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perspectives

Reducing Urban Greenhouse Gas

Emissions:

Effective Steering Strategies for City Governments

Sara Hughes

About IMFG

The Institute on Municipal Finance and Governance (IMFG) is an academic research hub and non-partisan think tank based in the Munk School of Global Affairs at the University of Toronto.

IMFG focuses on the fiscal health and governance challenges facing large cities and city-regions. Its objective is to spark and inform public debate, and to engage the academic and policy communities around important issues of municipal finance and governance.

The Institute conducts original research on issues facing cities in Canada and around the world; promotes high-level discussion among Canada's government, academic, corporate and community leaders through conferences and roundtables; and supports graduate and post-graduate students to build Canada's cadre of municipal finance and governance experts. It is the only institute in Canada that focuses solely on municipal finance issues in large cities and city-regions.

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Executive Summary

City governments around the world are pledging to make significant reductions to their greenhouse gas (GHG) emissions, a goal that requires significant changes to urban institutions, infrastructure, and behaviour patterns. Such changes are not easily made, and often fall outside the formal jurisdiction of city governments. However, city governments are taking up this challenge because of the threat of climate change and the opportunity to reap local benefits from GHG emissions reductions.

This paper draws on the experiences of three large cities in North America: Toronto, New York City, and Los Angeles. Each city government has set ambitious GHG reduction targets, and developed programs and policies to reach these targets. While the responses are unique to each city, their experiences demonstrate that if city governments are to successfully meet their GHG emissions reductions targets, they must “steer” their cities: leveraging both their formal and informal authorities as well as a range of interventions and partnerships.

Three steering strategies have proven effective in all three cities:

- **Building and maintaining coalitions:** Coalitions are important for generating buy-in and facilitating implementation. The most effective programs and policies in the three cities are often supported by a broad-based coalition of governmental and non-governmental actors working toward a specific goal.
- **Aligning incentives with capacity:** It is not enough to require action, or even to change incentives. Significantly reducing GHG emissions also requires an investment in capacity-building, data collection, and education so that stakeholders can meet new requirements and standards.
- **Combining institutionalization and innovation:** New ideas, new financial tools, and new standards of practice are necessary to reduce GHG emissions in cities. These innovations need to be embedded into the formal and informal institutions that guide decision-making in cities to ensure continuity and broad adoption.

The experiences of these three cities demonstrate that formal powers and political economic context are not good predictors of cities’ success in reducing GHG emissions. Rather, as city governments confront the complex and long-term challenge of reducing GHG emissions, steering strategies that combine the multiple sources of authority and influence held by city governments will generate the outcomes needed to address climate change.

