



# Demonstrating Climate Action

AMO Climate Change Position Paper

November 2010

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## 1. Executive Summary

The Province has committed to a significant climate change action plan and municipalities will play an important role in Ontario's efforts to reduce greenhouse gas emissions. While there are numerous initiatives underway among Ontario municipalities, there is currently a lack of coordinated action. AMO recommends the Province establish a demonstration community program. Under this proposal, grants would be awarded to interested municipalities who developed the most innovative plans to integrate a series of measures aimed at greenhouse gas reduction and climate change adaptation. The program would generate new approaches to integrated climate change management and develop valuable expertise in the participating municipalities across Ontario. These developments would increase capacity in the municipal sector which would be drawn upon in subsequent years to help the Province reach its climate change goals.

## 2. Background & Rationale

### 2.1. Introduction

The International Panel on Climate Change (IPCC) is a scientific body established in 1989 by the United Nations to assess information relevant to climate sciences and has released numerous comprehensive reports on the state of climate sciences. The 2007 report of the IPCC was unequivocal: human activity is emitting greater and greater amounts of heat trapping gases—carbon dioxide, methane, and nitrous oxide—into the atmosphere, and these greenhouse gases are causing rising global temperatures. The most recent projections indicate that even with a moderate reduction of greenhouse gases, average temperatures in Ontario will rise by at least 2.5°C by the year 2050 (Expert Panel, 2009). Given the agreement in the scientific community that any temperature increase exceeding 2°C will result in grave environmental, social, and economic disruption, climate change action will be necessary if municipalities are to ensure the sustainability of their communities.

The most common understanding of sustainable development was set out by the UN's Brundtland Commission and is defined as "development that meets the needs of the present, without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, ch. 2, pp.

1). This approach focuses on the interdependence of economic development and environmental protection. Since the influential Brundtland Report there have been numerous approaches to incorporating this concept into governance and business practices. The Organization for Economic Cooperation and Development (OECD) has been developing approaches to integrating sustainability in the decision-making process. Under the OECD model, sustainability is understood as balancing economic, environmental, and social effects of a development over time (OECD, 1997). This triple bottom line approach means considering the short-term and long-term impacts and benefits of a choice. At the core of this conception of sustainability are five types of capital.<sup>1</sup> Sustainable development balances the investment in and use of the various types of capital within a society. Not only does sustainable development avoid the over-use of any one type of capital, it also ensures short-term gains in capital do not come at the expense of future generations' capital (OECD, 1997). Because climate change threatens to irrevocably change the environment around us, Ontario municipalities will be faced with numerous challenging decisions as they adapt to these new circumstances. More frequent extreme weather events will damage built capital including municipal infrastructure. Exposure to more pronounced threats such as heat waves, will tax our public health units and can erode human capital. On the other hand, the transition to a low-carbon economy presents the opportunity for Ontario to develop economic opportunities as a green energy leader that will foster the growth of our financial and social capital.

Regardless of the precise effects of greenhouse gas emissions, addressing climate change through sustainable development will be a beneficial strategy for Ontario municipalities. The solutions that will be employed to answer the climate change challenge are goals consistently pursued by municipalities: creating well-designed neighbourhoods that foster active living and strong communities. Climate change action will mean we are wasting fewer resources by maximizing previous investments in our built environment, and saving tax dollars by achieving greater energy efficiency. Transitioning to a low-carbon economy will also lighten our effect on the environment around us and on the natural capital we will be leaving to generations ahead. In addition, preparing for the effects of climate change will mean upgraded infrastructure sized for sustainable growth and designed to withstand environmental threats,

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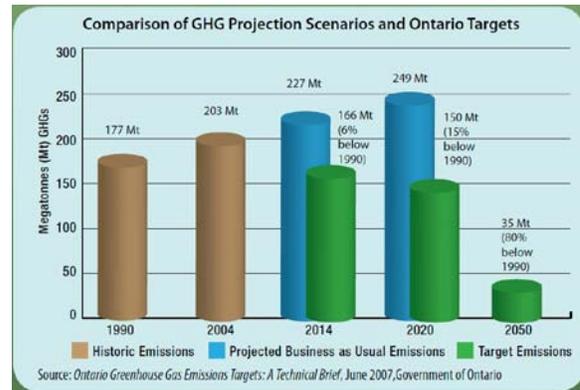
<b>Economic resources</b>	<i>financial capital</i> such as savings and investments
	<i>built capital</i> such as infrastructure and machinery
<b>Social resources</b>	<i>human capital</i> such as knowledge and training
	<i>social capital</i> such as relationships and institutions
<b>Environmental resources</b>	<i>natural capital</i> such as natural resources and ecosystems

and developing stronger public health services to promote healthy living and protect our communities from health threats.

Making the right decisions to build sustainable communities, while entirely desirable, is no simple feat. With the uncertainty involved in making long range climate predictions and the sheer number of partners needed to address this global issue, the ideal course of action is hardly evident. Despite the uncertainty, it is clear that two broad types of action are necessary: actions to reduce greenhouse gas emissions (mitigation) and actions to manage those effects of climate change that we cannot eliminate (adaptation). Taking decisive action to meet and surpass current greenhouse gas emissions reduction goals is necessary if we are to slow global warming and the associated negative impacts. Despite greater international attention to the climate change issue resulting in multinational agreements and carbon reduction policies, global emissions have grown by 25% since the turn of the century, exceeding the worst case scenario predictions of the international Panel on Climate Change (Field et al., 2007). As a result, scientists, governments and communities have been forced to consider how we are to adapt to the unavoidable effects of climate change. Adaptive capacity is the term used to describe the ability of a community or organization to adapt to climate change (Smit et al, 2001). The most common indicators of adaptive capacity include a community's economic resources, access to technology, skills, and information, and the preparedness of institutions and infrastructure. Municipalities must actively engage increasing adaptive capacity so that our businesses, neighbourhoods, and infrastructure are less vulnerable to the effects of climate change.

There is no question that Canada needs to do more to tackle climate change. Despite signing and ratifying the Kyoto Protocol and pledging to reduce emissions to 6% below 1990 levels, Canada has not lived up to its international obligation. Canada's now annually emits 747Mt of greenhouse gases, which is 32% higher than were previously pledged to emit by 2012 (Au et al., 2009). Our performance is even worse when emissions are calculated on a per capita basis: Canadians emit 22.6 tonnes per year, which is the second highest per capita rate of all OECD countries (Au et al., 2009; Conference Board of Canada, 2010). Ontarians expect their governments to take meaningful steps to address climate change. Despite the recent economic downturn polls have confirmed that the majority of Canadians (64%) believe "environmental initiatives should remain as high a priority as the economy even as the economy weakens" (Harris Decima, 2009).

Climate Change mitigation has begun in Ontario. In 2007 the Province set aggressive targets for greenhouse gas reduction, mandating a drop of approximately 30 megatonnes by 2014, and 50 megatonnes by 2020 (Province of Ontario, 2008). The elimination of coal burning electricity plants and working towards a cap and trade system for regulating greenhouse gas emissions figure prominently in the Ontario plan, however, municipalities have a significant role to play if the Province is to be successful in reaching these goals. Municipalities exert direct or indirect control over approximately 44% of greenhouse gas emissions (FCM, 2009). As a result, any meaningful provincial climate change plans must be done in collaboration with municipalities if they are to achieve meaningful results.



Ontario has also begun to address climate change adaptation with the creation of the Expert Panel on Climate Change Adaptation in 2007. The Panel issued a report in November 2009, making 59 recommendations on how to increase climate resiliency in Ontario. The Expert Panel highlights the important role municipalities will play in climate change adaptation, noting that developing the “adaptive capacity of communities is indispensable.” (Expert Panel, 2009, p. 58). Many of the Panel’s recommendations, from developing storm water management master plans to enhancing emergency management, will be implemented by municipalities (for further information see AMO’s response to *Adapting to Climate Change in Ontario: towards the design and Implementation of a Strategy and Action Plan*).

The Environmental Commissioner of Ontario has also identified municipalities as partners in the province’s climate change strategy. The Environmental Commissioner is charged with evaluating the Province’s progress towards meeting Ontario’s climate change targets and in his annual progress reports he has noted that the Province will not achieve the short- or medium-term targets based on the current efforts. A key criticism of the Commissioner is the lack of transparency and delineation of roles and responsibilities. Following the Commissioner’s report AMO committed to produce a policy paper providing an analysis of municipalities’ role in helping the Province to achieve climate change mitigation

and adaptation goals. Accordingly, the focus of this paper will be to develop an approach that will harness the unique attributes and creativity of municipalities to address climate change in Ontario.

