasts to 2031 for each of the regions within the Greater Golden Horseshoe.

Fertility rates are expected to rise slightly, but to remain below the 2.1 children per female replacement level. Demographers expect that, after declining steadily over the past thirty years, younger women's fertility rate will stabilize near current, historically low, levels, while older women's fertility rate continues to increase.

The median population projection is based upon continuation of current immigration trends and this slight gain in fertility rates. It predicts an Ontario population of nearly 18 million by 2036. With stronger immigration and a recovery in fertility, provincial population could reach 20 million (high scenario). With reduced immigration and further declines in fertility, population would reach only 15.5 million (low scenario).

**Figure 2: Ontario Population Projections**

Ontario population, 1971 to 2036



Over the period to 2036, the population over 65 years old is expected to double, growing nearly three times as fast as the overall population. Life expectancy is expected to increase over that period to 85 years for men and 89 years for women, from 79 and 83 years now, respectively.

Housing patterns are also evolving. Condominium ownership increased by 33% between 2001 and 2006 and has accelerated since then. In the City of Toronto, condominiums account for 75% of the homes built since 2000. The number of multifamily households in Ontario is also rising rapidly ---with a three-fold increase over that period to 326,000.

### Energy Affordability

For low-income individuals, the cost of energy, and recent increases in those costs, can be a serious financial burden. Data from the 2006 Census shows that about 25% of families in Ontario have incomes of less than C\$20,000. At that income level, the average cost of natural gas and electricity for families that pay their energy costs themselves amounts to about 6% of their income. For families with incomes below C\$10,000, this share can exceed 10% of income.

In recognition that rising power costs and the hardship associated with disconnection from energy sources can produce, the Ontario

Energy Board launched a consultation on low-income energy issues in 2008.

That consultation focused on three areas:

- Temporary emergency financial assistance for low-income energy consumers in need;
- Access to more flexible customer rules on matters such as billing, bill payment, disconnections, security deposits and arrears management; and,
- Targeted electricity conservation and demand management and natural gas demand side management.

As a result of these consultations, a Low-Income Energy Assistance Program (LEAP) was developed. It includes:

- Emergency assistance to low-income consumers, to be funded through a 0.12% levy on distribution revenue, delivered through a partnership of social agencies and utilities;
- Rules designed to reduce the incidence of disconnection and to minimize the impact of security deposits on low-income consumers;
- Utility funded energy retrofits to reduce consumption of natural gas and electricity by low-income families. With customers consent, utilities will be expected to purchase and install basic energy efficiency measures (e.g. low-flow showerheads, faucet aerators, pipe wrap, programmable thermostats) in low-income households and to undertake energy audits to determine cost-efficient “extended measures” (e.g. weatherization, high efficiency furnaces, tankless waterheaters). Given the Ontario climate, natural gas utilities will be expected to make weatherization (insulation, caulking, etc) a priority.

For a number of years, most utilities in Ontario have avoided customer disconnections during winter months.

### The Economy

Ontario’s Ministry of Finance projects that Ontario real GDP growth will average 2.6% over the 2010-2030 period. This is less than the 3.2% growth projected globally, but stronger than growth expected in

most other mature economies, many of which are facing flat or shrinking labour forces.

Ontario has been the leading exporter to the United States market, but that pattern is changing as Asian exporters gain a larger share of the U.S. market and Ontario exports to growing Asian markets increase. Ontario's share of total U.S. imports has decreased from 12% in the mid-1990s to 9% in 2008. Exports to other parts of the world have now grown to \$50 billion.

Ontario's economy is increasingly a service economy. Over the period from 1988 to 2009, services' share of Ontario employment grew from 69% to 79%, while manufacturing employment's share has declined from 21% to 13%. Nearly  $\frac{3}{4}$  of Ontario's real GDP is now generated in the service sector, up from  $\frac{2}{3}$  in 1988.

Employment in high skilled occupations is growing at twice the pace of lower skilled jobs. Professional, scientific and technical services are leading job growth, at 4% per year. Areas that have shown particularly strong job growth include: computer software development, business and financial services, entertainment and creative services, and life sciences (pharmaceuticals, medical devices and scientific and laboratory services).

In the manufacturing sector, Ontario remains a leader in auto assembly and parts. GM, Ford, Chrysler, Toyota and Honda all produce vehicles within Ontario's Greater Golden Horseshoe. Fiat and Hyundai are also reportedly considering investment in the province.

Construction and real estate activity in the GTA remains a major source of employment. Construction employment increase 50% between 1996 and 2006 to 85,000. While housing starts have declined from their 2008 peak, construction of condominiums, office buildings and hotels has continued at a torrid pace despite the global financial crisis.

Agriculture employs a relatively small share of the region's workforce, but is an important contributor to the region, particularly in the large Green Belt that surrounds the Greater Toronto Area.



Employment growth over the past decade has been largely concentrated in the regions surrounding the city of Toronto. The growth of multiple employment centres throughout the Region has led to more complex commuting patterns. In 1987, employment in the City of Toronto was double that in the surrounding regions [1.4 million vs 700,000]. By 2007, employment in the suburban regions matched employment in the City of Toronto [1.47m each].

A primary focus going forward is the growth in so-called “Green Economy”, as the role of renewable energy in Ontario grows and the Province’s already strong conservation efforts continue to expand. The Province has estimated that over the next three years, the Ontario economy will generate 50,000 green jobs. Statistics Canada estimates that the environmental technology industry already generates total revenues of \$6.6 billion in Ontario.

#### Urban Structure

Toronto has avoided the extremes of urban sprawl evident in many other North American cities. The urban core also did not experience the decline seen in many American cities. In fact, Toronto has seen a dramatic surge in high-rise condominium construction in recent years. A decade ago, three out of every four new homes in the GTA were low-rise: single-detached, semi-detached or townhomes. In the last three years, high-rise units have accounted for 51% of new home sales. Three-quarters of these sales have been in the City of Toronto.

Urban density in Toronto is substantially higher than that of most North American cities, but lower than most European and Asian centres. The City of Toronto has a density of about 4,000 people per square kilometer. Density in New York and London is just over 10,000 per square kilometer, while a typical US city has a density of about 2,000 people per square kilometer. (e.g. Denver, Source: Jaccard et al, 2009) The density of the Toronto Census Metropolitan Area (roughly equivalent to the GTA) is 866 people per square kilometer, similar to the Vancouver and Montreal CMAs. Other urban CMAs in Canada (Ottawa, Calgary, Winnipeg, Quebec City, Halifax) have densities ranging from 70 to 300 per square km.

42% of the GTA is green space (tree canopy, natural areas and urban parks), ranging from 18% in the City of Toronto to 53% in Durham Region. The Green Belt surrounding Toronto provides 1.8 million acres of protected space.

Commuters in the GTA are less likely than their counterparts in most North American cities to rely on private automobiles for their daily commute. Nevertheless, 68% of commuters still depend on private motorized transport to get to work. That figure pales in comparison to cities like Stockholm and New York City, where only 54% and 34% of commuters, respectively, rely on private transport. Reliance on private cars has increased over the past two decades. Between 1986 and 2006 the proportion of trips taken by private auto increased by 56%, faster than the 45% population growth over the same period. Furthermore, occupancy per car during rush hour in the Greater GTA is 1.15 people. This indicates that the large majority of cars have a single occupant. Private automobiles are a major contributor to urban pollution and green house gas emissions. Personal vehicles account for 21% of carbon dioxide emissions in the GTA.

Where you live affects your travel choices. One-third of downtown Toronto trips are made by public transit, one-third are made by walking or cycling and one-third by private automobile. Outside the City of Toronto, transit use, walking and cycling account for only 7% of trips. Winding streets and widely spaced homes in suburban subdivisions make the provision of efficient and convenient public transit a challenge.

Seven separate local transit agencies serve the Greater Toronto and Hamilton Area. This patchwork system has made travel across municipal boundaries, which accounts for one-quarter of all trips, inconvenient, frustrating, unattractive and costly. In 2006, the Province established Metrolinx and tasked it with coordinating, rationalizing and growing public transit across the region. Metrolinx undertook extensive consultation and, in 2008, announced a 25-year “Big Move” plan to improve transport and transit in the GTHA. The key elements of that plan are reviewed in Section 3 of this report and in Appendix 2.

Road congestion in the GTA exacts major costs on both commuters and the economy. In an economy where just-in-time delivery is essential, delays hurt competitiveness. Metrolinx, the agency charged with rebuilding and modernizing urban transit in the Golden Horseshoe, has estimated that congestion imposes a \$3.3 billion economic burden on commuters and results in \$2.7 billion in lost opportunities for economic expansion each year. A study carried out for Metrolinx estimates that, without action, these costs would grow to \$7.8 billion and \$7.2 billion, respectively, by 2031. Much of Toronto's urban infrastructure dates from the 1950s and 1960s and is expensive to repair and replace. Ontario's Ministry of Finance recently estimated that the Province faces a \$22.4B infrastructure deficit and that, in addition, it needs to spend \$3.7B per year to meet current and future infrastructure needs.

To meet these needs, the government announced in its 2005 Budget a \$30 billion ReNew Ontario program. Fiscal challenges associated with the recent recession could slow the flow of this funding to municipalities in the Greater Golden Horseshoe. A key focus of this renewal is ensuring that development is planned so that underutilized infrastructure currently available is fully utilized and that urban areas are designed to best use new infrastructure. This will require a 40% increase in urban density across the region over the next 20 years. The Province will enforce specific density targets for urban growth centres, ranging from 150 residents and jobs per hectare in some of the downtown areas in outer-tier regions to 400 residents and jobs in the City of Toronto growth centres.

## **2. Energy Profile**

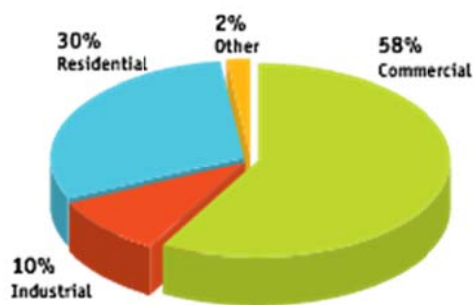
Within the City of Toronto, commercial activity accounts for over half of annual electricity consumption and about 30% of natural gas consumption.