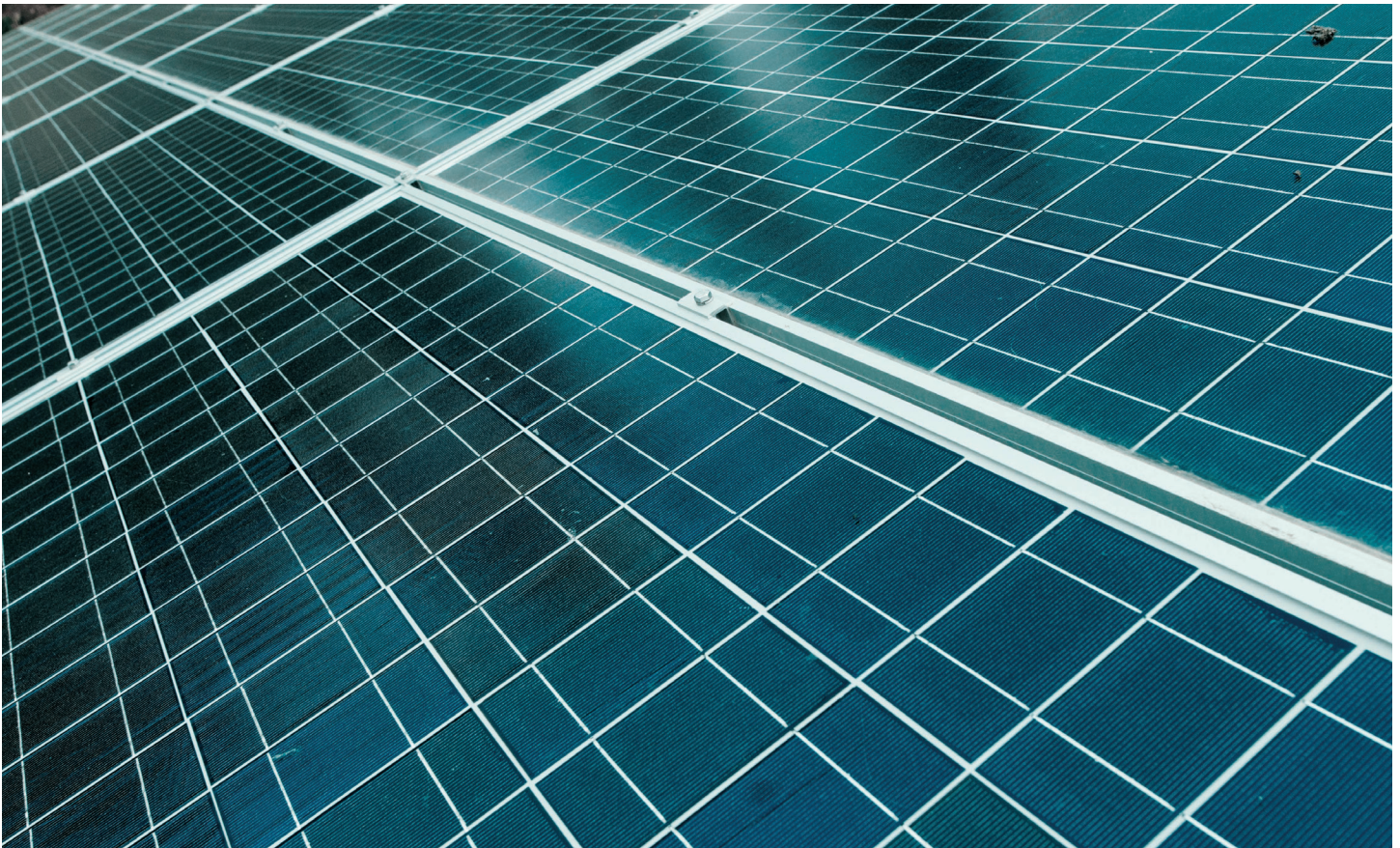


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Introduction

Climate change has become an important policy issue for thousands of city governments around the world. More than 500 cities have joined the global Compact of Mayors,¹ and in Canada alone, nearly 300 cities are members of the Partners for Climate Protection program.² These city governments are setting greenhouse gas (GHG) emissions reduction targets and developing plans to invest in new infrastructure, institutions, and efforts to bring about behavioural change to meet those targets.

In 1988 the City of Toronto hosted the Toronto Conference on the Changing Atmosphere, and in 1990 Toronto became the first city to make a formal pledge to reduce its GHG emissions. This commitment was reinforced with the 2007 plan, “Change is in the Air,” when the city pledged to reduce its GHG emissions by 30 percent by 2020. The city is currently exploring ways to design policies and programs to reduce the city’s GHG emissions by 80 percent by 2050.

Even though climate change is an inherently global problem, there are some explicitly urban dimensions to the problem, particularly with respect to the sources and governance of GHG emissions. Cities are responsible for at least two-thirds of global energy-related GHG emissions

due to their concentration of population and economic activity. Moreover, city governments have jurisdiction over at least one-third of global GHG emissions. In Canada, the Federation of Canadian Municipalities estimates that city governments have direct or indirect control over 44 percent of the nation’s GHG emissions. Cities have also demonstrated that they are capable of taking leadership in the international arena, even as international negotiations have stalled. At the Conference of Parties in Paris in December 2015, city governments were officially recognized as important partners in global efforts to reduce GHG emissions.

However, reducing GHG emissions in cities is a complex endeavour. Three very different sectors contribute the majority of urban GHG emissions:

- energy use in buildings (a function of both energy sources and energy demand);
- transportation;
- waste management.

The relative contribution of each sector can vary significantly between cities. For example, in Toronto, transportation is responsible for 41 percent of the city’s GHG emissions, while in New York City transportation is

responsible for only 21 percent of the total (see Figure 1). This difference matters, because the investments and actions needed for GHG reductions vary significantly between sectors. For example, reducing GHG emissions from transportation systems requires public and private capital investments in mass transit, while reducing GHG emissions from energy use in buildings requires that hundreds or thousands of building owners install energy-efficient appliances, windows, lightbulbs, and HVAC systems. Reducing the GHG emissions from electricity production means replacing carbon-intensive sources, such as coal, with lower- or zero-carbon alternatives such as solar and wind power.

City governments each have a unique set of capacities and political opportunities for reducing GHG emissions. Some, such as Los Angeles, have municipally owned energy utilities, giving them greater authority over energy supply and conservation incentives. Many cities, however, purchase electricity from third-party, often private, providers and have no formal authority to determine how that electricity is produced. Planning and financing large transportation projects often takes place at a regional scale. There are also differences in the level of support for such initiatives from the public and other levels of government, which can generate or stifle the political will to take on new projects.

City governments each have a unique set of capacities and political opportunities for reducing GHG emissions.

Nevertheless, the policy trend remains consistent: more cities are committing to reducing GHG emissions each year, and they are setting increasingly ambitious targets. This trend raises two important questions.