## 2.2. Predicted Effects of Climate Change

A changing climate is expected to change both average and extreme weather conditions in Ontario. Even with significant progress towards a low-carbon society, we can expect to see changes in annual temperature and precipitation averages. In addition, there will be an increase in the frequency and intensity of extreme weather events. Changing averages and extremes present challenges to municipal planning and infrastructure, and as we begin to experience more significant climate change effects, our communities will become increasingly vulnerable. These changes represent a significant threat to Ontario municipalities' natural and built capital, which will have repercussions on our economic, environmental and social sustainability. As indicated in the Expert Panel's report to the provincial government, downscaled climate modelling at a greater resolution than currently available will be required to allow communities to develop region-specific adaptation plans, however, there is now information available indicating the broad types of climate effects that will affect us in the coming decades (Expert Panel, 2009). A review of some of the most significant consequences expected for the province of Ontario follows.

### *Temperature & Precipitation*

The average temperature and precipitation amounts are expected to increase in the coming decades, with higher average temperatures predominantly occurring during the winter months (Chiotti & Lavender, 2008). Heat extremes during the summer are expected to occur more frequently; the number of days reaching over 30°C will more than double by the year 2050 (Hengeveld & Whitehood, 2005). Modelling for precipitation indicates that moisture levels will vary by season. In general, winter and spring precipitation is projected to increase by as much as 20% in northern Ontario by 2050, while a slight decrease in summer and fall precipitation of up to 10% is expected in southern Ontario (Chiotti & Lavender, 2008). There is also expected to be greater variation in regional precipitation due to the Lake Effect. Lake Effect precipitation is created by moisture evaporating from the Great Lakes and falling as rain or snow on southern and eastern Ontario. Lake Effect snow is expected to increase over the first half of the century, but will gradually be replaced by heavy rainfall events in the latter half of the century (Chiotti & Lavender, 2008). These general temperature and precipitation trends will have significant ramifications on the natural and human environment.

### *Increased Frequency & Severity of Storms*

Windstorms, tornadoes, floods, hailstorms, and ice storms all have a significant impact on communities, destroying crops, causing property damage, overloading stormwater and other municipal systems, and in the most tragic situations, costing human lives. Severe weather events have been increasing in their frequency in recent decades: from an average of two to four events per year to an average of twelve per year in the last decade (McBean, 2006). In addition, we are experiencing unprecedented weather events such as the 1998 ice storm, which was one of the 30 largest loss events of any type ever recorded by the insurance industry worldwide (ICLR, 2010). The storm, which struck Ontario, Quebec, New Brunswick, and Nova Scotia caused over \$5.4 billion of damage and took the lives of 28 people (Lemmen, Warren, & Lacroix, 2008). Because climate change will increase the risk of weather related emergencies, it is likely these severe events will cause problems that are unanticipated in current municipal emergency management plans (Expert Panel, 2009). For example, the June 6th, 2010 tornado caused serious property and crop damage in Leamington and indicated a gap in the severe weather warning system (Globe and mail, June 6, 2010). Extreme precipitation poses serious risks to municipalities' built capital, most significantly overloading sanitary and stormwater systems which can cause flooding and road washouts and damage to homes. More intense periods of precipitation represents a significant concern for the municipalities, property owners, and the insurance industry in the face of mounting claims resulting from flooding and water damage to homes and properties (ICLR, 2009). Extreme rainfall can also have serious economic and environmental effects outside of the urban environment, for example, high levels of precipitation in short periods can cause tailing ponds capped with water to overflow, releasing contaminants into the surrounding areas (Chiotti & Lavender, 2008).

### *Water Levels*

Changes to the water level in the Great Lakes are expected to be one of the most significant climate change impacts for the Province of Ontario (Chiotti & Lavender, 2008). This has serious implications for Ontarians given that 98% of the population lives in the Great Lakes basin (Expert Panel, 2009). While greater amounts of precipitation are predicted, higher temperatures and reduced ice covering are expected to combine to cause increased evaporation leading to lower water levels (Mortsch, 1998). The lower lake levels can have myriad effects. For example, the lower levels will reduce the depth of navigation channels and could force container ships to carry less cargo; as lake levels drop, docks and harbours will also become inaccessible (City of Toronto, 2008). This may also increase pressure for dredging of navigational channels (Expert Panel, 2009). Lower water levels have the potential to reduce hydro-electric capacity by an estimated 1,160 Megawatts (Expert Panel, 2009). This has already

occurred in British Columbia, where in 2002 the province was forced to purchase electricity as a result of hydro-electric generation capacity lost due to low water levels (Wheaton et al., 2005). In addition, higher water temperatures and lower water levels will combine to cause water quality and supply issues including water contamination, loss of capacity to provide water, and algal blooms (Expert Panel, 2009). For example, in 2001-2002 the severe drought that affected a number of Canadian Provinces including Ontario had a twofold effect on municipal water supplies: surface water and reservoirs were lowered by the lack of precipitation, while demand for water increased as a result of irrigation needs for agricultural crops (Wheaton et al., 2005). These threats and demands can spark resident demands for increased treatment and the development of new water supply systems.

### *Eco Systems*

Water level reductions are expected to threaten shoreline habitat and wildlife in the Great Lakes basin, which is home to over 3500 plant species and 250 types of fish (Field et al., 2007; Expert Panel, 2009). Changes in biodiversity attributed to our changing climate such as the reductions or extinction of cold water fish like the mottled sculpin in the Upper Grand River Watershed have already been noted (Expert Panel, 2009). Researchers believe climate change effects are responsible for the sharp decline of snake populations in a number of different countries (Reading et al., 2010). This loss of natural capital is also a threat to human capital: the decline may lead to booming rodent populations and an increase in vector-borne diseases due to the predatory relationship of snakes and rodents (Reading et al., 2010). While research has been conducted examining the effect of temperature and precipitation changes on Ontario's forests, the complex mix of factors that make up a forest's climate envelope make predicting the fate of a forest type extremely difficult. However, some scenarios project impacts as wide ranging as a decrease in the growth rate of commercially harvested species, the northward retreat of the boreal forest, or the loss of vulnerable and rare species in the deciduous forest of south-western Ontario (Expert Panel, 2009). Despite the uncertainty regarding how the different effects will interact, there is agreement that regardless of the scenario, species that have high migratory rates and earlier reproductive maturity will dominate the forests at the expense of the current biodiversity in Ontario's natural environment (Browne & Hunt, 2007). These changes could spell significant changes in the types and patterns of predators, diseases, and invasive species.

### *Air Pollution*

Greenhouse gases and other emissions from electricity generation and the transportation sector are two of the biggest sources of pollutants that cause air quality issues in Ontario. Concentrations of nitrogen

dioxide, ozone, carbon monoxide, and fine particulate matter cause irritation to the eyes and respiratory system (Chiotti & Lavender, 2008). Air pollutants can worsen pre-existing cardiopulmonary conditions, and chronic exposure can lead to premature death (Air Quality Ontario, 2008). Despite gains in air quality expected from eliminating coal-fired electricity generation, Ontario can expect air quality problems to continue because a significant amount of pollutants enter Ontario from the United States. Anthropogenic temperature increases as a result of climate change will also compound the adverse health effects of air pollutants because hot and humid conditions exacerbate the ill effects of both ozone and fine particulate matter (Air Quality Ontario, 2008). These health effects will erode human capital and carry a financial cost in the form of increase acute and long-term health care expenses. Additional erosion of financial capital is possible from the agricultural sector because air quality issues can affect plant growth, causing reduced agricultural yields and crop losses (Chiotti & Lavender, 2008). As a result, agricultural and forestry profits, as well as urban greening initiatives may be affected.