**Figure 3: Electricity and Natural Gas Consumption and GHG Emissions by Sector in the City of Toronto**

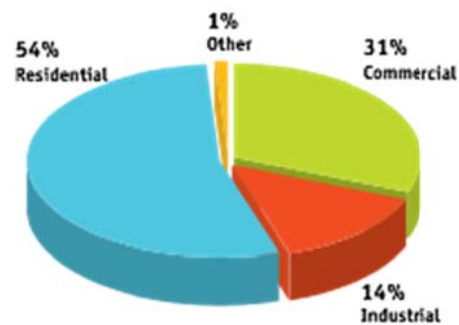
Market Sector	Electricity		Natural Gas		Total GHG Emissions (Mt/yr)
	Consumption (GWh/yr)	GHG Emissions (Mt/yr)	Consumption (Mm <sup>3</sup> /yr)	GHG Emissions (Mt/yr)	
Commercial	14,806	3.61	1,303	2.63	6.24
Industrial	2,553	0.62	589	1.19	1.81
Residential	7,658	1.87	2,270	4.58	6.45
Other	511	0.12	42	0.08	0.21
<b>Total</b>	<b>25,527</b>	<b>6.23</b>	<b>4,205</b>	<b>8.49</b>	<b>14.72</b>

\*GWh = Giga (10<sup>9</sup>) watt-hour    Mt = Mega (10<sup>6</sup>) tonnes    Mm<sup>3</sup> = Million (10<sup>6</sup>) cubic metres

**Figure 2: Electricity Consumption by Sector**



**Figure 3: Natural Gas Consumption by Sector**



Source: City of Toronto, "Live Green: Toronto's Sustainable Energy Strategy", October, 2009

In the Greater Toronto Area in 2005, energy use averaged 151 gigajoules per capita, compared to approximately 95 gigajoules in New York and 79 in London. At the other extreme, per capita energy use in Calgary and Denver was 175-200 gigajoules. (Source: Jaccard et al, p.11)

Energy use in the GTA in 2005 was made up of 200,801 Terrajoules (TJ) of electricity, 327,000 TJ of natural gas, 232,896 TJ of gasoline and 78,000 TJ of diesel fuel, or 24%, 39%, 28% and 9% shares, respectively, for electricity, natural gas, gasoline and diesel fuel. With successful conservation efforts, electricity use was reduced to 177,000 TJ by 2009.

In terawatt-hour (TWh) terms, electricity consumption in the Toronto region in 2009 translates to approximately 50 GWh, or 35% of Ontario demand. Over the 2008-12 period, provincial demand is expected to decline by an average of 1.2% per year, reflecting some of the most aggressive electricity conservation measures in North America and declines in demand by major power users, most notably the iron and steel and forestry industries. Demand peaked in 2006 at just over 27,000 megawatts and has declined from that point.

Ontario's power supply is relatively clean, with non-emitting nuclear and hydroelectric sources providing 79% of the province's power supply. In 2009, coal-fired generation provided 7% of supply, with natural-gas-fired generation providing 10% and wind power accounting for nearly 2%. Installed wind power capacity has tripled to 1200 MW since 2006. With total installed generating capacity of 33,682 MW, Ontario produced 150 TWh of power in total.

**FIGURE 4: ONTARIO ELECTRICITY SUPPLY MIX, 2009**

<b>SOURCE</b>	<b>CAPACITY SHARE</b>	<b>SUPPLY SHARE</b>
Nuclear	32%	55%
Hydroelectric	22%	24%
Coal	18%	7%
Natural gas	24%	10%
Wind	3%	2%
Other	<1%	<1%

Ontario is committed to fully phase out its 6400 MW of coal-fired power generation by the end of 2014. Between 2008 and 2009, coal-fired generation was reduced by more than half. Over two thousand megawatts of coal generation capacity will be removed from the system in 2010.

Most of Ontario's 11,400 MW of nuclear capacity will also have to be either retired or refurbished over the next decade. Over 2000 MW of new gas supply and 1500 MW of refurbished nuclear power are

expected to come into service by 2014. In Ontario, natural gas is used primarily as a peaking fuel, to complement baseload nuclear and hydro power and intermittent renewable power.

The power supply system serving downtown Toronto largely dates from the 1950s and is in need of major refurbishment. While potential conservation measures should largely offset load growth in downtown Toronto over the next decade, major refurbishment of the 115 kilovolt system that serves the central business district of the city will be required, both to maintain service levels and to accommodate increases in distributed generation.

Over the past two decades, there have been a substantial number of low-probability, high-impact outages in major cities, including New York City several times, Chicago, San Francisco, Detroit and Auckland. In an increasing number of jurisdictions, there is a recognition that, given the population density and the concentration of businesses with systems dependent on high quality power in major urban centres, the human and economic impact of outages in those areas is more severe than in other locales. As a result, there is a need for higher reliability standards in those areas.

Toronto has fewer major supply points than other comparable cities in North America. While other cities with similar load profiles have 5-11 supply points, Toronto has only two. The Ontario Power Authority has identified options to address this vulnerability, including distributed generation and a major new transmission connection.

In its Integrated Power System Plan, submitted to the Ontario Energy Board in 2007, the Ontario Power Authority recommended examination of five options to address Downtown Toronto reliability needs: 1) Technical and survey studies to assess the feasibility and cost of large scale application of distributed generation in Downtown Toronto; 2) Exploring the feasibility and cost of work to improve the short-circuit capacity of the city's major transformer stations; 3) Engineering and technical studies to establish the scope and cost of major new transmission line options; 4) Due diligence to study the suitability of Voltage Source Converter high-voltage direct current technology for supply to Downtown Toronto; and 5) The initiation of

necessary Environmental Assessment approvals for the preferred plan. These options are currently being studied.

The modernization of the power system in the Greater Golden Horseshoe will take place within the context of provincial and local “smart grid” initiatives. Ontario’s decision to install smart meters in every home in Ontario by the end of 2010 and to move 3.6 million Ontario consumers to time-of-use power pricing by June 2011 has required the development of the most sophisticated two-way communications infrastructure of any power system in North America, providing Ontario the opportunity to take the lead in developing a truly smart grid. The installation of smart meters is now largely complete and time-of-use metering is being rolled out across the province. In order to chart the path to the development of a comprehensive smart grid, Ontario convened a Smart Grid Forum, which brought together the Independent Electricity System Operator, transmitters, distributors, equipment suppliers, academics and others. The Report of this Forum, issued in 2009, mapped out a range of measures needed to implement a modern grid that will use sensors, monitoring, communications, automation and computers to improve the flexibility, security, reliability and safety of the Ontario electricity system. A number of Ontario initiatives will be enabled by this system, including incentives to reduce peak demand, the ability to manage power consumption with demand management and load control programs and technologies, the coordination of widespread small-scale renewable power generation and the development of the infrastructure needed to efficiently host large numbers of plug-in electric vehicles.

#### Emission Profile

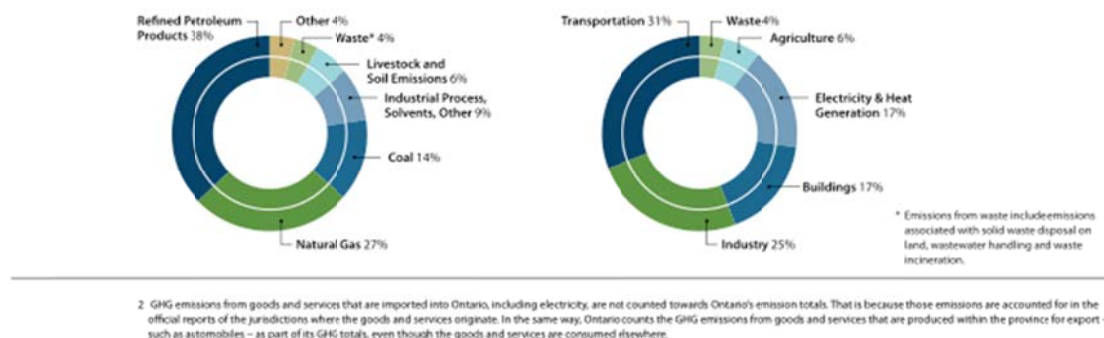
Per capita CO<sub>2</sub> emissions in the City of Toronto were 9.8 tonnes in 2004, compared to 8.0 tonnes in New York and 6.5 tonnes in London. Toronto per capita CO<sub>2</sub> emissions are approximately ½ the Canadian national average. There is a clear correlation between urban density and greenhouse gas emissions. Another key driver of cities’ emissions levels is the generation source of electricity they use. As one would expect, cities such as Geneva, Stockholm, Vancouver and Montreal with low emission power sources, whether nuclear or hydro, generally have lower overall green house gas emissions. Ontario’s

commitment to phase out coal-fired power generation by 2014 will produce a 75% reduction in carbon emissions from Ontario's power system, compared to levels that existed in the 1990s, and make a substantial contribution to lowering emission intensity in the Greater Toronto Area and across the province. (Note: these emissions estimates for cities include emissions produced outside the city if those emissions are associated with electricity used within each city.)

Across the GTA, per capita CO<sub>2</sub> emissions average 11.6 tonnes per capita. Electricity generation accounts for 23% of carbon dioxide emissions; natural gas combustion, primarily for space heating, contributes 31% of total CO<sub>2</sub> emissions; ground transportation accounts for 36%; and waste adds the final 5%. Air travel originating from Toronto generates an estimated 5 million tonnes, mostly outside the GTA.

The Figure below provides a breakdown of emissions by source and sector on a province-wide basis:

**Figure 5: Ontario's 2007 Emissions by Source and Sector**



Source: Ontario Ministry of Environment, Climate Change Action Plan, Annual Report 2008-2009, p. 9