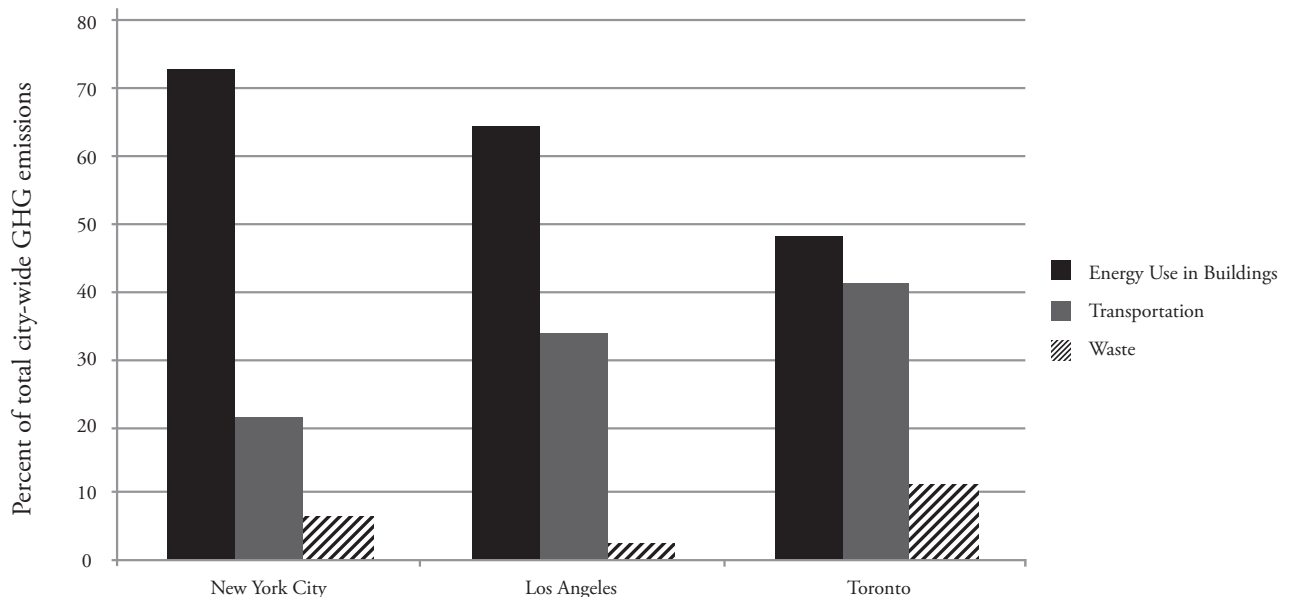
First, why are local governments working to address a global problem? Drawing on past research and the international academic literature, I identify four reasons for city governments to reduce GHG emissions: the need to address a looming threat, the possibility of local benefits, a desire to spur action at other levels, and the opportunity for recognition.

Second, how can city governments be effective in reducing GHG emissions? Here I use my own research on New York City, Los Angeles, and Toronto to identify effective steering strategies. These strategies demonstrate how city governments combine approaches and leverage multiple sources of authority to address climate change, and can serve as options or models for other cities.

Why Cities? Local Motivations for a Global Problem

City governments have emerged as the surprising leaders in climate change policy, for at least four reasons.

Figure 1: The relative contribution to GHG emissions of energy use, transportation, and waste management in New York City, Los Angeles, and Toronto



Addressing a looming threat

Hurricane Sandy in New York City in 2012 and Toronto's ice storm of 2013 forced decision makers to acknowledge that high land values, dense populations, and the concentration of economic activity make cities vulnerable to the impacts of climate change. These impacts include sea-level rise, heavy precipitation, drought, and extreme hot and cold temperatures. As city leaders become aware of this vulnerability, they are compelled to take action.

Many in city government also perceive climate change as a common problem facing society. Faced with failed national and international policy efforts, they are willing to invest municipal resources into the collective effort to reduce GHG emissions.

Local benefits

Programs and investments that reduce GHG emissions often have other benefits that may be of equal or greater importance to a city.

For example, investing in public transportation not only reduces GHG emissions but also improves congestion and air quality and increases mobility for urban residents. Incentivizing or subsidizing solar panel installation can be a significant source of new jobs. Investing in energy efficiency measures saves money by reducing electricity bills and avoiding the need to expand generating capacity.

A study in Los Angeles found that every \$1 million spent on energy efficiency creates 16 local jobs in the city. Many cities have found that the benefits of climate change mitigation are just as important as the GHG emissions reductions, as they create opportunities for broader coalition-building.

Spurring action at other levels of government

Leadership by city governments in addressing climate change can motivate other levels of government, or allow new ideas or strategies to be tested locally. In large cities, climate change policies have often been an independent response to policy inaction at other levels of government. In many countries – including Canada and the United States, but also Mexico and India – large cities were the first to develop plans and pledges to reduce GHG emissions. Some city governments see their efforts to reduce GHG emissions as a way to pressure or inspire state, provincial, or federal governments to do the same.³

Cities can also be important laboratories for new ways of doing things. For example, many cities have adopted building codes that require enhanced energy-efficiency measures; in some cases, these standards are then adopted by state or provincial governments. Similarly, a stated desire from city governments for renewable energy supplies may influence the choices other governments and private utilities make about their energy portfolios.⁴

Opportunities for recognition

Climate change has become something of a “celebrity issue” for city mayors, and bold action has landed several mayors in the national or even international spotlight. For example, former mayor of Toronto David Miller served as the Chair of the C40 global network of cities from 2008 to 2010. Likewise, Michael Bloomberg, former mayor of New York City, introduced a number of sweeping measures for reducing GHG emissions in his city. He became an influential member of the C40 global network of cities and, based on

his expertise and vision, he was appointed by UN Secretary-General Ban Ki-moon as the first Special Envoy for Cities and Climate Change in 2014.

Faced with failed national and international policy efforts, many in city government are willing to invest municipal resources into the collective effort to reduce GHG emissions.