### *Public Health*

The combination of the various predicted effects on our natural surroundings will translate into stresses on public health. As noted above air pollutants effect on human health is well documented, and is exacerbated by hotter and more humid days. The Ontario Medical Association estimated that air pollutants contribute to 5800 deaths and 16,000 hospital admissions in a single year. In a review of existing research in the field, scientists note that increased allergic disorders such as asthma, and increased incident of cardiopulmonary disease, as a result of climate change (McMichael, Woodruff, & Hales, 2006). Higher temperatures and heavy precipitation also combine to increase the spread of water-borne diseases (Thomas et al., 2006). The potential for insect-borne diseases is increased given longer warm periods allowing for greater population growth and migration in these vectors (City of Toronto, 2008). Heat extremes can also have a serious impact on health resources in Ontario. Researchers have documented an increased mortality rate and a 10% increase in ambulance calls during heat extremes in Toronto over only a four-year period (Dolney & Sheridan, 2006). Heat extremes present a significant challenge to public health agencies in southern Ontario given that Environment Canada predicts there will be double the number of days where temperatures exceed 30°C in the GTA by 2050 (Expert Panel, 2009). The IPCC also notes that certain strains of the West Nile Virus require higher temperatures, and are therefore more likely to spread in Canada as a result of climate change (Field et al., 2007). The IPCC have predicted an increased vulnerability to extended drought across all of North America which can create food security concerns (Field et al., 2007). For example, the drought of 2001-2002 caused a drop of \$3.6 billion worth of agricultural production in Canada (Wheaton et al.,

2005). This stressor is particularly troubling considering recent droughts such as those seen in 2001-2002 can affect all growing regions in the country.

### *Economic Impact*

Because of the intertwined relationship of the three pillars of sustainability, No sector of the economy is safeguarded against the environmental effects of climate change. The potential for damaged crops, forests, and infrastructure will increase business costs and lost economic activity. In addition, the large fluctuations in energy costs experienced over the past decade are predicted to continue and are poised to exert significant economic pressure on municipalities who do not reduce their carbon footprint (Rubins, 2009). Economic impacts will likely be felt most acutely by northern, remote and aboriginal communities. The detrimental effect of stresses on the forest ecosystem, permafrost deterioration, coastal erosion, and changing sea-ice conditions threaten the natural, economic, social sustainability of these communities (Lemmen, Warren, & Lacroix, 2008). For example, forestry-based businesses provide approximately 67,000 jobs to Ontarians and the sector contributes \$18.3 billion annually to our economy (Expert Panel, 2009). Warmer and shorter winters have permitted the spread of the mountain pine beetle into the eastern Rockies, increasing the likelihood of an infestation that could cause similar devastation as was seen in the British Columbia pine forests. The loss of conventional forestry industry would be an enormous economic and social upheaval in many Ontario communities. Even if the worst case scenario is avoided in Ontario forests, costs in the forestry sector will likely increase as a result of increased need for fire suppression, additional pesticide treatments, and reduced winter harvesting seasons (Browne & Hunt, 2007). The northern Ontario tourism industry must grapple with the fact that climate change will negatively affect its two main draws: snow and ice conditions and biodiversity. Participation decreases are expected in snowmobiling, skiing, ice fishing, and skating (Browne & Hunt, 2007). The risk to tourism operations is not only concentrated in northern Ontario: snow making costs may double for ski hill operators by 2050, which could jeopardize the financial viability of some facilities (Browne & Hunt, 2007). Some marquee winter events may have to be rescheduled or cancelled; this has already occurred in Ottawa where Winterlude is now scheduled over three weeks to minimize risk of cancelling events for lack of cold weather (Expert Panel, 2009). Some summer tourism attractions including golf courses and wineries may benefit from longer warm seasons, however they could also face increased irrigation costs and greater risk of damage from severe storms (Expert Panel, 2009). Extreme precipitation either in the form of rainfall or snowfall can cause serious disruptions to transportation networks. For example, a June 2002 storm in north-western Ontario washed out both the Trans-Canada Highway and the CN rail bed, cutting off land transportation and costing over \$30

million to repair the damage (Chiotti & Lavender, 2008). This estimate did not include the loss of economic activity caused by the disruption of freight along the corridor. Similarly, the August 2005 rainstorm in Toronto washed out a section of Finch Avenue, disrupting vehicular travel, natural gas pipelines, water mains, electricity transmission, and telecommunications lines. Insured losses totalled over \$500 million (Chiotti & Lavender, 2008).

### 2.3. Policy Landscape

Despite these threats to our environmental, economic, and social sustainability, there has been insufficient government response to climate change. With such wide ranging effects, the climate change issue touches all areas of public policy and spans all three orders of government. In part due to the diversity of municipalities and the direct relationship they share with residents municipalities have been on the leading edge of initiatives to reduce emissions and adapt to climate threats. The stark reality of the situation is that municipalities do not have the resources to address climate change alone. Concerted support from both the federal and provincial governments is required to move forward on the climate change action developing in Ontario municipalities. Without significant investment of funds and technical resources municipalities simply cannot take on climate change action plans in addition to the full spectrum of services they already provide to citizens.

There is research investigating the specific barriers faced by municipalities when addressing climate change issues; in 2005 Pamela Robinson and Christopher Gore conducted a review of municipalities across Canada to gain insight into the barriers to municipal climate change action. This analysis identified three themes: that municipalities lack the funds and staff to adequately tackle the issue, that municipalities lack sufficient information to identify and implement effective action, and there that is difficulty establishing climate change as a council priority.

Certainly, financing large initiatives is always a challenge for municipalities. While a comprehensive response to the climate change challenge will involve many different approaches, infrastructure investments will be central in mitigating and adapting to the effects of climate change. Even without climate change considerations, municipalities face intense financial demands to address the current infrastructure deficit. A 2008 infrastructure review conducted by AMO, the City of Toronto, and the Province of Ontario found that \$60 billion dollars in additional spending would be required to compensate for deferred investments and match development growth (AMO, Province of Ontario, &

City of Toronto, 2008). Based on this funding gap, concerted climate change action will not be possible without new revenue sources for Ontario municipalities.

Federal research into climate change action in Canada has found that access to knowledge, data, and decision support tools is a key obstacle to effective climate change action (Lemmen, Warren, & Lacroix, 2008). In reviewing the tools available to municipal staff and councillors AMO's Climate Change Task Force noted that there are many sources of information on climate change available from government, industry and the non-profit sector. Most municipalities in Ontario do not have dedicated climate planning staff and do not have the expertise or time to sort through the volumes of information available. The task force has recommended the development of a single window for reliable climate change information that can be accessed by municipal decision-makers. Having a trusted resource for relevant and local government oriented climate change information would significantly reduce the difficulty municipalities face in planning climate change initiatives. Another approach that will be key to reducing barriers to climate change action will be inter-municipal cooperation. Municipalities across the province will need increase the use of partnerships, sharing economic, human, and knowledge resources to maximize the effectiveness of climate change initiatives.

Encouragingly, there are climate change funding and capacity building initiatives in other Canadian provinces. For instance, the Province of Manitoba providing funding to 8 municipalities over a four-year period under the 2009 Community Led Emissions Reduction Pilot Program (Province of Manitoba, 2009). The participating municipalities are currently implementing the program which includes establishing an emission inventory, setting emission reduction goals, and implementing programs to reduce emissions. The Manitoba program is an excellent example of a strategic approach to funding climate change initiatives at the municipal level because it incorporates community input and emission inventory analysis to target the most appropriate and effective measures for each municipality. The program could be enhanced by expanding its scope to include vulnerability assessments and funding for climate change adaptation initiatives at the local level. Quebec has operated a funding program for municipalities seeking to minimize their exposure to natural disasters, including climate change impacts. The initiative has provided over \$55 million to municipal projects that have addressed risks from coastal erosion, flooding, and landslides (province of Quebec, 2008). Nova Scotia recently announced a similar fund devoted exclusively to innovative adaptation initiatives. Municipalities and other community or research groups are eligible for up to 100% of the cost of programs that increase adaptive capacity in the province (Province of Nova Scotia, 2010). While the financial contribution made by the government of

Quebec is significant, it is not dedicated exclusively to climate change action, and neither provinces adaptation programs make use of climate modelling to target initiatives that will yield the greatest increase in adaptive capacity.

The types of action that municipalities will take, and the manner in which they undertake climate change action will be shaped in part by the policy landscape that surrounds them. The remainder of this section will briefly introduce some of the key organizations and initiatives which will play significant roles in municipal climate change action in Ontario.