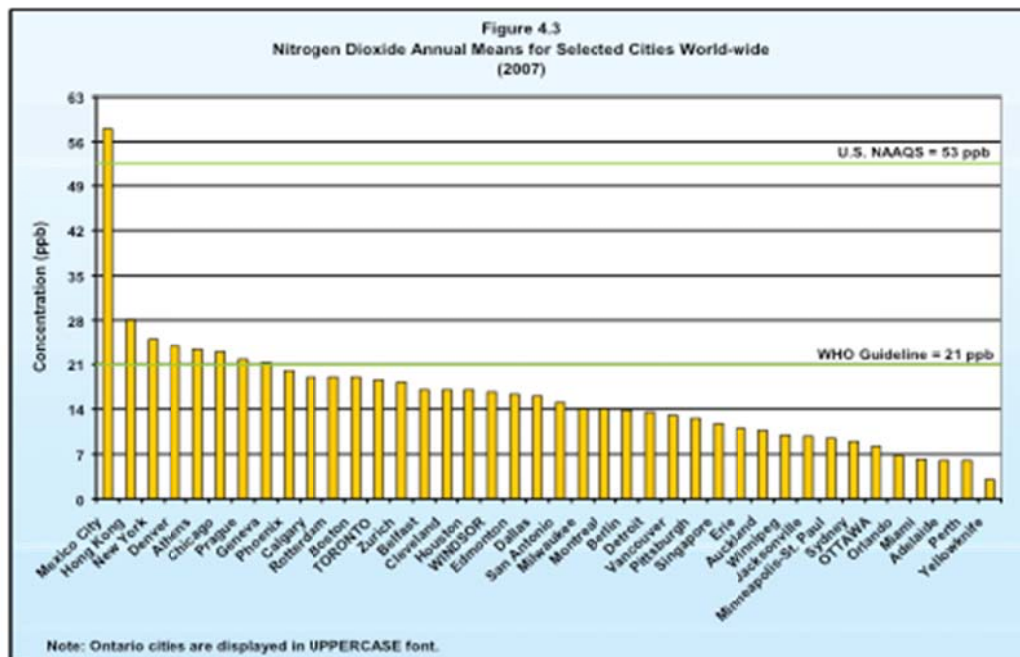
Compared to other major cities, Toronto has relatively cold winters. In terms of heating degree days per year, Toronto's winters are similar to Prague and about 50% colder than London, Geneva and New York. Greenhouse gas emissions associated with space heating track fairly closely with heating needs as measured by heating degree days, although cities that derive a substantial



proportion of their heating from coal or oil fired generation have proportionately higher emissions (e.g. Prague, Geneva, Capetown) and cities that rely on hydropower for space heating have substantially lower emissions (e.g. Montreal). Given the large contribution natural gas-based heating of commercial and residential space makes to overall emissions in Toronto and the Greater Golden Horseshoe, efforts to improve the energy efficiency of building envelopes is a key focus for GHG reduction in Toronto and the surrounding area. Measures to address this issue are described in more detail in Section 3.

Nitrogen dioxide emissions in the GTA in 2005 were 105,000 tonnes. Transportation accounts for 58% of NO<sub>x</sub> emissions, with commercial transportation accounting for the majority of these emissions [55%]. Electricity generation and natural gas consumption accounted for 20% and 14%, respectively, of NO<sub>x</sub> emissions. NO<sub>x</sub> concentrations have come down gradually from 25 parts per billion in 1970s to about 15 ppb over the past 5 years and compare reasonably well with other global cities and World Health Organization Guidelines.

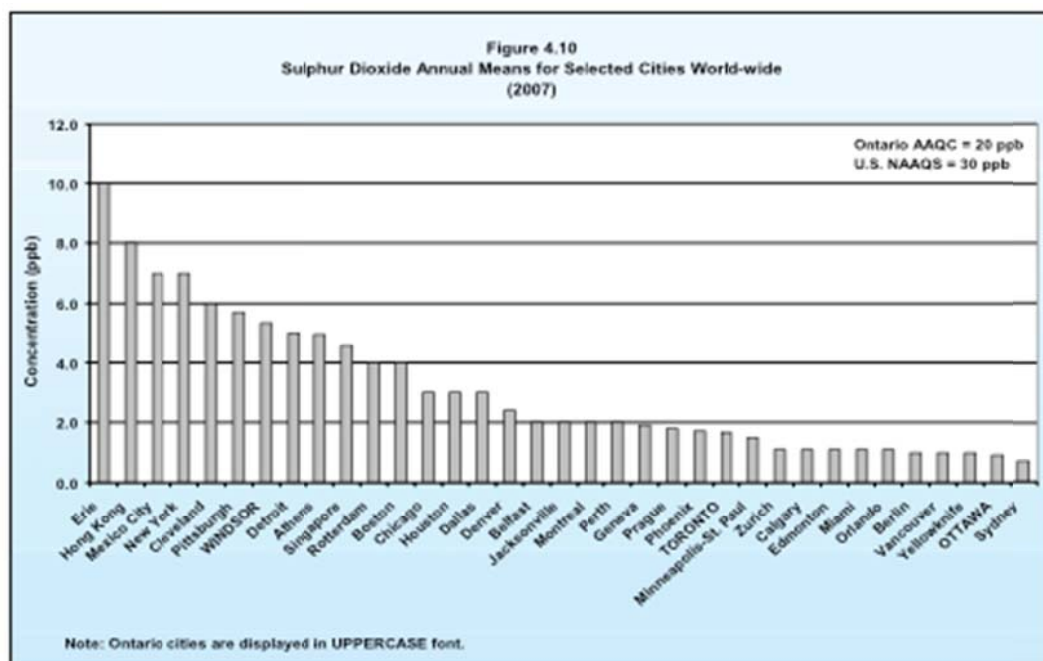
**Figure 6: Nitrogen Dioxide Annual Mean Emissions for Selected Cities World-Wide**



Source: Ontario Ministry of Environment, [Air Quality Index](#)

Sulphur dioxide emissions were 62,000 tonnes. Electricity generation and industry accounted for 80% and 18%, respectively, of Ontario SO<sub>2</sub> emissions in 2007. SO<sub>2</sub> concentrations come down from 30 ppb in 1971 to 3 ppb in 2007, and have declined further since then as the phase-out of coal-fired power production has commenced. These SO<sub>2</sub> concentrations compare well with those in other global cities and are well below the Ontario and US standards.

**Figure 7: Sulphur Dioxide Annual Means for Selected Cities**



Source: Ontario Ministry of Environment

While the elimination of coal-fired generation is contributing to lower emissions of SO<sub>2</sub> levels, ozone and particulates that contribute to smog, the majority of smog causing emissions in southern Ontario originate in the mid-west U.S. and the Ohio Valley, where power generation continues to be dominated by coal-fired plants.

Over the period 1991 to 2007, Ontario's GDP has increased at an average annual rate of 2.6%, while GHG emissions have grown at a

0.5% annual rate. **With economic growth projected to average 2.3% to 2020 and GHG emissions targeted to decline at an annual rate of 2%, radical measures to break the economic growth-emissions link are required.**

## **II. POLICIES**

### **1. National and Provincial Policies**

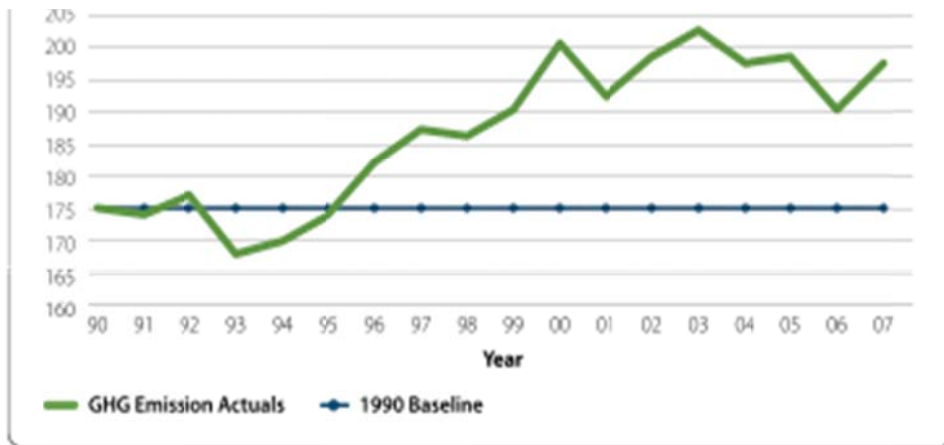
The Government of Canada believes that, given the integrated nature of the North American economy under NAFTA, it is essential that Canada fully align its climate change targets and policies with those of the United States. It has therefore proposed targets in line with initial US proposals: specifically, to reduce green house gas emissions by 17% from 2005 levels by 2020. The federal government has not yet set out a full set of policies to achieve this target. Canada has, with the United States, established a senior level Clean Energy Dialogue to enable cooperation between the two nations on critical science and technology measures. While the federal government supports clean energy initiatives across the country, a major focus of its climate change actions is technology development that can help check emissions from growing carbon sources in western Canada --- most notably major carbon capture and storage demonstration projects. Canada plans to become a global leader in the development and demonstration of CCS technologies.

At the Provincial level, Ontario has established more ambitious targets: a 6% GHG reduction by 2014 and 15% by 2020 **from 1990 levels**. Since Ontario emissions rose 13% between 1990 and 2005, these targets are equivalent to 20% and 33% reductions, respectively, from 2005 levels. Ontario has also set a 2050 target of 80% below the 1990 GHG emission level. The 2020 target represents a 41% reduction in **per capita** CO<sub>2</sub> emissions from 2005 levels and would bring Ontario per capita CO<sub>2</sub> emissions to roughly the level that currently exists in the City of Toronto. This target also represents a 60% reduction in provincial emission intensity (CO<sub>2</sub> emissions per unit of real GDP) over the next ten years. The

Greater Golden Horseshoe is expected to provide a disproportionate share of the GHG reductions, with the City of Toronto alone targeting reductions from 1990 levels that are twice as aggressive as the provincial targets.

**Figure 8: Ontario GHG Emissions 1990-2007**

National Inventory Report, 2009  
Mt CO<sub>2</sub> equivalent



Source: Ontario Ministry of Environment, Climate Change Action Plan, p. 10

In December 2009, the Province passed legislation to implement a cap-and-trade system that will be aligned with systems in other North American jurisdictions, such as California. Ontario is a member of the Western Climate Initiative, which participates in the International Carbon Action Partnership.

The Province's Climate Change Action Plan is designed to engage every community, every sector and every level of government in meeting the climate change challenge. Increasingly, municipal governments and non-governmental environmental groups are taking up the challenge.

The Provincial Government focuses on setting and monitoring broad targets, greening the provincial energy supply mix, creating a

framework for energy efficient municipal planning, setting broad building and appliance standards, coordinating delivery of services that cross municipal borders and providing support and funding to municipalities, local distribution companies, community groups and First Nations in their efforts to deliver conservation and distributed generation.

Municipal governments and their agencies are focused on the delivery of incentives to residents and businesses to implement energy efficiency measures, including conservation, distributed generation and district energy. A number of regional and local governments have also established local emission reduction targets and policies that address local opportunities and priorities.

Examples of local initiatives include policies to encourage the development of urban growth poles and increased density targets that exceed the Provincial plans. Local and regional governments also have a key role to play developing cleaner and more attractive urban and commuter transit options. Cities and local utilities are in many cases exploring district energy and other distributed generation alternatives designed to improve the efficiency of energy delivery and use. Many municipalities and their utilities are developing plans to take advantage of Ontario generous feed-in-tariff regime through the installation of small-scale solar and wind generation. An additional area of focus for a number of municipalities is planning measures designed to protect green space and expand the urban canopy.

A number of these initiatives are reviewed below, as part of an examination of “road maps” to improve energy efficiency, address the carbon challenge and improve the quality of urban life.