Another example comes from Grand Rapids, Michigan. A small city of less than 200,000 people, its commitment to climate change has given the mayor international exposure; the World Wildlife Fund paid for his participation in the 2015 Paris climate talks, where he represented the Compact of Mayors.⁵ Mayors with ambitions for higher-level political office can demonstrate their leadership and forward-thinking vision by taking innovative action to address climate change.

Reducing GHG Emissions in New York City, Los Angeles, and Toronto

In 2007, New York City, Los Angeles, and Toronto each developed a plan to reduce city-wide GHG emissions: New York City pledged to reduce GHG emissions 30 percent by 2030, Los Angeles pledged to reduce GHG emissions 35 percent by 2030, and Toronto pledged to reduce emissions 30 percent by 2020. These targets mirror discussions at the international level concerning what constitute meaningful but feasible GHG emissions reductions goals. For example, the fourth Intergovernmental Panel on Climate Change assessment report, released in 2007, states that “by 2030, about 30 percent of the projected GHG emissions in the building sector can be avoided with net economic benefit.”⁶ In 2015 and 2016, Canada, the United

States, the European Union, Japan, and the United Arab Emirates all made similar pledges.

Adopting a climate change plan or emissions reduction target is a low-cost action for city governments. Taking steps to develop and implement policies and programs in pursuit of GHG reduction targets is the real challenge.⁷ Reducing GHG emissions by 80 percent, 50 percent, or even 30 percent requires that cities be fundamentally transformed: energy production systems, energy use patterns, transportation networks, and waste management strategies must all be significantly altered.

The City of Toronto, for example, warns that reducing the city's GHG emissions by 80 percent "will require big changes in the ways that we live, travel, work and consume goods and services, which in turn will affect everything from the structure of our local economy, to the types of jobs we hold, to our education and training programs, and more."⁸

Each of the three cities has pursued a unique mix of policies and programs that reflects the opportunities and challenges they face, their sources of GHG emissions, their formal powers and capacities, and the broader political economy.

New York City

New York City has a strong mayoral system of government, which includes mayoral power

over the city's annual budget. Both former mayor Michael Bloomberg and current mayor Bill de Blasio have been vocal climate change champions.

New York City has multiple own-source revenue streams – including local property, sales, and income taxes – totalling more than \$6,000 per capita, which have been used to fund climate change and energy programs. The city has also made effective use of outside sources of funding, including grants from the federal government and non-profit and philanthropic organizations.

New York City generates 9 megawatts of solar power capacity on city-owned buildings, and in 2015 issued a Request for Information to solicit options for powering city government operations entirely from renewable energy sources. The city has the largest electric vehicle-charging network in New York State, operating 600 plug-in electric vehicles and 153 charging stations.⁹ The city is hoping that such actions will influence the energy market and motivate the private sector to take action.

New York City has also passed more than 100 pieces of legislation to help reduce GHG emissions.¹⁰ In December 2009 the City passed legislation requiring that private owners of large buildings upgrade their buildings' lighting systems by 2025. The City's energy code has been repeatedly revised since 2007 to incorporate standards that help reduce energy demand in buildings. In 2010 the City also passed legislation regulating heating oils in the city, reducing particulate emissions, and requiring that heating oils contain at least 2 percent biodiesel. The urge to regulate has sometimes led the City to tread outside its formal jurisdiction, as in its failed attempt to require hybrid taxis, struck down by a state court.

New York City has also increased transportation options for residents by requiring that 20 percent of new parking lots be charger-ready for electric vehicles and building more than 700 new miles (well over 1,000 km) of bike lanes, doubling the number of people who commute by bicycle.¹¹ The City has introduced Select Bus Service with dedicated bus lanes and faster commute times, and made progress on three subway and commuter-rail expansion projects. Despite an increase in cost, the City has been working since 2006 to restructure the transportation of waste outside the city to reduce GHG emissions and congestion, shifting waste transportation from trucks to barges.

New York City has passed more than 100 pieces of legislation to help reduce GHG emissions.

New York City's strong mayoral leadership and powers have facilitated its use of direct interventions to reduce GHG emissions.

However, the City has also employed indirect interventions. It provides information and incentives through programs such as GreeNYC, an awareness-building initiative for energy conservation in the private and residential sectors.

New York City has also invested in information collection and monitoring, developing incentives and infrastructure for large building owners to track and report their energy use through the Greener, Greater Buildings Program. The City hopes that building owners will recognize the savings potential available to them through efficiency measures. They refer to this effort as a "one-stop shop for information that is also proactive."¹²

A failed but high-profile intervention was the City's bid to introduce congestion pricing in the downtown core, one of Mayor Bloomberg's first policy projects. While the Department of Transportation committed funding, the project required state approval. Ultimately, the New York state legislature did not approve the City's plan and the project was scrapped.

The City has also removed barriers to allow others to take the necessary steps to reduce GHG emissions, particularly in the area of energy generation. New York City's electricity comes from Consolidated Edison (ConEd), a private utility, leaving the City with little formal authority to influence energy sources. Instead, the City has collaborated with ConEd, using memorandums of understanding, to expand the natural gas distribution system in the city and building a new natural gas plant in Astoria.¹³ New York City also developed the Energy Aligned Clause, an innovative mechanism for commercial leases that allows owners and tenants to share the costs and benefits of energy conservation.