### *Regional Mitigation Initiatives*

The Regional Greenhouse Gas Initiative (RGGI), an assembly of 10 states from the north-eastern US, established a cap on carbon dioxide emissions from electricity generation in January 2009 (RGGI, 2009). The cap, or total emission allowances on carbon dioxide emissions, is set by the RGGI and one-ton allowances are auctioned four times a year to the energy sector. Proponents of cap and trade regimes argue that they are more effective and manageable than carbon tax initiatives because the regulator only has to set the cap, and the market determines the price of emissions through allowance auctions (RGGI, 2009). At the last auction, held in March 2010, the price for a one-ton allowance was \$2.07, with the revenue generated by the auctions used to fund energy efficiency programs for consumers and to develop green energy projects (RGGI, 2009). The RGGI is a modest proposal, applying only to electricity generation and targeting only a 10% reduction by 2018. In addition, some critics argue that the current allowance price is too low to provide sufficient incentive for energy producers to adopt more efficient, low-emission power generation technology (Centre for American Progress, 2010). However, the RGGI holds promise as a successful example of a market mechanism for including the cost of greenhouse gases into emission-generating economic activity.

The RGGI is not the only North American cap and trade initiative. Ontario and three other Canadian provinces have partnered with seven states to form the Western Climate Initiative (WCI). The group was established to develop regional targets for reducing greenhouse gas emissions, and are focused on developing an inter-jurisdictional cap and trade system (Western Climate Initiative, 2010). The WCI is currently engaged in benchmarking emissions of various industry sectors, and developing policy that will coordinate the partners with the US Environmental Protection Agency and other cap and trade initiatives (Western Climate Initiative, 2010). WCI's cap and trade allowance system is scheduled to take effect January 2012 and with full implementation by 2015. The system will apply to most industries,

covering 90% of greenhouse gas emission sources (Western Climate Initiative, 2010). The WCI stands to provide a landmark tool for reducing greenhouse gas emissions in North America.

### *National Climate Change Action*

As noted above Canada will not meet its emission reduction commitment made under the Kyoto Protocol. In place of meeting the 6% reduction in greenhouse gases from 1990 by 2012, the federal government's current target is a 17% reduction from 2005 levels by 2020, which is "completely aligned with the U.S." (Government of Canada, 2010). While there has been little success on the national level of reducing emissions, the federal government has been engaged in other successful initiatives including the Ecoenergy Program for building retrofits, the national emissions inventory, and the climate change adaptation initiative (Government of Canada, 2010).

### *Green Energy & Water Opportunities Acts*

These two new pieces of legislation will have a significant effect on municipalities and climate change action in Ontario. The *Green Energy Act* received royal assent on May 14, 2009 and is designed to encourage the development of green energy projects, encourage energy conservation, and promote the growth of green collar jobs. The bill has significant implications for municipalities as it requires them to develop energy conservation and demand management plans. Municipalities are also permitted to operate small power generation facilities without incorporating as a utility. Developing low-carbon alternatives to fossil-fuel-based power generation and reducing electricity use will be important steps in mitigating the effects of climate change. The *Green Energy Act* takes some important steps towards building a greener, more climate friendly energy sector in Ontario but municipalities still struggle with the same lack of staffing, technological, and capital budget challenges as they had before the act. The *Water Opportunities and Water Conservation Act* which received first reading on May 18, 2010 intends to establish a framework to drive innovation, create economic opportunities, sustain water infrastructure and conserve Ontario's water. If passed, the Act will require new water sustainability plans for water, wastewater, and stormwater services which will include asset management, financial planning, conservation, risk assessment, and water technology procurement components. The Act also allows the Province to set new performance standards which could include new conservation targets and water technology specifications. The measures in the *Water Opportunities Act* have the potential to improve climate change adaptation and mitigation in Ontario municipalities. By reducing total consumption levels municipalities increase their adaptive capacity in terms of protection from adverse effects of low water levels and drought. For example, by improving water conservation municipalities

can increase their adaptive capacity to drought, while at the same time reducing energy consumption and emissions.

#### *Climate Change Organizations*

The Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR) is billed as a resource hub for researchers and stakeholders, and one of their strategic priorities is to develop climate change adaptation tools for Ontario municipalities. OCCIAR is led by the co-chair of the Expert Panel on Climate Change Adaptation, Dr. David Pearson, and has already established itself as a reliable source for up-to-date and relevant information for communities seeking to address information barriers. OCCIAR, in conjunction with the Clean Air Partnership, has been selected by the Province of Ontario to run its climate change outreach program, the Community Adaptation Initiative. OCCIAR is also involved in the Ontario Regional Adaptation Collaborative established by the Federal Department of Natural Resources to reduce risk and capitalize on the opportunities presented by climate change. In these capacities, OCCIAR will be a key resource for Ontario municipalities in developing and implementing climate change action plans.

#### *International Council for Local Environmental Initiatives (ICLEI)*

ICLEI is an international association of local governments who provide technical consulting, training, and information services to assist municipalities fight climate change and become more sustainable (ICLEI, 2008). The Canadian Branch of ICLEI has developed a number of resource guides and toolkits addressing topics such as moving towards sustainability and transportation demand management. ICLEI has also developed a protocol for accurately quantifying municipal greenhouse gas emissions and in late 2010 will be piloting the development and implementation of climate change adaptation action plans in 15 Canadian municipalities. The process involves guiding the municipalities through the five milestones outlined in their recently produced document *Changing Climate, Changing Communities: Municipal Climate Adaptation Guide and Workbook* (ICLEI Canada, 2010). ICLEI Canada also provides consulting services and has assisted municipalities with tasks such as greenhouse gas emission inventories, energy and emission audits, and quantifying the benefits of emission reduction. The organization constitutes a valuable repository of professional and expert information for municipalities tackling climate change and sustainability issues.

#### *Federation of Canadian Municipalities (FCM)*

FCM is the national member-based organization representing municipalities from all provinces and territories across Canada. The organization plays host to a number of initiatives to assist municipalities including the Centre for Sustainable Community Development. The flagship program of the Centre for Sustainable Community Development is the Green Municipal Fund which provides grants and low interest loans to municipalities undertaking brownfield, energy, transportation, waste, and water projects. The centre also hosts a sustainable communities' conference, providing a forum for the exchange of ideas and expertise on the latest developments in sustainable community policy and practices.

### *Gas Tax Programs*

Gas tax revenues represent a significant source of revenue dedicated to increasing the sustainability of municipal governments in Ontario. Between 2005 and 2014, the federal government will provide over \$4B to Ontario municipalities and has made a commitment to making the program permanent. The program is intended to provide a stable source of funding for environmentally sustainable infrastructure, and capacity building projects. AMO administers the program to all municipalities in Ontario, with the exception of Toronto, on a per capita basis, and municipalities may use the funds for projects that fall into any of the following categories: public transit, water, wastewater, solid waste, community energy systems, capacity building, or roads, bridges, and active transportation. The Province of Ontario also provides a gas tax program for municipalities with a public transit service. The program provides two cents a litre to municipalities and is allocated based on ridership and total population levels.

### **Municipal Spheres of Climate Change Action**

Local governments have been recognized as a driving force in climate change mitigation and adaptation, taking on a wide range of initiatives to reduce carbon footprints or increase the adaptive capacity of communities. Projects have been undertaken by AMO members in all major areas of municipal service delivery and operation, and address both mitigation and adaptation challenges. Because many municipalities are already focused on sustainable community development, some municipalities have identified the threats posed by climate change and made significant strides towards developing comprehensive climate change action plans. For example, the Region of Durham has established a climate change round table to coordinate their climate change initiatives. The Region has a number of environmental initiatives already underway and has now completed an emissions inventory necessary to prepare a strategic plan for reducing emissions (Region of Durham, 2010). The Town of Caledon has had

an environmental progress plan in place since 2005, focusing on seven strategic priorities including climate change. The town has completed and subsequently updated an emissions inventory, regularly reporting on progress made towards achieving the plan's goals (Town of Caledon, 2009). To provide a better perspective on municipal climate change action in Ontario we highlight below some of the most pressing challenges that lie ahead, and some of the innovative approaches Ontario municipalities have taken to tackle specific climate challenges.