### **III. ROAD MAPS**

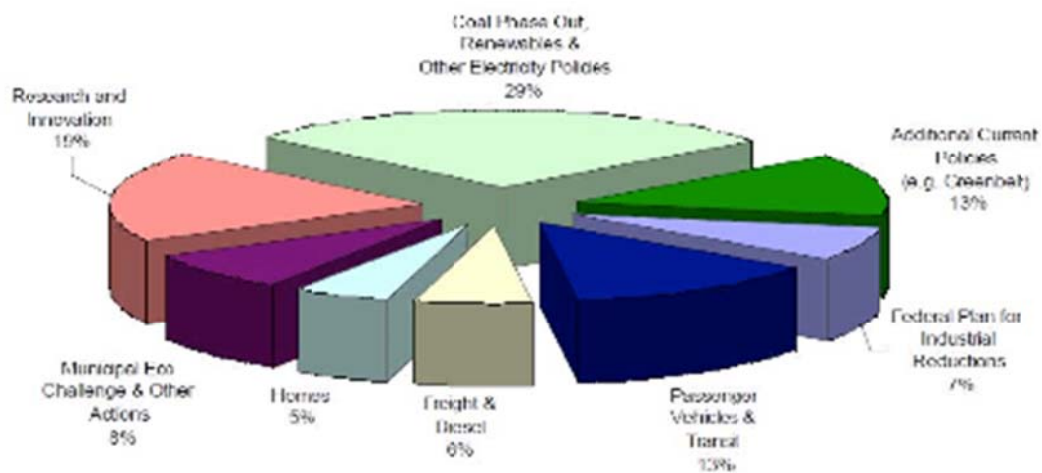
#### **1. Ontario’s Climate Action Plan**

Ontario’s Climate Change Action Plan contains 70 provincial government initiatives to help achieve the Province’s emission reduction targets. These measures include the elimination of coal-fired electricity generation, North America’s first comprehensive Feed

In Tariff renewable energy program, energy conservation initiatives that are among the most aggressive in North America, building code changes, national vehicle energy efficiency standards, expansion of public transit, protection of the boreal forest and public sector leadership. Appendix 4 provides detail on these initiatives, including the lead agency associated with each.

**REPLACE WITH 2009 FIGURE (44,17,6,3,5,5,11,7%)**

**Figure 9: Where Emission Reductions Will be Achieved by 2020 in Ontario**

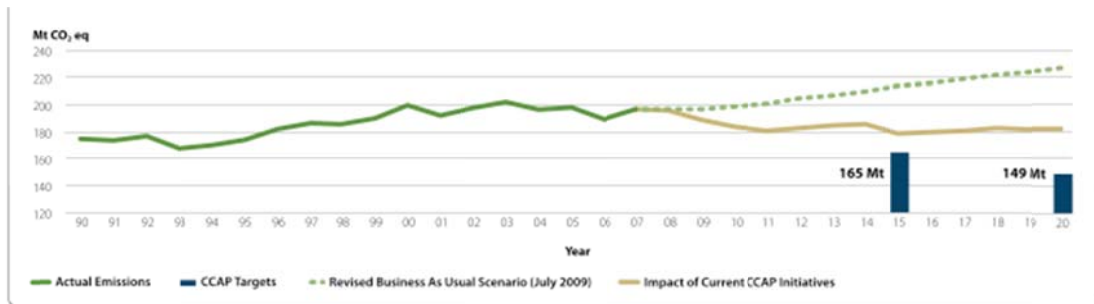


Source: Go Green: Ontario's Action Plan on Climate Change, August 2007, Government of Ontario

<sup>2</sup> Some transportation-related GHG reductions would be captured under "Other Current Policies", for example reduced driving as a result of improved community design facilitated by the Growth Plan.

Measures under way should deliver over half of the GHG reductions required to meet the Province's 2020 emission reduction target. Depending on its design, a cap-and-trade carbon pricing system has the potential to deliver further GHG reductions, but further actions will be required to achieve the 2014 and 2020 targets. Moreover, Reaching the 80% reduction target by 2050 will require fundamental changes in how we live and use energy.

**Figure 10: Impact of Climate Change Initiatives vs Targets**

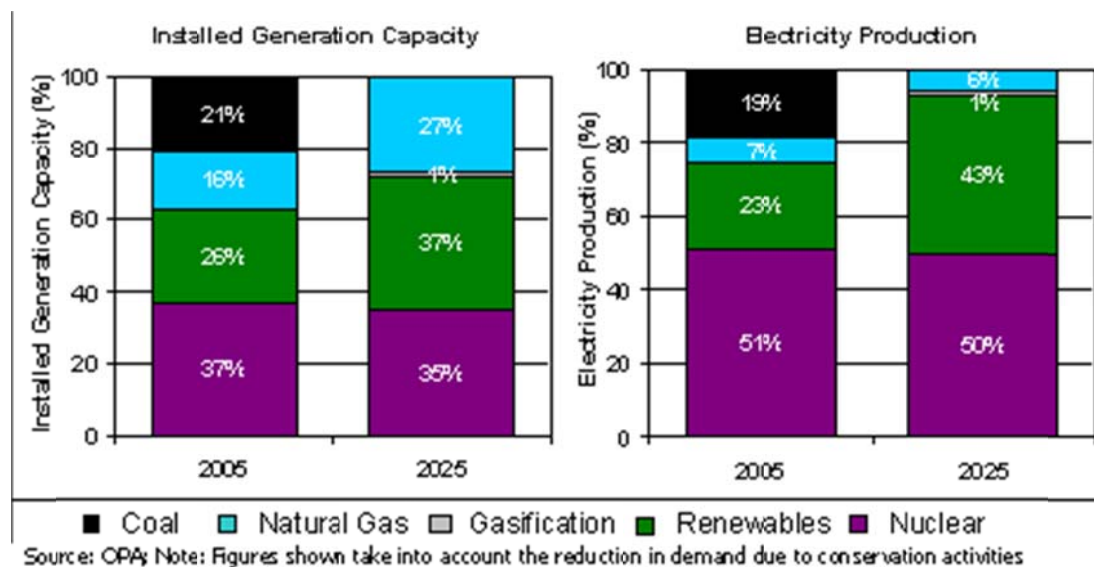


Source: Ontario Ministry of Environment, Climate Change Action Ontario's Climate Change Action Plan, p. 13

## 2. Ontario's Integrated Power Supply Plan

In 2005, the Ontario Power Authority undertook, at the request of the Ontario Minister of Energy, a review of potential electricity supply sources for the Province over the following 20 years. As a result of this review, the Power Authority recommended a supply mix that would: 1) Maintain the existing nuclear baseload supply, via refurbishment or nuclear new build; 2) Expand renewable sources so that they, together with conservation initiatives, effectively replace production currently generated from coal-fired plants; and, 3) Additional natural gas capacity to serve as peaking capacity and to complement intermittent renewables. As a result, 93% of the province's power supply would be from non-emitting nuclear and renewable sources by 2025 and almost all the remainder would come from natural gas-fired generation sources. Ontario has decided on conservation, renewable refurbishment or replacement, renewable energy and natural gas as the best replacements for coal in Ontario's electricity generation mix.

**Figure 11: Direction for Ontario's Electricity System Development**



The Minister of Energy endorsed this supply mix, with minor qualifications, and instructed the Ontario Power Authority to develop a detailed Integrated Power Supply Plan (IPSP) to implement it. Following extensive consultation, that Plan was filed with Ontario Energy Board in late 2007.

In 2008, before that Plan was approved, a new Minister of Energy and Infrastructure directed the Ontario Power Authority to re-examine several aspects of the Plan, including the potential for new, more ambitious targets for renewable energy sources and conservation.

The Provincial Government subsequently passed a new Green Energy Act and the Minister directed the Ontario Power Authority to develop a Feed-In Tariff (FIT) Program to maximize procurement of renewable energy and instructed the province's primary transmitter to begin development work on 20 major transmission projects, expected to cost at least \$8 billion, to facilitate the development and delivery of new renewable generation. This new program is projected to generate 50,000 green jobs and to make Ontario a leader in renewable energy and smart grid development.

Ontario's FIT Program is North America's most comprehensive feed-in tariff renewable energy program. The program provides for 20-year contracts (40 years for waterpower) with attractive inflation-adjusted fixed prices. The program covers on-shore and off-shore wind, photovoltaic solar, biomass, biogas, landfill gas and



waterpower. 930 FIT applications, totaling over 8,000 MW in supply were received in the first three months of the program for projects over 500 kW.

The province has about 2500 MW of available transmission capacity, with 1500 MW more slated to come into service by 2012, so that major transmission build-out will be required to accommodate new renewable projects under the program.

In April 2010, the Power Authority announced that it had signed contracts for 184 large projects to generate over 2400 MW of power. This included 76 large ground-mounted solar projects, accounting for 650 MW and 47 on-shore and off-shore windpower generation projects, totaling nearly 1600 MW. As more transmission capacity is developed additional projects will be launched. These projects involve a total of approximately \$9 billion in new private investment in Ontario's renewable energy sector.

As of April 6, 2010, in the associated microFIT program, over 8500 applications, primarily for solar PV installations, had been received.

Given the expected rapid growth in intermittent power, the province will need added dispatchable power available when the wind doesn't blow or the sun doesn't shine. Natural gas generation and hydroelectric imports from other provinces can play this role. These sources, together with nuclear new build, are also the primary options available for new baseload supply.

### **3. Growth Plan for the Greater Golden Horseshoe**

In 2006, the Province of Ontario released the Growth Plan for the Greater Golden Horseshoe (GGH), which includes and surrounds Toronto. This 25-year land use and infrastructure plan provides growth management policy direction for the GGH under the authority of the Places to Grow Act, 2005. The plan directs population and employment growth to existing built-up areas to make efficient use of infrastructure and limit urban sprawl.

This Plan recognizes that, unlike many mature urban regions in other developed countries, the population of Toronto and the surrounding region will continue to grow for the foreseeable future, as the region remains a magnet for immigrants. While growth brings a range of benefits, careful management of that growth is required to deal with the potential negative impacts of growth including increased traffic congestion, deteriorating air and water quality, and the disappearance of agricultural land, natural resources and green space.

To this end, the Growth Plan contains a suite of policies and targets to help support the development of more compact, complete and transit-supportive communities, including the implementation of ambitious targets for intensification:

- A minimum 40% of new residential development within each municipality in the region is to occur within the existing built-up area by 2015;
- A minimum density of 50 people and jobs combined per hectare for development in designated greenfield areas (the threshold require to support a viable transit service);
- Minimum gross density targets for 25 urban growth centres within the Greater Golden Horseshoe region ranging from 400 residents and jobs combined per hectare within the City of Toronto to 150-200 residents and jobs combined per hectare in other downtown areas across the region.