One of Bloomberg's first climate-change mitigation initiatives was the Mayor's Carbon Challenge, initiated in 2007. The program challenged the city's universities and hospitals to match the city government's accelerated target of a 30 percent reduction in GHG emissions by 2017. The program provides participants with templates and toolkits, information about best practices, and, critically, high-profile recognition from the mayor.¹⁴ Some challenge participants have already reached their goals and are going beyond them. The City uses these successes to motivate others: "We point to them over and over for others to learn lessons from them: technical, policy, and management lessons."¹⁵

New York City's "blitz" approach to steering the city to reduce GHG emissions is largely a product of its broader context. The city's sources of GHG emissions are so varied that a mix of approaches is necessary. Nearly 80 percent of the city's GHG emissions come from energy used in buildings. This means that thousands of building owners and occupants must make investments and behavioural changes to reduce energy consumption and that the state and private utilities must invest in lower-emission energy sources. Alternatively, introducing more renewable energy or natural gas can reduce the carbon intensity of energy use.

The City has taken a multi-pronged approach, requiring changes when and where it can, incentivizing the actions it would like to see, removing barriers to conservation and infrastructure investments, and motivating action by others. This combined approach reflects the City's commitment to reducing energy use, the carbon intensity of the City's energy supplies, and the varied means by which city governments can act to make a difference.

Los Angeles

While the mayor of Los Angeles lacks some of the powers enjoyed by the mayor of New York City, the City has greater authority over its sources of GHG emissions, including energy and transportation systems. Los Angeles has therefore primarily focused on reducing GHG emissions through provisioning strategies.

In 2008, the City and then-mayor Antonio Villaraigosa led the campaign to pass Measure R, a county-level ballot measure that introduced a 0.5 percent increase in sales taxes to pay for transportation projects.¹⁶ Nearly two-thirds of the revenue generated by the tax increase is earmarked for public transit capital and operations.

Shortly thereafter, the mayor advocated successfully for federal changes to transportation funding. The new rules allow cities to access revenue sources that will allow projects to be completed quickly while tax revenues accumulate. The City has undertaken additional transportation initiatives to reduce GHG emissions, such as synchronizing stoplights to improve traffic flow and installing electric-vehicle charging stations throughout the city.

A second successful provisioning effort in Los Angeles is the expansion of solar energy generation, prioritized by Villaraigosa in his appointments to the Board of Commissioners for the Los Angeles Department of Water and Power (LADWP), one of the largest municipal utilities in North America.¹⁷ LADWP offers generous incentives for solar installation through its Solar Incentive Program, which provides rebates to home and business owners who lease or purchase solar panel systems. The utility set its incentives above the state-recommended levels (starting at \$3.25 per watt for Los Angelenos), offering one of the highest incentive levels in the state.

LADWP has paid nearly \$30 million in rebates and supported the installation of 168 megawatts of solar power through 22,000 systems. LADWP has also introduced a feed-in tariff program, which provides a mechanism for third parties to generate solar power and sell it to LADWP. The City plans to incorporate 150 megawatts of solar energy through this program and by 2016 had commissioned 14 megawatts. LADWP is also developing a Community Solar Program through which customers can buy shares in solar energy projects installed on City-owned buildings and lock in their energy rates.

As a result of these efforts, the city increased its renewable energy use from 3 percent in 2003 to 20 percent in 2015. The City has also committed to eliminating the use of coal, partly in response to state legislation, selling its 21 percent share of the Navajo Generating Station in Arizona, a coal-fired power plant. Only about 15 percent of Los Angeles' electricity is now generated from coal.

The utility has consistently set and reached its energy use reduction targets. Since 2000, LADWP has spent \$423 million on energy efficiency and conservation, reducing energy use by about 1,756 GWh/year. These funds come from LADWP ratepayers, not from the city's tax revenues.

These efforts increased after the Natural Resources Defense Council (NRDC) found in 2011 that the LADWP was falling behind its peer utilities.¹⁸ In 2012, LADWP announced a \$267-million budget over two years for energy-efficiency programs and a target of 15 percent by 2020. These programs include incentives and rebates for energy-saving retrofits in commercial, institutional, and residential buildings and outreach, as well as education programs to promote conservation.

Los Angeles' focus on provisioning is a product of its larger context. The City's municipally owned water and energy utility, LADWP, provides invaluable opportunities for direct interventions that target the primary source of GHG emissions: energy generation and use. The City's ability to shape its energy supplies so directly provides important leverage to the city government. Ratepayers, not general tax revenues, fund LADWP, so the utility has an independent revenue source. Los Angeles did not have the same level of buy-in or political momentum behind the City's climate change targets as New York City did, so LADWP may help the City make progress while avoiding the need for broader political consensus.

The State of California is a leader on energy and climate change policy, introducing standards and targets for municipal utilities over the last 10 years. While Los Angeles has adopted targets that are more ambitious than the State's (such as its energy conservation target and its solar energy programs), the state still provides valuable frameworks and resources the city can use to pursue its goals.