#### 2.4. Energy

##### *The Challenge:*

The generation of electricity from fossil fuels is a major source of greenhouse gas emissions and the municipal sector is one of the highest energy users in the province. The financial and environmental sustainability of our communities will be dependent on developing local, renewable and green sources of electricity generation. Providing energy-intensive services such as water and waste water treatment, street lighting, and recreation centres leads to electricity costs of over \$680 million a year for municipalities in Ontario (IESO, 2010). Many of these services are at the core of what municipalities do, so finding more efficient and less carbon dependent ways of providing these services will play a key part in municipalities' mitigation plans. Electricity demand pressures are also a significant climate change adaptation challenge. With greater extreme heat episodes, and a general trend towards increased energy consumption we can expect a greater vulnerability to frequent electricity shortfalls and brownouts (TRCA, 2010). Compounding this issue is the predicted drop in water levels which is expected to reduce hydro-electric generation capacity (Expert Panel, 2009). Energy conservation and distributed renewable energy projects can greatly assist both mitigation and adaptation measures.

##### *Opportunities:*

Local Authority Services (LAS), a wholly-owned subsidiary of AMO has developed a three dimensional energy performance benchmarking framework that assesses facility energy use from technical, management, and organizational perspectives. The summary report, released in the spring of 2010 revealed significant opportunities for conservation gains in all three areas (LAS, 2010). Encouragingly, many of the efficiencies can result in financial savings for municipalities and some do not require extensive and expensive facility retrofits. It should be noted that energy performance management does not preclude gaining efficiencies from infrastructure investments in existing facilities. For example, the City of Kingston has engaged in a \$3.4 buildings retrofit project including lighting, water, heating and cooling, building envelope, and automated control systems. The project involves 38 buildings and the

energy efficiencies created are expected to contribute towards the city's goal of reducing greenhouse gas emissions by 25% (City of Kingston, 2010). The combination of three dimensional energy performance management and energy retrofits holds much promise in helping municipalities reduce emissions resulting from energy consumption. LAS also offers sophisticated monitoring software (Energy Management Tool), energy planning software (Energy Planning Tool), and a solar photovoltaic program to help Ontario municipalities develop complete local integrated energy management regimes. The Federal government and provincial energy ministers have also been promoting Integrated Community Energy Solutions (ICES; Council of Energy Ministers, 2009). ICES is a holistic approach to considering energy sources and demand within a community. ICES is premised on incorporating principles of efficiency, strategic use of passive and waste sources of energy, and land use planning to maximize energy use and it is estimated that ICES has the potential to cut greenhouse gas emissions in half (Council of Energy Ministers, 2009).

Increasing the capacity of smaller scale green energy generation facilities an effective way to enhance the adaptive capacity of the power grid, creating a more diffused green energy generation system will not only of benefit in terms of reduced reliance on fossil-fuel-based electricity generation, but it will also increase Ontario's adaptive capacity. Spreading production capacity decreases the likelihood and severity of service disruption.

## 2.5. Water

### *The Challenge:*

A number of climate change impacts noted above adversely affect our water resources. Increasing temperatures and reduced ice cover cause greater evaporation from lakes and watersheds and increase the likelihood of algal blooms and water contamination (Expert Panel, 2009). These risks can be exacerbated by discharge from wastewater systems and could affect potable water resources in Ontario (Expert Panel, 2009). Already, municipalities such as the city of Guelph are dealing with demand for water that outstrips the municipal supply. Part of the challenge faced by municipalities is the paucity of water data in areas that include the location potable water reserves, the severity of water availability issues, and present and future demand forecasts (Globe and Mail, May 27, 2010). The other significant challenge facing municipalities will be upgrading already aging sanitary and storm sewer systems to deal with new precipitation patterns. The sustainability the water system is of paramount importance to the long term health of a community. Increasing the adaptive capacity of vital water management systems

will be critical as extreme weather events become more frequent and intense, causing significant damage through washouts and flooding.

*Opportunities:*

There are substantial gains to be made in water conservation. The recently introduced Water Opportunities Act, if passed, will establish the Water Technology Acceleration Project designed to encourage the adoption of new water treatment technologies (Province of Ontario, 2010). The project holds great potential for municipalities to take advantage of the development and commercialization of innovative water management techniques and technologies. There is no question that water conservation could be improved through more widespread adoption of newer technologies. For example, the installation of high efficiency toilets in households in the Great Lakes basin area would conserve 213 billion litres of water a year (Environmental Defence, 2010). Because the treatment of water as it enters and leaves municipal systems represents the single biggest energy use by municipalities, gains in water conservation are accompanied by greater energy efficiency, and therefore lower greenhouse gas emissions. It should be noted that these conservation results should also be counted as greenhouse gas offsets in future cap and trade systems, to reflect the gains made from avoiding the energy consumption.

Some municipalities have already embraced new technologies to improve the efficiency of their water systems resulting in significant savings in environmental, financial and built capital. Both Thunder Bay and the Region of Halton employ electronic leak detection systems to identify and repair leaks in the water distribution network. In the case of the Halton system, the savings from reduced water loss allowed for the deferral of a planned expansion in the water supply (Ontario Centre for Municipal Best Practices, 2006). This saving represents not only an investment in natural capital by limiting the demand for water, but also a huge financial saving for the municipality by avoiding the significant capital and operating expenses that would have been required for an expanded water supply system. Municipalities have also experienced success with user-directed initiatives. For example, the City of Welland has operated a downspout inspection program since 2006. The program achieves a number of conservation and adaptation goals including: reducing the potential for sanitary sewer overload, reducing wastewater treatment costs, improving public education regarding water conservation and treatment, and developing an inventory of stormwater inflows and infiltration sources (City of Welland, 2009). Conservation initiatives will also be important components of climate change adaptation strategies. Reducing inflows into stormwater and sanitary sewer systems increases the ability of the pipe network

to handle higher peak levels. Municipalities such as Kitchener and Waterloo have implemented unit pricing for stormwater services, which educates users about their use of the service and encourages adaptive behaviours by reducing inflows to the stormwater systems.

Some municipalities have already engaged in comprehensive infrastructure planning to increase adaptive capacity due to the impact they have already felt from natural disasters. For example, the City of Peterborough has implemented a Flood Reduction Master Plan, developed after a July 2004 storm which dropped 14 billion litres of water on the city in five hours, shut down the city for 15 days, and caused over \$100 million worth of damage to property (City of Peterborough, 2005). In the review commissioned to examine the disaster, the City learned that while the storm water volumes from the torrential rains more than doubled the current design standards, much of the stormwater system could not handle current capacity requirements which contributed to significant overburdening of the city's sanitary sewer treatment system and increased the risk of flooding during normal precipitation conditions (City of Peterborough, 2005). To deal with the situation the city approved a comprehensive flood reduction action plan including soil, groundwater and pipe inspection regime, watercourse management, environmental assessment, emergency preparedness, sewer maintenance programs and public awareness campaigns. As recommended in climate change adaptation best practices, the action items included in Peterborough's plan are prioritized using a risk assessment system targeting the greatest vulnerabilities.

There is also new research directed toward developing effective tools for incorporating climate change adaptation in infrastructure management. The Public Infrastructure Engineering Vulnerability Committee (PIEVC), a joint project of Engineers Canada and Natural Resources Canada, has developed a protocol for vulnerability assessments, using the water systems of Portage La Prairie, Manitoba as a pilot project (PIEVC, 2007). The five step protocol draws on relevant climate, site, and system information to develop recommendations for data needs and remedial action required. Such protocols are valuable in that they direct the actions of the municipality towards actions that will bear the most increases in adaptive capacity.

## 2.6. Waste Management

### *The Challenge:*

Ontario's waste disposal system is stretched beyond capacity due to population and consumer purchasing growth, lack of capacity for new landfill sites, and regulatory limits on innovative practices

(AMO, 2005). Environmental impacts from waste disposal extend beyond issues within landfills themselves to emissions generated during the production and collection of waste materials, and wastewater generated from processing plants. Emissions from the transportation of waste are compounded because Ontario produces more waste than can be accommodated in local landfills: 4 million tonnes of waste is sent to facilities in the United States from Ontario every year (AMO, 2005). Complicating efforts to minimize waste disposal is the fact that local taxpayers subsidise the cost of disposal of waste through property taxes, and as a result, the full cost of managing waste is not included in market pricing, so the economic pressure to reduce waste is masked (AMO 2005). To be successful, waste diversion must become a closed system that includes the full cost of waste disposal. It also must follow a waste management decision hierarchy, beginning with enhanced product design to reduce waste generation, then product re-use, recycling and composting, and resource recovery options before considering energy-from-waste initiatives landfill disposal options (AMO 2005).