The Growth Plan also contains policies designed to help reduce greenhouse gas emissions by encouraging development that supports modes of transportation other than the automobile. For example, municipalities are required to identify areas that are appropriate for intensification such as radial corridors and around major transit stations, and to ensure that pedestrian and bicycle networks are integrated into transportation planning.

Additionally, the Growth Plan includes policies that promote energy efficient construction and support conservation of water and energy, as well as better integrated waste management.

In addition, the Ministry is a funding partner in a national study to examine the potential greenhouse gas reductions resulting from better linkages between energy systems, transportation options and growth management strategies in Canadian cities. The study is being undertaken by Quality Urban Energy Systems of Tomorrow (QUEST): a national coalition of government, non-profit, energy providers, industry and academics whose goal is to foster an integrated approach to land use, energy and infrastructure planning in order to reduce greenhouse gases, air pollutants and waste.

Finally, the compact urban form called for in the Growth Plan increases opportunities for the installation of integrated energy systems which comprise the planning and development of all aspects of a community, such as land use, energy, transportation, waste and water, in a way that improves energy efficiency. By mapping and identifying energy sources and key service infrastructure, together with planning for more compact, mixed-use communities can more effectively achieve growth planning and energy efficiency goals. Greater Golden Horseshoe communities like Guelph have become leaders in the development of community energy plans.

**Figure 12: Greater Golden Horseshoe Urban Growth Centres**



#### **4. Sustainable Transportation**

Metrolinx, a Provincial agency, has been given the task of coordinating the seven separate local transit agencies that serve the region and developing and implementing a plan to meet the region's transportation needs.

In planning transportation options, the following hierarchy will be employed: 1) Trip reduction; 2) Active cycling and pedestrian travel; 3) Public transit; 4) Ride sharing; 5) Single occupancy vehicle travel.

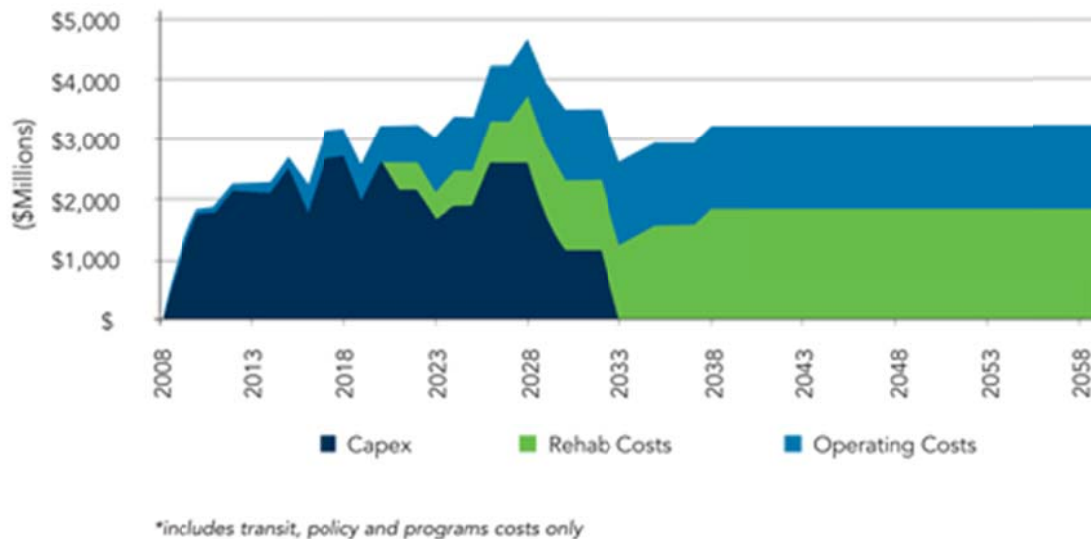
The resulting “Big Move” plan calls for incremental investment of \$50 billion over 25 years. This plan includes the development of 1200 kilometers of rapid transit capacity, tripling the current total length of rapid transit in the region. The plan also calls for 7000 kilometers of new lanes, trails and pathways for cyclists and pedestrians, a six-fold increase.

By creating a number of “mobility hubs”, the region will be able to move away from the current radial system where most transportation systems focus on delivering commuters to downtown Toronto. This will help facilitate public transit between municipalities and the growth of multiple employment centres.

By 2031, the average drive distance is expected to be reduced by 1/3; a 50% population increase will be incorporated while average commute time comes down from 82 minutes per day to 77 minutes; 80% of residents will live within 2 kilometers of rapid transit; the proportion of commuter trips by transit should rise from 16.5% to 26.3%; the share of commutes by bicycle or foot will rise from 9.0% to 12.5%; and annual green house emissions per capita associated with transportation will decline from 2.4 tonnes to 1.7 tonnes.

Long-term rehabilitation and operating costs to maintain a quality transit system across the region are estimated at \$3 billion/year.

**Figure 13: Regional Transportation Plan Expenditure Profile (\$2009)**



Source: Metrolinx

The Goals and Objectives of the Long-Term Regional Transmission Plan developed by Metrolinx are presented in Appendix 2 below.

Metrolinx will continue to consult on ways to provide stable and assured funding for public transit in the region and report back to the Province in 2013 on long-term tools and revenue options.

Using electricity to power commuter rail transit throughout the Greater Golden Horseshoe can make an additional and substantial contribution to reducing green house gas emissions.

Metrolinx is studying the electrification of the GO commuter rail system. The GO Train fleet is expected to grow from 17 currently to 41 by 2031. The cost of new power stations, overhead wiring and new electric locomotives to replace the entire fleet would be approximately \$1 billion. Some money would be recouped from selling the diesel locomotives and subsequent operating and fuel costs would be lower.

While the expectation is that all-day service will become more common, the bulk of the power use will still be in the morning and evening rush hour period. This has implications both in terms of cost

and emissions. Ontario prices power in real time and peak prices are roughly twice off-peak rates. While natural gas-fired generation accounts for only about 10% of Ontario's power supply, it tends to be the marginal source at peak times. The carbon intensity associated with incremental electricity used to fuel commuter transit will therefore be higher than that associated with nuclear and renewable power which will account for the large majority of Ontario's power generation. Nevertheless, electric engines are twice as efficient as diesel engines and the carbon intensity of natural gas is substantially lower than that of diesel fuel, so there would still be substantial emission reductions. Diesel trains are also the source a fairly large amounts of sulfur dioxide and nitrous oxide, as well as soot and fine particles.

Electric trains have a number of other advantages, including faster acceleration and top speeds that will reduce commuting times, less noise and less maintenance. Metrolinx has commissioned a comprehensive examination of the costs and benefits of electrification. That study will be completed by the end of 2010, and Metrolinx will report the Agency's conclusions to the government shortly thereafter.

## **5. The Role of Electric Vehicles**

With Ontario's low-emission electricity system following the 2014 end of coal-fired generation, electrification of transportation systems offers major emission gains. Ontario has other advantages that help position it to be a leader in electric vehicle development and implementation.

By 2011, virtually all households will be equipped with smart meters and be billed on time-of-use electric rates that substantially lower the cost of recharging during off-peak overnight hours.

Ontario has a large auto industry, with many of the automakers and parts suppliers dedicated to electric vehicle development located in the province, including Toyota, Honda, GM, Chrysler, Ford and parts maker Magna. There is a strong tradition of collaboration in research and development among these firms and Ontario's colleges. A wide range of energy, technology, automotive and research organizations

are participating in Ontario's Plug 'n Drive Coalition.

THE Ontario government expects one in every 20 vehicles on the road in 2020 to be electric vehicles and has a plan to achieve this objective. Most of these vehicles will likely be used in urban areas. The Province has introduced generous incentives up to \$8500 per vehicle to encourage electric vehicle purchases. Toronto has also committed to be a leader in preparing for electric vehicles by becoming one of the 14 cities taking part in the C40 Electric Vehicle Network, a part of the Clinton Climate Initiative and one of 10 Partner Cities in the Rocky Mountain Institute's *Project Get Ready*. One specific Toronto initiative, led by the Toronto Atmospheric Fund, is a pilot project, called EV 300, which will see the purchase of 300 electric vehicles for fleets within the GTA.

## **6. Toronto's Sustainable Energy Plan**

The City of Toronto has undertaken a number of energy-related initiatives that contribute to conservation and renewable energy development (see Text Box below). In late 2009, the City undertook to provide a long-term strategy to address the climate change challenge. That document is entitled The Power to Live Green: Toronto's Sustainable Energy Strategy (October 2009).

The Mayor and City have embraced a strategy designed to move from large-scale, centralized generation with high per capita levels of energy consumption to a new path founded on greater conservation, renewable energy sources, reduced use of fossil fuels and the implementation of a smart grid.

The City has established emission reduction targets of:

- 6% below 1990 levels by 2012
- 30% below 1990 levels by 2020
- 80% below 1990 levels by 2050

Natural gas use accounts for 35% of Toronto's greenhouse gas emissions, primarily for space heating and domestic hot water. Electricity accounts for 25% of emissions. Most of the rest results from transportation. Since 58% of electricity consumption in Toronto occurs in the commercial sector, electricity conservation and demand



management policies will be targeted at that sector. The residential sector accounts for 54% of natural gas use and will be the primary target for natural gas conservation programs.

### Figure 14: Existing City Policies and Programs

1. *Mayor's Tower Renewal*: Facilitates energy retrofits in both public and private high-rise residential buildings.
2. *Toronto Green Development Standard*: A two-tiered set of mandatory standards and incentives that encourages more sustainable building development practices, including energy efficiency measures in new construction.
3. *Home Energy Assistance Toronto*: "HEAT" provides up to \$1000 from Toronto and \$10,000 in combined federal and provincial grants for energy conservation measures in low-rise residential buildings.
4. *Better Building Partnership*: In partnership with the Ontario Power Authority, provides financial assistance for energy efficient retrofits and new construction.
5. *Toronto Hydro Corporation*: This municipally owned utility delivers a range of sustainable energy programs and is working with the City on a number of renewable energy projects, including biogas cogeneration plants, solar PV and on- and off-shore wind projects. It is also developing smart grid technology that will help residential, business and institutional customers better manage their energy use.
6. *Enwave Energy Deep Lake Water Cooling*: Partly owned by the City, this is the largest district energy company in Canada and one of the largest in North America. In addition to providing 2.5 billion pounds of steam each year, its deep water cooling system uses cold water from Lake Ontario to provide air conditioning to large buildings in downtown Toronto. The system has enough capacity to cool approximately 100 large office towers.
7. *Toronto Atmospheric Fund Projects*: Established in 1991, TAF has funded over 300 leading-edge projects to reduce emissions and improve air quality. Recent examples of projects funded include the Mayor's Tower Renewal and the EV300 initiative, aimed at developing the electric vehicle market through co-coordinated fleet purchases.