Finally, the City's long-standing interest in reducing congestion and air pollution has allowed transportation projects to go forward that will reduce GHG emissions. As many cities have found, coordinating the resources necessary for transportation projects can be a major challenge due to high capital costs and fragmented jurisdictions. Nevertheless, transportation infrastructure takes a long time to build and may take even longer to affect the city's GHG emissions.

Toronto

Toronto has largely focused on reducing emissions from city government operations and removing obstacles that prevent others from acting. The strength Toronto brings to climate change mitigation is its administrative capacities

and innovation provided by the Toronto Atmospheric Fund (TAF).

Toronto was an early actor on climate change, and its Energy and Environment Division has more experience than other North American cities in reducing GHG emissions and finding creative solutions to embedded problems. TAF is an in-house think tank unique to Toronto that has helped the city experiment in ways that other cities might find difficult.

One of the City's priorities has been developing innovative strategies in energy conservation and efficiency projects. In 2007, the City partially monetized outstanding debt from Toronto Hydro to create a \$62-million fund to support building retrofits – the Sustainable Energy Funds – and establish the City's Energy Efficiency Office.¹⁹ The funds have been used as a revolving loan program for retrofits in both City-owned and privately owned buildings. The City

made interest-free loans to City agencies and non-profit groups that had had trouble accessing capital for such projects from other sources.²⁰

By 2012, the City had provided \$28.6 million in loans, primarily to City government entities

(agencies, divisions, corporations of the city, business improvement areas), hospitals, and universities. The City reevaluated the program that year and decided that declining private interest rates and increased policy attention from the provincial government to climate change meant that it was no longer necessary to use reserve funds for energy conservation investments.

In place of this funding, the City established a low-interest loan program, called Sustainable Energy Plan Financing, explicitly aligned with the City's 2010 sustainable energy plan. The new program provides low-interest loans to public and, increasingly, private building owners interested in energy conservation retrofits through the Better Buildings Partnership. Together, these programs have supported retrofits in about 2,100 buildings in the city.

The City of Toronto also invested in a deep-lake water-cooling system,²¹ which has reduced energy demands from several large, high-profile city buildings, including City Hall, Union Station, Exhibition Place, and police headquarters. The system was successful enough to allow the City to sell its shares and create a spin-off corporation (now owned by EnWave) to continue financing this work in other buildings, both public and private, for a total of 140 downtown buildings.

Coordinating the resources necessary for transportation projects can be a major challenge due to high capital costs and fragmented jurisdictions.

The City has reduced the barriers to energy conservation in single and multi-family residential buildings by providing new financial tools. This differs from the approach taken by Los Angeles, which has been to incentivize or even partially fund such measures directly. Toronto's Home Energy Loan Program (HELP) and High Rise Retrofit Support (HiRIS) Program provide homeowners and property owners with low-interest loans for energy conservation retrofits. The loans can be paid off over time on the owner's property tax bill; in this way, the debt remains with the property rather than with the owner. These innovative programs were recognized with a 2016 Sustainable Cities Award from the Federation of Canadian Municipalities.

In 2007 TAF established a program called TowerWise to combine innovative financing opportunities with awareness-raising activities in order to reduce energy use in the city's many high-rise residential buildings. Specifically, TAF has developed two financing tools.

- Using Energy Saving Performance Agreements, TAF can fully fund energy efficiency retrofits, and building owners can repay the loan using a percentage of the energy savings.
- Alternatively, TAF will pay for the incremental cost of energy-efficient elements of new construction. The loan is taken on by the subsequent tenants, but energy cost savings outweigh the loan repayments. This program is intended to remove any disincentives to making energy efficiency choices on the part of building owners.

Beyond facilitating energy conservation in publicly and privately owned buildings, Toronto has invested in alternative energy supplies for city operations, and a low-emissions fleet of City vehicles. In 2012 the City partnered with Toronto Hydro and leveraged provincial programs to install photovoltaic panels on City-owned buildings. In 2014 City Council voted to require that all new City-owned buildings generate at least 5 percent of their energy use from renewable sources, such as solar panels. The City has invested in methane capture technologies in the City's five landfills, an initiative that has reduced waste-related emissions by 25 percent since 2004.²² Finally, the City embarked on an effort to "right-size" the City's fleet, introducing electric and hybrid vehicles, bicycles, and smaller vehicles wherever possible.²³

Toronto's mix of interventions reflects its context. The city government is the weakest of the three levels of government, with the Ontario provincial government playing a strong role in regulating and planning for the City, especially for energy supplies, and the mayor having little formal power to control the City's policy agenda. Perhaps for this reason, the City has struggled to gain broad buy-in and political support from key stakeholders.

The City also has little flexibility in its spending choices, with property taxes rising at a rate lower than the rate of inflation and a self-imposed debt cap.²⁴ Volatile swings in mayoral priorities have reinforced a "working-under-the-radar" mentality among City staff.²⁵ Despite some supportive decision makers and a largely committed staff, the City has had little success in pursuing regulatory or provisioning strategies, nor has it been able to marshal the political resources to distribute direct financial incentives. Rather, the City has relied on its innovative staff and the Toronto Atmospheric Fund to develop tools and programs that reduce barriers and improve City operations.

Like Los Angeles, the City has benefitted from a provincial government that has similar priorities. In 2002, then-Premier Ernie Eves pledged to shut down all coal-fired power plants, and in 2014 Ontario became the first jurisdiction in North America to be coal-free.