*Opportunities:*

There is enormous potential for climate change mitigation in the waste management sector. The key to improved waste management strategies will be to close material and waste cycles to eliminate, prevent, or significantly reduce the causes of waste (AMO, 2005). Doing so will not only reduce demand for landfill capacity and reduce transportation emissions associated with waste disposal, but it will also cut industrial emissions that would have been generated during the manufacturing of products. Some examples of climate change initiatives through waste management innovation are well underway in Ontario. In 2008 the Province implemented new regulations under the *Environmental Protection Act* which requires new, expanding or large landfill facilities to capture methane, a gas that is released by decomposing waste and is 20 times more potent as a greenhouse gas than carbon dioxide. The City of Guelph currently operates a methane capturing system that has the dual effect of preventing emissions and generating electricity for the power grid. The power plant, operated by the city-owned Guelph Hydro Electric Systems Incorporated is currently generating approximately 2.5 megawatts of electricity a year for region's power grid (Ecotricity Guelph, 2007). Bold and innovative action required, but there is significant potential to achieve climate change action through integrated waste management, resource use, and energy creation.

## 2.7. Planning

### *The Challenge:*

Land-use planning is a fundamental source of greenhouse gas emissions because our energy use and emissions are shaped by the organization of our streets, buildings, and communities. Our built capital has a formative effect on the social and economic interactions within a community, and thus well organized communities reap the social and economic benefits of good land-use planning. Low-density development, characterised by single family dwelling units and low rise development produces approximately two and a half times more greenhouse gas emissions than higher density development (Condon, Cavens, & Miller, 2009). The traditional calculations that formed the basis of development patterns in North America over the past decades have operated on the assumption that walking will only be the preferred mode of transportation for destinations within 600 feet (Garreau, 1992). While that distance can be stretched, for example on vibrant downtown streets or in a shopping mall, developers build under the assumption that trips of a greater distance are preferably made in a car. Furthermore, standard calculations for office development are based on the ratio of 250 square feet of office space to 400 square feet of parking space for each employee. This ratio has resulted in development patterns where 60% of lot space is allocated to parking, compared to only 40% for other building uses (Garreau, 1992). The high energy demands of low-density development do not stem solely from personal transportation patterns. The delivery of essential services is vastly less efficient where development is dispersed, and this holds true for such disparate services as building heating and water services, to mass transit and waste removal functions. If we are to make significant strides to reducing greenhouse gas emissions, then organizing our communities in more efficient development patterns will play a seminal role in a successful action plan.

There are, however, significant obstacles impeding the implementation of carbon-friendly land-use planning. Land-use patterns in existence today are the product of decades of development. The implementation of more sustainable planning policies will necessarily be a gradual and slow acting process, and while in-filling and other changes to existing development can remediate some inefficiencies, these measures are not universally applicable and population patterns may simply not sustainably support the densification of many low-density developments. In addition, local governance models sometimes hinder effective decision-making: while single municipalities can be too small to successfully implement comprehensive climate mitigating planning policies, multi-party and regionally coordinated planning initiatives can face organizational issues which hinder the development of cogent planning policies (Condon, Cavens, & Miller, 2009).

Land-use planning presents significant challenges for climate change adaptation as well. Low-density development translates into increased vulnerability to service disruptions to transmission lines and piped services. Less intensive settlement patterns can also mean development in vulnerable areas such as floodplains, or in ecologically sensitive areas such as waterfronts and native species habitat. Reviews of attempts to incorporate climate change adaptation planning policies have found that municipalities do not have the tools and expertise to identify micro-climatic conditions which are necessary to develop land-use planning that is sensitive to climate change risks (Collins, 2005). The climate change adaptation challenge facing planners and municipal leaders is to incorporate vulnerability assessments into planning documents, to proactively assess high risk areas and restrict development in locations that reduce our adaptive capacity.

*Opportunities:*

AMO is currently collaborating with the Ministry of Municipal Affairs and Housing to develop an educational strategy designed to improve the use and understanding of tools in the Planning Act. The strategy is expected to increase the understanding of planning staff, senior municipal officials, and councils regarding the options and tools available to implement innovative and progressive land-use plans. Land-use planning is an extremely attractive tool because of the myriad ways it can contribute to increased sustainability. In recent years, many of Ontario's municipalities have been incorporating smart growth principles in their official plan reviews. Smart growth principles encourage higher density developments with a greater mix of land-uses than traditional planning, and emphasize greater street connectivity and multi-modal transportation (Smart Growth Ontario Network, 2009). This leads to increases in financial capital due to greater economic activity, but it also increases social capital by increasing the accessibility and social interactions within a community. The city of Brantford has developed a new plan for the downtown core, focusing on an economic resurgence. The plan received an award for planning excellence in 2009 from the Ontario Professional Planners Institute and includes multiple principles of smart growth such as a mix of land-uses, a new transit terminal, and increased density targets (City of Brantford, 2008). The implementation of the plan has not been without controversy, exposing tensions between heritage preservation and development, but the plan represents some bold steps towards sustainable community planning.

As noted in our response to the Expert Panel's report on climate change adaptation, the most appropriate tool for incorporating climate change into the planning context is through official plans. The

City of Welland recently updated their official plan, and incorporated climate change issues in the review process and amended official plan (City of Welland, 2010). The plans strategic directions include the climate change issues in the site area and neighbour design processes. This strategic direction is displayed in specific features of the plan such as increased flexibility in the development approval process to accommodate new energy efficiency features, and requiring the consideration of climate change impacts in secondary plans support studies.

## 2.8. Transportation

### *The Challenge:*

Transportation is the single largest source of greenhouse gas emissions in Ontario, accounting for over 60 Megatonnes annually. As a result, transportation emissions are a prime target of *Ontario's Climate Change Action Plan*. Some of the reductions are being sought from international or regional initiatives, such as low-carbon fuel standards, or more aggressive fuel efficiency standards, but these measures on their own will be insufficient to achieve sufficient reductions in emissions to meet mitigation targets (Province of Ontario, 2007). Reducing transportation emissions must therefore also require passengers to become more efficient, that is, we will need to make far fewer trips in our cars by ourselves.

Unfortunately, this shift is easier to prescribe than to implement. However, personal habits and beliefs are difficult to change, and unsustainable transportation choices are reinforced by an unsupportive built environment dominated by low-density housing developments far from work centres and lack of attractive alternatives to single occupant vehicle trips (ACT Canada, 2006). In his greenhouse gas report for 2010, the Environmental Commissioner emphasizes that public transit simply must become a larger percentage of how we get around if we are to achieve emission reductions in from transportation sources (ECO, 2010). The report also highlights the fact that current funding sources are inadequate, and new sources, ranging from increased federal and provincial funding to fully priced road networks must be considered to bridge the funding gap (ECO 2010). With all three levels of government facing budgetary pressures, it is difficult to leverage funds for transportation solutions and options such as road tolls and lane reductions are contentious proposals that are difficult to obtain consensus on. However, expanded public transit networks are a necessity and funding that expansion represents one of the biggest challenges in achieving climate change action in the transportation sector.

### *Opportunities:*

Transportation Demand Management, an umbrella term for strategies aimed at reducing single occupant vehicle trips, offers some promising tools for reducing transportation related greenhouse gas emissions. Most demand management strategies can be classed into three categories: incentives for active or mass transit, disincentives for single occupant vehicles, or eliminating the need to make some trips (Province of Ontario 2008b). The City of Ottawa has developed a transportation master plan that features transportation demand management as one of four strategic focus areas. The measures to be used to influence transportation demand include compact mixed use develop nodes as the basis for future land-use growth planning, reducing parking requirements, incenting the construction of active transportation infrastructure by local businesses, universal student transit pass programs, intelligent transportation systems strategies to reduce congestion during peak times, and public outreach programs. The commitment of the city to implementing the comprehensive travel plan is clearly demonstrated by the ambitious target of increasing bus trips to represent 30% of all motorized trips by the year 2020 (City of Ottawa, 2003). Municipalities have also been hard at work applying new transit planning techniques to provide more efficient and attractive transit options to commuters. For example, Sarnia reconfigured a series of bus routes linking destinations in the south and east ends of the city, focusing on improving service to new commercial growth and improving connections to existing hubs. The reconfiguration included an increase of only eight additional hours of bus service, but the changes corresponded with a six percent increase in ridership (Ontario Centre for Municipal Best Practices, 2005).