8. *Live Green Toronto*: Created in 2008, it is investing \$20 million to green Toronto homes and businesses with innovative projects such as shared geo-thermal systems and green roofs.
9. *Toronto Solar Neighbourhoods*: A pilot project to install 150 solar hot water systems, as the first phase of a city-wide solar hot water campaign to be rolled out in 2010.
10. *Exhibition Place's Net Zero Energy Program*: The City's Exhibition Place has committed to become a net zero energy operation by 2012. Initiatives include a 100,000 kW of solar PV system, energy efficient lighting, the first urban wind turbine in North America and numerous other pilot projects.
11. *Greening of City Hall*: Numerous initiatives, including expanding the green roof, thermal upgrades, control automation, micro generation, procurement of green power from renewable energy sources and connection to Enwave's Deep Lake Water Cooling system.
12. *Eco-roofs*: Incentives of up to \$100,000 per installation for green and cool roofs on industrial and commercial buildings.
13. *Ashbridges Bay Wastewater Treatment Plant*: An 8 megawatt biogas co-generation plant, utilizing a digester process that provides methane for electricity generation and heat, as well as emergency standby power.

The City has established specific targets for electricity conservation, natural gas conservation, renewable energy generation and the generation of renewable thermal energy, primarily in the form of district energy fuelled by biogas and landfill methane.

Measures designed to reduce electricity consumption include incentives to industrial and commercial entities to replace incandescent lighting, to retrofit buildings and build new energy efficient structures.

Natural gas use is primarily for space and water heating. Incentives to improve the energy efficiency of commercial and residential buildings can reduce gas use by as much as 50%. The City plans to develop by 2011 an implementation plan to phase in energy

efficiency standards for both new buildings and existing structures to help meet the 2050 target.

### Figure 15: City of Toronto Cumulative Conservation Targets

(Based on 2007 levels of 5,000 Megawatts (MW) of electricity consumption and 4,200 Million cubic metres (Mm<sup>3</sup>) of natural gas consumption.)

SOURCE	By 2012	By 2020	By 2050
Conservation—Electricity *	Reduce by 200 MW	Reduce by 550 MW	Reduce by 1050 MW
Conservation—Natural Gas Heat	Reduce by 240 Mm <sup>3</sup>	Reduce by 730 Mm <sup>3</sup>	Reduce by 1560 Mm <sup>3</sup>
Renewable Electricity Generation	Increase by 120 MW	Increase by 550 MW	Increase by 1000 MW
Renewable Thermal Energy	Displace 20 Mm <sup>3</sup> of Natural Gas	Displace 90 Mm <sup>3</sup> of Natural Gas	Displace 200 Mm <sup>3</sup> of Natural Gas

\* Conservation targets are in addition to the existing 330 MW reduction by 2010 called for in the Toronto Directive from the Ontario Power Authority. See Appendix A for more details.

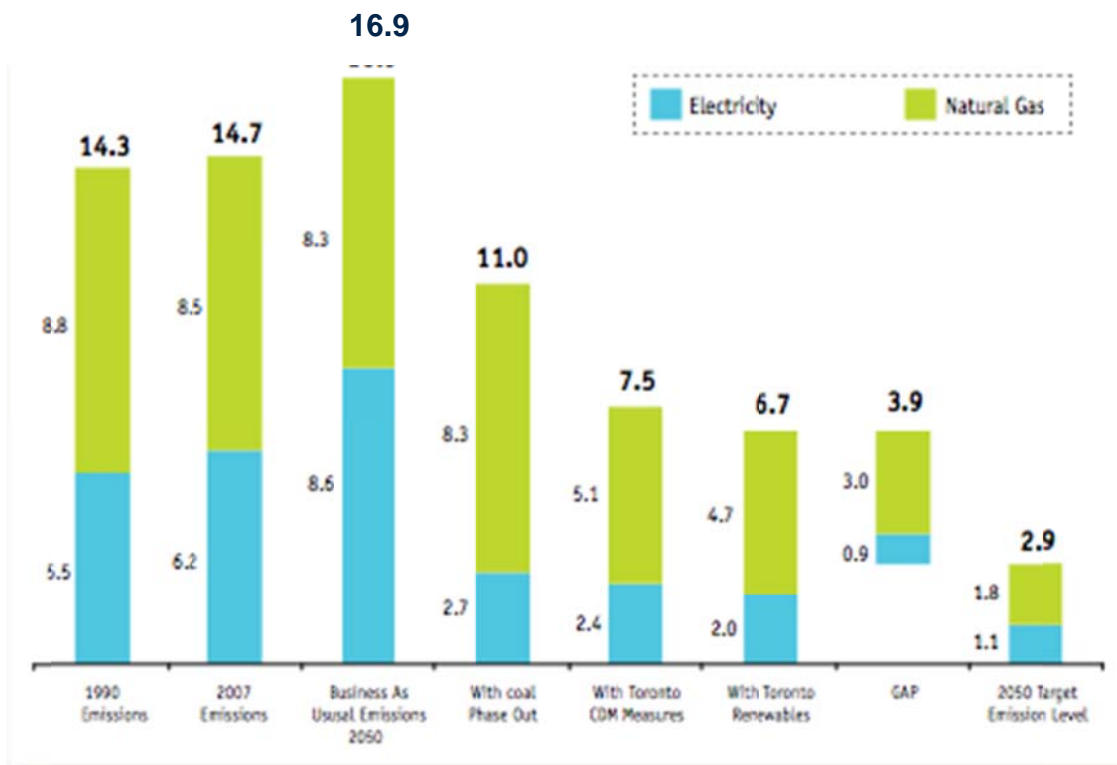
Source: Toronto, The Power to Live Green, p. 8

The Province's MicroFIT program provides generous incentives for renewable electricity generation in the form of small-scale solar photovoltaic, wind and biomass applications. The City will ensure streamlined approvals of these installations and its utility, Toronto Hydro, will ensure user-friendly grid connections.

The City also sees major opportunities for district heating and cooling to reduce the use of natural gas. It will play an active role in identifying and enabling partnerships that manage the supply of heat and electricity to maximize the efficiency of energy use.

Despite these initiatives, and those of the federal and provincial governments, the City recognizes that there remains a gap that will require new innovative approaches if the 80% reduction by 2050 is to be achieved. The chart below illustrates the remaining gap

**Figure 16: City of Toronto Green House Gas Emission Projections from Electricity Generation and Natural Gas Usage, Including Coal Phase Out, Conservation Measures and Renewable Energy Generation, 1990-2050 (megatonnes per year)**



Source: Toronto, The Power to Live Green, p. 9

## 7. A Livable City Core

Unlike a number of North American cities, Toronto never experienced a “hollowing out” of its city core. Downtown neighbourhoods with single-family housing have remained attractive locations. More recently, Toronto has seen the emergence of a booming condominium market, which now accounts for roughly three-quarters of new housing starts.

There have been several major high-rise development projects over the past decade. These projects have tended to focus on smaller units --- generally less than 1000 square feet. The largest of these development projects is the 16-tower City Place development on the

former railways lands in downtown Toronto. When completed the project will total 7500 units. Some critics have argued that this project and others have failed to build a sustainable multi-use community and remain too car-oriented. These developments have tended to attract young, childless residents who tend to move to suburban single-family properties when they have children.

A major new development is also underway on a 2000 acre underutilized brownfield site adjacent to the city core and on the city's waterfront. This \$17 billion Portlands project is one of the largest projects of its kind in North America. Unlike a number of recent high-rise developments in the city, sustainable development will be a key driver of this project. The project will create neighbourhoods characterized by animated places with increased building density and mixed use compact form, green buildings, public transit, parks, knowledge-based, creative industry, multi-mode recreation and urban wilderness spaces.

Waterfront Toronto, an agency created by the City of Toronto, the Province of Ontario and the Canadian Government in 2002 is charged with developing this project and the overall redevelopment of the Toronto waterfront. This development is financed through contributions from senior levels of government and the sale of property to private developers.

Waterfront Toronto has developed a Sustainability Framework, which will guide the transformation of the waterfront into sustainable communities.

All the buildings in the project will be connected to Waterfront Toronto's District Energy System, which will produce and provide hot and chilled water via an underground piping network. All buildings will meet the LEED Gold building standard.

Waterfront Toronto recognizes that, in addition to high performance buildings, maximizing sustainability requires a comprehensive neighbourhood-wide perspective. This project has joined the LEED for Neighborhood Development (ND) Pilot Program administered by the US Green Building Council. LEED ND projects pursue community-scale issues such as development density and proximity, walkable streets, affordability, involvement and diverse local uses.

Ninety percent of dwelling units will be within ¼ mile of a transit ride and 86% will be within ¼ mile of a walking or biking trail. All buildings will have provision for bicycle parking and there will be continuous sidewalks within the project site. Surface parking will be limited to 2.1% of the surface area. The high-density, mixed-use communities that make up the project will cater to a range of family types and income levels. The walking, cycling and transit orientation will decrease air pollution and GHG emissions.

Compared to a business-as-usual development approach, emissions from residential and commercial use will be reduced by 40%. Emission reductions associated with more convenient transportation options are still to be determined.

Waterfront Toronto's longer term goal is to achieve net zero emissions on a neighbourhood basis. To meet this goal and to encourage further energy efficiency and CO<sub>2</sub> emission reductions, Waterfront Toronto is examining a range of possible strategies, including:

- Incorporating renewable energy sources (biomass) and cogeneration of electricity in the District Energy system;
- Encouraging the use of energy from solar and wind, either on-site or purchased support;
- Electric or biofuel opportunities for public transit, including ferries;
- Retrofitting intersections with LED lights and installing LEDs in all new areas;
- Smart building technologies to increase automation and energy efficiency;
- Equipping residential vehicle parking spots with charging stations to maximize access for electric vehicles;
- Increasing the number of native and non-invasive tree species with higher CO<sub>2</sub> sequestration potential.

## **8. Industrial Energy Efficiency**

Industrial companies can bid demand reductions into Ontario's Independent Electricity System Operator's wholesale power market in competition with power suppliers.



The Ontario Power Authority is also launching an Industrial Transmission-Connected Electricity Efficiency Program. This five-year program will provide Ontario's 68 large transmission-connected industrial customers with financial incentives to fast-track capital investments in major energy efficiency initiatives. These financial incentives will cover up to 70% of eligible design, engineering and installation costs. The resulting investments are expected to yield energy savings up to 30% and result in improved reliability, productivity and product quality.