Effective Strategies for Cities

No one municipal approach has proven to be superior to others in terms of reducing GHG emissions. New York City, Los Angeles, and Toronto all report GHG emissions reductions since setting their targets in 2007. New York City claims to have reduced emissions 12 percent below 2005 levels (the city's peak); Los Angeles claims to have reduced emissions 20 percent below 1990 baseline levels; and Toronto claims to have reduced emissions 25 percent below 2004 levels. Comparing these results is challenging, as each city uses a different baseline level of emissions and wrestles with issues of data accuracy and attribution of emissions reductions. Still, the cities are generally on track to meeting their longer-term goals.

On closer examination, however, the three cities have employed common *strategies* in developing and implementing their programs: building and maintaining diverse coalitions, aligning incentives with capacity, and combining institutionalization and innovation. These strategies point to good governance practices for urban climate change mitigation that may inspire other cities.

Building and maintaining diverse coalitions

The most effective programs and policies in the three cities are supported by a broad-based coalition of governmental and non-governmental actors that help generate buy-in and facilitate implementation. They also bring together the financial, political, and technical resources needed to pass new legislation and implement new programs.

New York City created coalitions through advisory task forces in several of its climate-change policy initiatives, such as the Green Codes Task Force (GCTF). The GCTF,

assembled in 2008 by former mayor Michael Bloomberg and former City Council Speaker Christine Quinn, was composed of city decision makers, environmental groups, technical experts, and representatives from the private sector. Their task was to review all city codes and to identify opportunities for energy efficiency and climate-change adaptation measures. This independent, multidisciplinary committee gave the community ownership over the outcomes; in any case, the city government lacked the technical capacity to make the necessary recommendations. The GCTF developed 111 recommendations, of which about half have been acted upon. The collaborative approach is credited with increasing implementation and improving the technical feasibility of the recommendations.

Toronto and Los Angeles found coalition-building to be essential to passing important local legislation for climate change mitigation. Toronto's Home Energy Loan Program (HELP) provides homeowners with low-interest loans for home retrofits that conserve energy. The initial bylaw was approved by City Council but, crucially, had the written support of a coalition of labour unions, environmental groups, civic organizations, the Toronto Real Estate Board, and energy utilities. It was also reviewed by the economic development committee and framed as a job creation measure, further expanding its appeal for Toronto City Councillors.

Los Angeles took a similar approach when working toward the adoption of Measure R in 2008. Then-mayor of Los Angeles, Antonio Villaraigosa, spearheaded fundraising for the "Yes on Measure R" campaign, led by the regional transportation agency, which actively worked to gain public support for the initiative. An even broader coalition, "Move LA," was also highly influential. Rafael Mares and Aviva Rothman-Shore of the Conservation Law Foundation write that putting together the coalition of "environmental, labor and business communities, who had never worked together before and had literally never visited each others' offices, and getting them to agree to collaborate, sent a powerful signal to decision makers ... and ultimately provided the necessary momentum for Measure R."²⁶ Coalition members included real estate developers, the Los Angeles Chamber of Commerce, and the Los Angeles County Federation of Labor. Getting Los Angelenos to pay for transit has historically been very difficult, yet the ballot measure received nearly the exact number of supporting votes needed, passing with a 0.4 percent margin.

Coalition-building is effective because it helps generate buy-in from stakeholders, improve the technical feasibility of new measures, and broaden political support for measures to reduce GHG emissions. It is important throughout the policy process, from developing policy proposals themselves (as in the case of New York City) to helping policies pass through City Council (as in the case of Toronto) or by popular vote (as in the case of Los Angeles). Framing the benefits of GHG emissions reductions measures broadly – for example, highlighting their job-creation potential or expected cost savings for residents – is a useful tool in coalition-building. Strong leadership often facilitates coalition-building, but city governments also have the ability to seed new coalitions directly, as in the creation of the Green Codes Task Force in New York City.

Aligning incentives and capacity

These three cities have found, often through trial and error, that it is not enough to require action, or even to introduce financial incentives. Significantly reducing GHG emissions also requires an investment in capacity-building, data collection, and education so that stakeholders, citizens, and administrators can meet new requirements and adopt new standards.

Strong leadership often facilitates coalition-building, but city governments also have the ability to seed new coalitions directly.

One of New York City's flagship climate change programs is the Greener Greater Buildings Program (GGBP). The program is intended to reduce energy use in privately owned buildings (commercial and residential), which contribute more than 70 percent of the city's GHG emissions. The GGBP is considered by many to be the City's greatest achievement, and elements have been adopted by other cities, including Toronto and Los Angeles.

GGBP has three distinct and complementary components. The first is legislation. The City passed four bills in 2009 that established a city-level energy code, obligated large building owners to conduct an energy audit and to track and report their energy use, and required that lighting systems in private buildings be upgraded by January 1, 2025.

City staff quickly realized, however, that there was a gap in technical capacity and awareness among building owners that would impede adoption and compliance with the new legislation. The City therefore complemented the legislation with programs for technical support and capacity-building (for both building owners and the auditing community). Finally, it provided financing opportunities to offset the costs of compliance. The City reports 80 percent compliance with

the benchmarking requirements, which provides the City with a wealth of information to help develop strategies for further reductions in future. The willingness of the City to support and facilitate change instead of simply mandating change has proven to be an effective steering strategy.