Other municipalities have focused on active transportation to reduce transportation emissions. The City of Hamilton recently renewed their cycling master plan, outlining improvements to cycling infrastructure over the next ten years. The new plan builds upon the previous ten year plan which set out a city wide primary cycling route network. The City boasts an impressive completion rate 75% for projects identified in the original plan and the route network now spans over 400 kilometres, including more than 250 kilometres of routes exclusively for active modes of transportation (City of Hamilton, 2009). The Municipality of Dysart et al and a number of community partners have developed an active transportation plan for the village of Haliburton (Hall, 2009). The plan's goal is to develop built and social environments in the village that enable active transportation decisions. The key features of the plan include way finding tools such as large scale maps placed throughout the village, community initiatives such as the commuter challenge and walk to school week, developing a village walking trail, and identifying priority areas for active transportation infrastructure upgrades (Hall, 2009). The success

of the Active Transportation Plan hinged on recognizing the overwhelming majority of trips to the Village are made in motor vehicles, and focusing on effective ways to facilitate active transportation upon arrival in the Village. These programs are excellent examples of successful active transportation outside of the large urban context.

One opportunity to reduce transportation demand that has been successfully employed by Ontario municipalities is teleworking. The town of Richmond Hill implemented a pilot project in 2001 to test the effectiveness of teleworking and found that it did not affect work quality or co-worker relations (Town of Richmond Hill, 2001). Based on the success of the pilot project, the program was subsequently expanded to other town employees to help the municipality reduce greenhouse gas emissions. Teleworking also offers ancillary benefits to municipalities in that it can increase employee attraction and retention. Researchers have found applicants are swayed by advertisements promoting teleworking policies (Thompson and Aspinwall, 2009), and that teleworking is correlated with increased job satisfaction and improved organizational effectiveness (Peters & Heuskinfeld, 2010). At present, teleworking is not an option in some municipalities as a result of slow internet connections.

While provincial and federal initiatives are in place to address gaps in service, there is considerable progress needed in order to develop a comprehensive high speed internet network in Ontario. Given the numerous benefits to be gained from teleworking programs, the teleworking infrastructure including widespread access to the high speed internet, should be a high priority in Ontario.

## 2.9. Buildings

### *The Challenge:*

As with land-use planning, the stock of existing buildings was not designed and built with climate change issues in mind. Multiple technologies and practices have been developed which can be incorporated into new construction or can be retrofitted to existing housing stock to reduce carbon footprints and prepare for the effects of climate change ranging from solar panel installation and additional insulation, to downspout disconnection and flooding prevention technologies. When carbon pricing is implemented, the financial returns of building retrofits will only increase. With limited funds for such initiatives the challenge faced by municipalities is to assess which changes will bear the highest mitigation and adaptation dividends.

### *Opportunities:*

Retrofitting built capital provides an opportunity for economic investment in built capital which yields returns in natural and financial capital. The energy savings mean reduced operating costs, while at the same time reducing air pollution and carbon emissions. There are promising developments in many areas of new building construction. Environmental design principles are quickly becoming incorporated in the design process through certification programs such as the Leadership in Environmental Design (LEED) system. In addition, The Green Energy Act commits the province to including energy efficiency standards in forthcoming revisions to Ontario's building code, ensuring that new construction in Ontario will include features that reduce carbon impacts.

Municipalities have been actively engaged in building retrofits to reduce building related greenhouse gas emissions and prepare for the effects of climate change. The City of Waterloo conducted a feasibility study and implementation plan for green roofs in conjunction with a demonstration roof constructed on the city hall building (City of Waterloo, 2005). The report identified a number of benefits to green roofs including: energy savings from reduced need for heating and cooling; attenuating stormwater run-off volumes and temperatures, reducing the load on the stormwater system; reducing the heat island effect in the city; and removing air-borne phosphorous and fine particulate matter which contribute to air pollution (City of Waterloo, 2005). The implementation plan included spatial mapping of the areas of the city most likely to require each of the identified benefits of green roofs, and the results were aggregated to develop prioritized locations for new green roofs. The City of Waterloo approach is an excellent example of assessing the strengths and vulnerabilities in a community and targeting projects to address the highest risks and achieve maximum benefits from the investment.

Municipalities have also engaged in retrofit programs to increase the adaptive capacity of the community building stock. The City of Peterborough has implemented a homeowner subsidy program to install backflow valves and sump pumps which substantially reduce the risk of basement flooding during heavy precipitation (City of Peterborough, 2005). The combination of techniques improve the adaptive capacity of the city infrastructure and the homeowner's property in heavy rain falls.

Several American states have enabling legislation allowing for innovative municipal financing of retrofits on private property. Property Assessed Clean Energy (PACE) legislation allows local governments to raise funds through municipal bonds or a financing arrangement with a lending institution. The pool is used to provide loans to homeowners to complete an energy retrofit of their home, and the loan is then

repaid as part of the homeowners property tax bill (Lantz, 2010). PACE initiatives are attractive to municipalities because they provide the opportunity to fund retrofits in the community without requiring a large amount of capital. Citizens benefit from the programs because of the lower rate of interest compared to privately procured loans and the energy savings that accrue, while private sector lenders are motivated to participate because of the repayment security provided by the municipality. Some difficulties encountered by local governments who have implemented PACE initiatives include covering the administrative costs for the programs and quality control issues during system design and installation can either increase the cost of the program or reduce its effectiveness (Lantz, 2010). Property assessment-based retrofit programs, while still a relatively untested tool with some challenges, represent a potential opportunity to leverage private sector capital for climate change initiatives to address municipal funding challenges.

## 2.10. Public Health

### *The Challenge:*

Extreme heat events are the most direct public health threat posed by climate change. Currently an average of 120 deaths per year are heat related, based on climate modelling predictions, the number of days over 30 degrees Celsius will increase leading to a doubling of the mortality rate (Expert Panel, 2009). The ill effects of heat waves are also expected to be magnified by air quality conditions which compound during hot and humid spells (Expert Panel, 2009). Intestinal illnesses can become more common due to the water issues that will occur from climate change. Programs to address these increasing threats will require multiple components including: outbreak containment; reporting, investigation, and documentation of suspected and confirmed cases; public education campaigns; training for emergency preparedness and water systems personnel (Province of Ontario, 2009). Vector-borne diseases will also become a more widespread threat to communities as a result of climate change. The predicted changes in temperature and rainfall will increase the geographic range of both the pathogens and disease vectors resulting in larger areas becoming exposed to infection. While many vector born diseases are not currently a threat to Ontario communities, both Lyme disease and West Nile virus are already of concern to Ontario Public health agencies, and the interconnectivity of goods and people in our globalized economy means we are not isolated from infectious diseases traditionally not found in North America (Githeko et al., 2000). These public health risks are a serious threat to social sustainability and human capital. Vulnerable populations such as the elderly and lower socio-economic status groups are more susceptible to health threats, and pose challenges for effective service provision. Widespread health risks can also weaken social capital and have a negative economic impact through

lost work hours and diversion of funds to emergency and acute health response. In addition, it has been predicted that the effects of climate change could displace as many as 200 million people by the year 2050, which could result in significant increases in refugee applications and placements in Canada (Becklumb, 2010). Municipalities will be forced to consider how to meet the public health, not to mention social and human needs of this population, and consider how to address this challenge. All strategies to address public health challenges must appropriately target outreach and treatment initiatives to reach the most vulnerable populations and minimize the impact on social sustainability.

*Opportunities:*

Ontario Municipalities have developed hot weather response plans to address the increasing prevalence of heat related mortalities. The Region of Peel employs a spatial synoptic classification system, (Clean Air Partnership, 2007). The synoptic classification method is a tailor-made heat classification system that is capable of taking into account a number of meteorological, built form, and demographic characteristics of an area to develop localized warnings. The benefit of the spatial synoptic classification system is that it provides more sensitive data allowing for more targeted response to heat risks that accounts for micro-climatic variations caused by building patterns, and employs changing thresholds based on the location of more vulnerable populations (Clean Air Partnership, 2007). In communities of lower densities where there is less temperature, humidity, and population variation the data sensitivity of synoptic classification systems is not necessary, and a number of municipalities in Ontario, including the Region of Halton and the Municipality of Clarington, have implemented effective heat alert system based on Humidex values (Clean Air Partnership, 2007). Most response plans include issuing media alerts and public officials who work with vulnerable populations, opening cooling centres and extending the operating hours of municipal facilities such as pools and air-conditioned libraries. Some municipalities also provide free access to transit so they can access the cooling centres, and the Township of King waives user fees on municipal pools during heat advisories (Clean Air Partnership, 2007).