Under the Green Energy Act, Local Distribution Companies are expected to develop comparable programs for industrial customers connected to their distribution systems.

## **9. Energy in the Commercial Sector**

The Ontario Power Authority, municipal governments, Local Distribution Companies and natural gas distributors have designed a range of incentive programs and technical assistance aimed at encouraging commercial building owners and managers to make investments to reduce their consumption of electricity and natural gas.

One of the most successful programs is a joint venture between the Ontario Power Authority and the Toronto Building Owners and Managers Association (BOMA), which is targeted at buildings larger than 25,000 square feet. This 3-year program, launched in 2007, is expected to yield 150 megawatts in commercial electricity demand reductions.

Investments eligible for financial support include, but are not limited to:

- Lighting upgrades and control systems;
- Replacement of equipment such as chillers, fans and pumps;
- Heating, ventilation and air conditioning redesign;
- Variable speed drives;
- Building envelope improvements;
- Tenant submetering;
- Deep water lake cooling;



- Natural gas-fired generators.

This program is expected to serve as a model for similar conservation and demand management programs across the province.

## 10. Climate Change Adaptation

In 2007, Natural Resources Canada published From Impacts to Adaptation: Canada in a Changing Climate, which reported the evidence on the expected impacts of climate change on various parts of Canada. In Ontario, the largest temperature and precipitation impacts are expected to occur in the North West part of the province. Nevertheless, substantial changes are expected to impact Toronto and the surrounding region. For example, the number of days per year with temperatures over 35 degrees Celsius is expected to increase from 16 over the 1961-90 period to 26 in the 2020s and to 37 in the 2050s. While warmer winters will partially offset the impact of global warming on energy use, Ontario has recently become a summer-peaking market. Global warming is thus likely to continue to contribute to increasing peak power needs.

In 2008, the City of Toronto published a report on expected impacts and recommended adaptation measures: Ahead of the Storm: Preparing Toronto for Climate Change.

In 2009, the Ontario Ministry of Environment published the report of its Expert Panel on Climate Change Adaptation: Adapting to Climate Change in Ontario.

The Table below outlines the expected climate trends in southern Ontario and their potential impacts in the Greater Golden Horseshoe:

**Figure 17: Potential Impacts of Global Warming in Toronto and the Greater Golden Horseshoe**

Climate Change	Potential Impacts
Hotter, dryer summers	<ul style="list-style-type: none"> <li>• Increased smog</li> <li>• Increased electricity demand</li> <li>• Increased water demand</li> <li>• Stress on trees and other vegetation</li> <li>• Power outages</li> </ul>

	<ul style="list-style-type: none"> <li>• Reduced hydroelectric capacity</li> </ul>
Milder winters	<ul style="list-style-type: none"> <li>• Disease-bearing insects survive winters and expand range</li> </ul>
More intense precipitation	<ul style="list-style-type: none"> <li>• Pressure on storm water management system</li> <li>• Flooding in low lying areas</li> </ul>
More extreme weather	<ul style="list-style-type: none"> <li>• Damage to buildings, roads, transmission lines, trees, parks, beaches, natural areas</li> <li>• More blackouts</li> </ul>
Water level drop in Great Lakes basin	<ul style="list-style-type: none"> <li>• Increased concentration of contaminants in Lake Ontario</li> <li>• Loss of wetlands</li> </ul>

Source: City of Toronto, [Ahead of the Storm](#)

Examples of near-term actions the City plans to address expected climate change impacts include:

- Landscaping that reduces water demand and is adaptive to drought;
- Increasing the tree canopy;
- Rain barrels and permeable surfaces to reduce runoff from severe rain;
- Reflective or green roofs to reflect or reduce heat.

Both the Province and the City are committed to extensive planning to identify and address climate change impacts and to develop appropriate mitigation measures.

#### **IV. CONCLUSION**

The potential impacts of climate change globally and locally require urgent action, both to reduce emissions and to adapt to the inevitable impacts. National, Provincial and Local governments have set targets to reduce emissions. A wide range of initiatives to reduce emissions has been identified and are being implemented. In order to meet the aggressive targets that have been established for 2020, governments, communities, corporations and non-governmental

agencies throughout the Toronto region will need to cooperate to successfully implement the identified measures. It is clear, however, that further measures will be required to meet the ambitious 2020 targets. Meeting the 2050 target of an 80% reduction in GHG emissions will require fundamental changes in the way we live and move about the region. Best practices from other major urban areas around the world will need to be incorporated wherever practical.

## APPENDIX 1

Distribution of Population and Employment for the Greater Golden Horseshoe 2001-2031 (figures in 000s)								
	POPULATION				EMPLOYMENT			
	2001	2011	2021	2031	2001	2011	2021	2031
Region of Durham	530	660	810	960	190	260	310	350
Region of York	760	1,060	1,300	1,500	390	590	700	780
City of Toronto	2,590	2,760	2,930	3,080	1,440	1,540	1,600	1,640
Region of Peel	1,030	1,320	1,490	1,640	530	730	820	870
Region of Halton	390	520	650	780	190	280	340	390
City of Hamilton	510	540	590	660	210	230	270	300
<b>GGH TOTAL**</b>	<b>5,810</b>	<b>6,860</b>	<b>7,770</b>	<b>8,620</b>	<b>2,950</b>	<b>3,630</b>	<b>4,040</b>	<b>4,330</b>
County of Northumberland	80	87	93	96	29	32	33	33
County of Peterborough*	56	58	144	149	16	17	60	60
City of Peterborough*	74	79			37	41		
City of Kawartha Lakes	72	80	91	100	20	23	25	27
County of Simcoe*	254	294			85	102		
City of Barrie*	108	157	583	667	53	77	230	254
City of Orillia*	30	33			16	17		
County of Dufferin	53	62	71	80	19	22	25	27
County of Wellington*	85	91	269	321	36	41	137	158
City of Guelph*	110	132			63	76		
Region of Waterloo	456	526	623	729	236	282	324	366
County of Brant*	35	39	157	173	16	17	67	71
City of Brantford*	94	102			39	45		
County of Haldimand	46	49	53	56	17	19	19	20
Region of Niagara	427	442	474	511	186	201	209	218
<b>OUTER RING TOTAL**</b>	<b>1,980</b>	<b>2,230</b>	<b>2,560</b>	<b>2,880</b>	<b>870</b>	<b>1,010</b>	<b>1,130</b>	<b>1,240</b>
<b>TOTAL GGH**</b>	<b>7,790</b>	<b>9,090</b>	<b>10,330</b>	<b>11,500</b>	<b>3,810</b>	<b>4,640</b>	<b>5,170</b>	<b>5,560</b>

Source: Henson Consulting Ltd., "The Growth Outlook for the Greater Golden Horseshoe", January 2005

Note: Numbers rounded off to nearest 10,000 for GGH municipalities, GGH Total and Outer Ring Total, and to nearest 1,000 for outer ring municipalities.

\* Separate forecasts for these municipalities for 2021 and 2031 will be determined.

\*\* Totals may not add up due to rounding.



**PLACES TO GROW**  
GROWTH PLAN FOR  
THE GREATER GOLDEN HORSESHOE 2006

### SCHEDULE 3

## Distribution of Population & Employment for the Greater Golden Horseshoe 2001-2031

## APPENDIX 2

### GOALS AND OBJECTIVES

#### THE METROLINX REGIONAL TRANSPORTATION PLAN

**A. Transportation Choices:** People will have a wide range of options available to them for getting around regardless of age, means or ability, including walking, cycling, public transit and automobiles.

1. Increased transportation options for accessing a range of destinations
2. Improved accessibility for seniors, children and individuals with special needs and at all income levels
3. Decreased need for travel, particularly over long distances and at rush hour

**B. Comfort and Convenience:** There will be a strong emphasis on the traveler. Getting around will be more convenient with coordinated information, facilities, operations and pricing; more comfort and less crowding; and the highest standard of customer service across the system. Uncertainty regarding travel times and delays will be reduced.

4. Improved transportation experience and travel time reliability
5. Faster, more frequent and less crowded transit
6. Improved information, including real-time information, available to people to plan their trips
7. Region-wide integrated fare structure and collection, and schedule coordination

**C. Active and Healthy Lifestyles:** Walking and cycling will be attractive and realistic choices for all, including children and seniors.

8. Increased share of trips by walking and cycling

**D. Safe and Secure Mobility:** Getting around will be safer and more secure. Parents will feel comfortable allowing and encouraging their children to walk, cycle or take public transit to school.

9. Continued progress towards zero casualties and injuries on all transportation modes

10. Improved real and perceived traveler safety, especially for women, children and seniors
11. Improved safety for cyclists and pedestrians

**E. Fairness and Transparency:** Citizens will be active partners in shaping the future transportation system. Decision-making will be transparent and inclusive.

12. Increased engagement in the planning and financing of the transportation system from a diverse group of citizens

**F. A Smaller Carbon Footprint and Lower Greenhouse Gas Emissions:** The transportation system will operate sustainably within the capacities of – and in balance with – the GTHA’s ecosystems. GHGs and other harmful emissions related to transportation will be reduced.

13. Decreased use of non-renewable resources
14. Significant contribution to the achievement of the transportation-related GHG reduction targets of Go Green: Ontario’s Action Plan for Climate Change.
15. Improved air quality, and reduced impacts on human health

**G. Reduced Dependence on Non- Renewable Resources:** By reducing our dependence on non-renewable resources, the transportation system will be more resilient. We will be better able to withstand volatility in energy supply and prices, and have more flexibility to switch to new fuels and technologies.

16. Increased proportion of trips taken by transit, walking and cycling
17. Improved energy efficiency, including increased use of clean vehicles and green technologies
18. Reduced use of out-of-province energy sources

**H. Foundation of an Attractive and Well- Planned Region:** The transportation system will be a cornerstone of city building, helping to create a region that is a destination of choice for new residents and businesses. The transportation system will help us create valuable, beautiful and attractive places. Roads, streets, transit lines and stations will be designed to benefit both travelers and local residents. The transportation system itself will use less space, and help curb sprawl by supporting more compact and efficient urban forms. Transportation services, particularly transit, will not lag behind population and employment growth.

- 19. Reduced consumption of land for urban development
- 20. Reduced negative impacts on our agricultural and natural systems
- 21. More transit and pedestrian-friendly streetscapes, and improved walking and cycling amenities
- 22. Greater prevalence across the region of transit-supportive densities and urban design

**I. Foundation of an Attractive and Well- Planned Region:** Prosperity and Competitiveness: The transportation system will respond efficiently and equitably to the needs of the Ontario economy. It will create opportunities for greater prosperity throughout the region and support Ontario in becoming a leader in attracting the best and the brightest from around the world, especially for new green jobs in the transportation sector. Deliveries, imports and exports will be faster and more reliable thanks to a more efficient integrated and coordinated transportation system. Residents will be able to get to a greater number of jobs.