Because the health effects of climate change will be felt earlier and with more severity in vulnerable populations, innovative service delivery mechanisms must be considered. For example, the Niagara Health Bus is a mobile community health service, helping deliver services to homeless, vulnerable and geographically isolated populations. The service is staffed by nurses, a nurse practitioner, and a community mental health support worker who provide general health assessments, treatment of minor medical conditions, mental health counselling, (Niagara Region Public Health, 2010). This service

delivery model demonstrates one way Ontario's public health units can successfully target vulnerable populations.

### **3. Recommendation**

As is evident from the sampling of initiatives noted in this report, the breadth of climate change action currently underway in Ontario municipalities is extensive. The motivation to tackle climate change is strong in municipalities and the sector is eager to work with the province to achieve Ontario's mitigation and adaptation goals. However, concerted and comprehensive action from the municipal sector is not possible in the current policy landscape. As noted above, municipalities face an existing infrastructure deficit, representing approximately \$60 billion in deferred investment. As a result, it is not possible to develop new programs and place additional responsibilities on municipalities without increasing this infrastructure deficit gap. In addition, developing effective climate change initiatives requires a high degree of technical expertise and significant staff resources. Based on reviews from the Expert Panel on Climate Change Adaptation and the Environmental Commissioner, climate change policy capacity deficiencies exist most acutely in two areas: the ability to record baseline greenhouse gas emissions, quantify reductions, and monitor subsequent emissions; and the ability to create downscaled climate modelling to produce reliable vulnerability assessments. Compounding the capacity issue is the need for qualified staff to translate climate data into useable information that will inform municipal decision-making, most importantly in areas such as official plans, capital asset management, and transportation planning.

AMO supports some steps taken by the province to date. Developing a provincial climate change action plan and embarking on a strategy to develop a provincial adaptation plan have provided useful and necessary direction. In addition, establishing the Community Adaptation Initiative to spearhead outreach to communities developing adaptation measures is a welcomed resource which should provide some expanded capacity for municipalities in this area. Other funding sources from the province have been applied conscientiously by municipalities to achieve multiple objectives, including reducing emission and increasing adaptive capacity. Unfortunately, these measures alone will not be sufficient to address the funding and capacity issues facing Ontario municipalities.

To this end, AMO recommends the province work together with AMO to develop a program to identify and fund demonstration communities. The purpose of the program would be to facilitate planning and

implementation of climate change action plans in several Ontario municipalities, and showcase the innovation and efforts of the demonstration communities. The municipalities selected as demonstration communities would receive funding and policy capacity support to implement the proposed climate change action plans. This support would come in the form of funding for the development, implementation, and monitoring of comprehensive climate change action plans, as well as technical assistance from climate experts within the provincial government and from partner organizations such as the Community Adaptation Initiative.

To be eligible for the program, municipalities would propose a climate change action plan that integrates a series of measures to achieve reduction of greenhouse gas emissions and prepares the community for the effects of climate change. The climate change action plan must incorporate multiple initiatives addressing both greenhouse gas emission reduction and climate change adaptation measures. Ideally plans would incorporate a variety of approaches to climate change mitigation and adaptation including: enhancement of staff expertise and capacity, infrastructure investments, planning and policy reviews and amendments, community engagement, and public education initiatives.

There are a number of elements that should be included to ensure that the climate change action plans are comprehensive, provide concrete action towards meeting the province's climate change goals, and enhance the sustainability of the communities. First, the plans must be developed using an evidence-based approach including an emissions inventory and monitoring system. This includes establishing quantifiable specific greenhouse gas reduction targets for each initiative. As noted by the Environmental Commissioner, greenhouse gas accounting, in the form of verification and validation, is needed to ensure that concrete gains are being made and accurately reported (ECO 2010). Second, adaptation initiatives must be based on the development of downscaled climate models with sufficiently high resolution to make informed decisions regarding climate risks in the area, and a vulnerability assessment to identify priority areas. It is recommended that the province works closely with Environment Canada to develop these models. Third, initiatives in the action plans should be assessed using a sustainability lens to ensure that in achieving a climate change goal, the program does not erode the economic, environmental, or social capital in the community.

In order to ensure the relevance and applicability of the practices developed in demonstration communities the program participants should be selected to represent the diversity of local government in Ontario. To achieve this applicability, participating municipalities must represent the different regions,

governance models, and population densities found across the province. By including a range of municipalities the program will contribute towards the provincial climate change goals, foster policy capacity within the municipal sector, and ensure that the knowledge, practices, and technologies developed in the demonstration communities will be relevant across all municipalities. In addition, partnerships and cross boundary initiatives should be encouraged as a means of increasing the effectiveness of the climate change initiatives and increasing the impact of the demonstration communities program.

Finally, crucial to the success of the demonstration program is the broad dissemination of the comprehensive action plans. AMO and the Province would work together to promote the process employed to develop a comprehensive climate change action plan in the municipal context and the innovative policies and technologies implemented to reach the goals. The AMO annual conference provides an ideal venue for showcasing the successes of the program and disseminating the information widely among Ontario municipalities. In addition, the Ontario Municipal Knowledge Network, a web-based portal that acts as both a clearinghouse of successful municipal initiatives and a forum for dialogue among municipal professionals, presents an opportunity to disseminate the demonstration community plans. These measures, in conjunction with dissemination through provincial government sources and other education tools including workshops would ensure the best value is achieved from the investment in the Climate Change Demonstration Community Program.

Beyond the development of a demonstration community program, there are some measures that if implemented would bring significant benefits to municipalities in addition to contributing to emission reductions in Ontario. AMO strongly recommends increased funding for public transit across the province. As noted by the Environmental Commissioner, current funding levels and sources are inadequate to achieve real change. In order to increase the modal share of transit, new funding must be made available to significantly expand the number of communities with transit service, and intensify coverage and frequency in currently served communities. Expanded transit service also has the potential to reduce health costs associated with an inactive lifestyle, increase the mobility of the population and generate increased economic activity, fostering each of the three pillars of sustainability. However, without viable alternatives to single occupant vehicle trips, Ontario will be unable to achieve the emission reductions sought from the transportation sector, or the attendant sustainability gains. Similarly, new measures must be implemented to reduce transportation demand. AMO recommends that the province establish a teleworking framework based on widespread access to high speed internet service. Such a framework would provide significant stimulation to Ontario's emerging green economy

while reducing demand on the existing transportation network and therefore reducing greenhouse gas emissions. Without a reliable, high-speed internet network, teleworking is not a viable option in many Ontario municipalities. Training for municipal staff will be essential if municipalities are to develop the necessary capacity required to implement effective climate change action plans. New educational and skill building opportunities for current and future employees should be developed in partnership with educational institutions and technical organizations such as OCCIAR.

#### **4. Conclusion**

Climate change is an unavoidable reality for Ontario municipalities. Many initiatives have been undertaken to reduce greenhouse gas emissions and to prepare for the unavoidable effects of climate change, but much work remains to be done. Among the problems encountered by municipalities in developing and implementing comprehensive climate change are the lack of dedicated funding and the need for expertise and capacity to develop mitigation and adaptation programs. There are many attendant benefits that will be achieved by pursuing climate change action through a demonstration communities program. The program would foster healthier communities, with cleaner air, safer water, and improved transportation options. Municipalities would benefit from sound infrastructure investments which harness energy efficient technologies and are designed to meet the needs of the community in the 21<sup>st</sup> century. Communities would be better protected from natural disasters, prepared to meet the climate stresses approaching, and would be less vulnerable to damage and litigation. The proposed Climate Change Demonstration Communities Program would not only contribute towards meeting the province's climate change goals, but also address funding barriers in the demonstration communities, and enhance policy capacity and expertise across the municipal sector.

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