- 23. Lower average trip time for people and goods
- 24. Greater reliability of the freight and passenger systems
- 25. Managed congestion

**J. Multi-Modal Integration:** The transportation system will be fully integrated. It will be easy to make a decision on how to get somewhere or ship something thanks to seamless integration, accurate and timely information, and prices determined in a transparent manner.

- 26. Reduced delays, damage and costs in transferring goods from one mode to another, and more seamless region-wide services for travelers and service providers

**K. Interconnectedness:** The GTHA transportation system will be well connected to surrounding regions, the rest of Canada and the world.

- 27. Improved connections and service within the GTHA and to/from interregional, inter-provincial, and international terminals and facilities

**L. Efficiency and Effectiveness:** The transportation system will be designed to optimize the use of resources and provide better value to households, businesses and governments. Greater emphasis will be placed on moving people and goods, rather than vehicles.

- 28. Increased prevalence of Transportation Demand Management practices
- 29. Improved value of transportation investment and spending for

- households, businesses and governments
- 30. Optimized use of all travel rights-of-way by commercial vehicles through a range of incentives and disincentives
- 31. Increased productivity of the transportation system

**M. Fiscal Sustainability:** Funding to build and operate the new and existing system will be sufficient, reliable and predictable. Technology and infrastructure will be selected that promotes system productivity and safety, reduces ongoing operating and maintenance costs, and ensures integration across the system.

- 32. Sufficient, reliable and predictable funding sources for transportation investments
- 33. Technical rigour and transparency in the selection and prioritization of major projects
- 34. Increased financial self-sufficiency of transportation infrastructure and projects
- 35. Competitive shipping cost structure
- 36. Fair and effective fiscal treatment of various modes that better reflects the cost of transportation services in the prices paid by users
- 37. Minimized direct and indirect economic losses due to accidents



## APPENDIX 3

**Table 1: OPA 2009 Conservation Portfolio – Program Initiatives**

Consumer	Business	Industrial
Free pickup of old, working energy-inefficient appliances (Great Refrigerator Roundup)	Incentives for retrofit (lighting, motors and HVAC) of existing buildings (Electricity Retrofit Incentive, Toronto Comprehensive)	Voluntary load shedding – incentives to reduce load during relatively high price periods (Demand Response 1)
Rebates on high-efficiency replacement space heating, cooling and ventilation systems (HVAC) (Cool Savings Rebate)	Incentives for energy-efficient new construction (High Performance New Construction)	Firm load shifting – incentives for regularly shifting production from peak to off-peak periods (Demand Response 2*)
In-store coupons for energy-efficient products (Every Kilowatt Counts – Power Savings Event)	Incentives for retrofit (lighting and water heating) of small businesses (Every Kilowatt Counts – Power Saving Blitz)	Firm load shedding – incentives for committing to reduce load when called upon (Demand Response 3)
Direct load-control devices for air conditioning and electric water heaters (peaksaver®)†	Incentives for metering and management of large-scale building complex cooling facilities (Chiller Plant Re-Commissioning)	Incentives for retrofit (lighting, motors and HVAC) of existing buildings (Electricity Retrofit Incentive, Toronto Comprehensive)
Incentives for retrofit (lighting, motors and HVAC) of multi-family buildings (Electricity Retrofit Incentive, Toronto Comprehensive)	Incentives for audits and retrofits of existing hospitality industry buildings (Windsor) (ENWIN Utilities – Green Suites*)	Incentives for energy-efficient construction (High Performance New Construction)
Festive light exchange programs, incentives for appliance retirement, lighting, power bars with integrated controls and ceiling fans (Toronto) (Toronto Hydro – Mass Market)	Incentives for commercial-scale computer facility energy-efficiency projects (York Region) (PowerStream – Data Centres*)	Significant funding for capital-intensive process improvement projects and studies for transmission-connected industrial energy users (Industrial Transmission-Connected Electricity Energy Efficiency*)
Giveaways of power bars with integrated timer (Thunder Bay) (Thunder Bay Hydro – Phantom Load*)	Incentives for installing electrical outlet timers and controllers used for car block heater devices in winter (Thunder Bay) (Thunder Bay Hydro – Winter Parking Lot Control*)	Electricity bill credits for reducing demand in winter months compared to the same period in 2008 (Hydro One – Double Return – Winter)
Residential electricity bill credits for reducing consumption in summer months compared to the same period in 2008 (Toronto) (Toronto Hydro – Summer Challenge 2009*)	Direct load-control devices for air conditioning and electric water heaters for small commercial businesses (peaksaver®)	
Low-income: free installation of compact fluorescent light bulbs (Toronto) (Toronto Hydro – Low-Income)	Voluntary load shedding – incentives to reduce load during relatively high price periods (Demand Response 1)	
	Firm load shifting – incentives for regularly shifting production from peak to off-peak periods (Demand Response 2*)	
	Firm load shedding – incentives for committing to reduce load when called upon (Demand Response 3)	
	Electricity bill credits for reducing demand in winter months compared to the same period in 2008 (Hydro One – Double Return – Winter)	

\* Denotes a new initiative in 2009.

† Registered trademark of Toronto Hydro Corporation. Used under licence.

## APPENDIX 4

Appendices

### Key GHG Reduction Initiatives and their Forecasted Impact on Ontario's Total Emissions

Initiative Name/Description	Lead Ministry	Partners	GHG Reductions (Mt CO <sub>2</sub> e)*	
			December 31, 2014	January 1, 2020
<p><i>Afforestation</i></p> <p>Includes two afforestation programs in southern Ontario: 1) A program with Trees Ontario to plant 50 million trees in southern Ontario by 2020 and 2) A program with Evergreen Foundation to plant 100,000 trees in cities and urban areas by 2010.</p>	MNR	Trees Ontario	0.00	0.5
<p><i>Biogas Financial Assistance Program</i></p> <p>A three-year \$11.2-million investment, launched in September 2007, to help farmers and agri-food businesses develop biogas projects and the further expansion of existing projects in Ontario that produce clean energy, reduce electricity costs and contribute to local economies.</p>	OMAFRA		0.03	0.03
<p><i>2006 Building Code Changes</i></p> <p>Legislation which mandates increased energy efficiency for new buildings and for buildings undergoing renovation. Code changes are being phased in between 2006 and 2011 to give industry time to prepare. Emission reductions associated with this initiative come from natural gas and other fossil fuel demand reductions – electricity conservation impacts are reflected under Coal Phase-Out and related energy policies.</p>	MMAH	MEI	0.91	1.53
<p><i>Coal Phase-Out and Related Energy Policies</i></p> <p>Phasing out the province's use of coal-fired electricity by December 2014. There are numerous initiatives that are critical for the completion of Coal Phase-Out, including Clean Energy Supply, Renewable Energy Supply, and Conservation Programs.</p>	MEI	OPA, MOE	26.4	29.1
<p><i>Conversion to Electric Buses</i></p> <p>A \$180.1-million funding program to support the replacement of ageing municipal transit buses and provide long-term, sustainable funding.</p>	MTO	MMAH	0.06	0.16
<p><i>Energy Efficiency Act and Other Existing Efficiency Policies</i></p> <p>An act that sets minimum energy-efficiency standards for specified energy-using products and provides descriptions of the responsibilities of dealers with respect to these products. The act also sets out labelling standards for energy-using products, as well as the collection of statistics and information on energy use and alternative energy.</p>	MEI	MMAH	1.16	1.97

Key GHG Reduction Initiatives and their Forecasted Impact on Ontario's Total Emissions (continued)

Initiative Name/Description	Lead Ministry	Partners	GHG Reductions (Mt CO <sub>2</sub> eq)*	
			December 31, 2014	January 1, 2020
<i>Fuel Efficiency Standard</i> Federal regulations to limit GHG emissions from the automotive sector under the Canadian Environmental Protection Act, 1999.	MOE		2.24	5.45
<i>Green Commercial Vehicle Program/Anti-Idling Retrofits</i> A four-year \$15-million program that provides funding in the form of grants for companies to 1) Purchase hybrid and alternative-fuel vehicles; and 2) Retrofit heavy-duty vehicles with anti-idling technologies.	MTO		0.02	0.02
<i>Heavy Truck Speed Limiters</i> A \$425K program to develop mandatory speed limiters for all large trucks operating in the province. A speed limiter is an electronic device within a truck engine that caps the truck's top speed at a maximum of 105 km/h. Mandatory speed limiter requirements are now in place.	MTO		0.26	0.26
<i>Home Energy Savings Program</i> A \$372-million grant program to assist homeowners with completing an energy audit and associated retrofit work. The program also educates the public about where and how to improve energy efficiency in homes and reduce emissions.	MEI		0.16	0.16
<i>Methane Landfill Capture</i> Involves regulations which require landfill methane gas collection for new, expanding or operating landfills larger than 1.5 million cubic metres total waste disposal volume.	MOE		2.19	2.4
<i>Ontario Bus Replacement Program &amp; Public Transit Commitments</i> The province is supporting the achievement of GHG reductions through numerous funding programs and projects for transit. Dedicated transit programs such as Gas Tax Funding and the Ontario Bus Replacement Program provide municipalities with transit funding to renew, improve and expand their systems. Significant provincial investment in GO Transit will also help deliver top quality inter-regional transit service, serving millions of riders every year.	MTO	MMAH	0.7	1.1

Key GHG Reduction Initiatives and their Forecasted Impact on Ontario's Total Emissions (continued)

Initiative Name/Description	Lead Ministry	Partners	GHG Reductions (Mt CO <sub>2</sub> eq)*	
			December 31, 2014	January 1, 2020
<i>Places to Grow Act</i> An act that provides legal authority for the 2006 Growth Plan for the Greater Golden Horseshoe, a 25-year vision and plan to manage growth and development in ways that support economic prosperity, protect the environment and help communities achieve a high quality of life.	MEI	MMAH	0.11	0.34
<i>The Big Move</i> A 25-year Regional Transportation Plan to improve regional transportation, bolster global competitiveness, protect the environment and enhance quality of life. The RTP has a number of objectives which include providing transportation choices, promoting active and healthy lifestyles, and increasing interconnectedness in the GTHA.	Metrolinx	MTO, MEI, MMAH	0.14	0.77

\* NOTE: The impact of the individual transportation initiatives is higher than their combined impact reported in other portions of this report due to the interplay of changes to key emission drivers (e.g. vehicle kilometres travelled, vehicle fuel efficiency and the carbon content of fuel)