Changing incentives does not always require legislation, but it does work best when accompanied by capacity-building. Los Angeles has leveraged its municipal energy utility to increase solar energy production using financial incentives for homeowners and businesses. As early as 1999 the Los Angeles Department of Water and Power was providing rebates to home and business owners who installed solar rooftop systems through their Solar Incentive Program (SIP). In 2007 the SIP guidelines were revised, and the program was expanded, in response to state legislation that required municipal utilities to contribute to a statewide goal of 3,000 megawatts of solar energy production.

LADWP developed a 10-step declining rebate based on the capacity of the system installed and connected to the grid, starting at \$3.25 per watt in 2007 and declining to \$0.30 per watt in 2016. Electricity is relatively cheap in Los Angeles, which is good for customers, but makes pay-off times for solar power systems longer. The rebate was one of the highest incentive levels in California (above market price), and coincided with a 30 percent rebate for solar energy installation from the federal government through the residential renewable energy tax credit.

By 2011, it became clear that the demand for solar energy was greatly outpacing the utility's capacity to support installation, provide rebates in a timely manner, and guarantee customer safety. On April 8, LADWP suspended the SIP for five months to review and revise the program. When the SIP was re-launched in September 2011, it had twice as much funding for the following three years (from \$30 million to \$60 million), an accelerated inspection procedure, and an online, automated application tool. Within five days of the re-launch, LADWP had received applications for more than \$7.4 million in rebates to build 3.25 megawatts of solar power on Los Angeles rooftops. Realigning the incentives and capacities of customers and the city was crucial to the accelerated development of solar energy in Los Angeles, and the city now gets nearly 20 percent of its energy from solar.

Toronto has similarly found that combining incentives with capacity is an effective steering strategy. The success

of the Toronto Atmospheric Fund's work to promote innovation and experimentation depends on the willingness of city agencies and building owners to participate. Subsequently, TAF has invested significantly in raising awareness, through demonstration programs, participating in university research, publishing handbooks, and developing streamlined accounting tools. It also invests in pilot projects to test new ideas and the capacity of city government to take on new energy conservation projects.

One outcome of this broader approach to capacity-building is the expansion of the TowerWise program to community housing projects, contributing to the retrofit of seven Toronto Community Housing buildings with more than 1,200 households. These successes have been noticed by the Province of Ontario, which has pledged \$500 million to energy retrofits in social housing as part of its own climate-change mitigation strategy.

Reducing GHG emissions requires individuals and organizations to make new choices about how they invest, what they buy, how they behave, and what they build. Changing the incentive structures around such decisions –

for example, by requiring tracking and monitoring, providing rebates, or introducing new financial tools – is an obvious and attractive way to bring about different outcomes. However, as New York City, Los Angeles, and Toronto have found, new

incentives must be complemented with capacity-building if cities hope to see real change.

Changing incentives does not always require legislation, but it does work best when accompanied by capacity-building.

Combining innovation and institution-building

Reducing urban GHG emissions requires new ideas, new financial tools, and new ways of delivering services. However, innovations take time and money and can conflict with existing mandates and decision-making procedures. As one program manager in Toronto put it, "You're building the plane as you're flying the plane."²⁷ Innovations can also be subject to the upheaval caused by political turnover and new mayoral agendas. Many innovations, such as increasing solar energy capacity, require years if not decades to produce measurable GHG emissions reductions.

The institutionalization of innovation can help ensure that climate change policies and programs persist through administrative changes. This may mean passing new bylaws, creating new agencies, or shaping corporate cultures. For example, the City of Toronto offers a low-interest loan program for energy-efficiency upgrades, has installed photovoltaic systems on city-owned buildings, cools several

City-owned buildings using lake water, and captures methane at City-owned landfills for transformation into usable fuel. By 2012, Toronto had reduced the city government's own emissions by 49 percent compared with 1990 levels. Around this time, the City also realized that these innovations could generate additional revenue if they could be sold as carbon offset credits. There is an emerging private market for such credits, and nearby cities have had some success in selling credits to large companies interested in a "greener" portfolio.

Creating carbon credits, however, is a technical undertaking requiring additional guidelines. In 2013, Toronto City Council approved a Carbon Credit Policy, "which outlines conditions under which the City will sell its carbon offset credits including a condition that credits, once sold, must be retired immediately and not re-sold to potential polluters."²⁸ To date the City has identified three carbon credit projects: a waste-to-energy project at a City landfill, energy efficiency in City-owned buildings, and a retrofit of Toronto Public Library buildings.

By taking their success in reducing City GHG emissions and transforming this into an institutionalized carbon credit, the City has not only helped ensure that the credits are retired and have a real impact, it has also helped develop a capacity that will serve the City well as it and the Province enter the cap-and-trade market with California and Quebec.

Institutionalization can also lead to innovations. Requiring new practices and changing agency and corporate missions can spark ideas and remove obstacles to collaboration. Institutionalization can also smooth political transitions and ensure long-term attention to climate change. After New York City released its first climate change plan in 2007, City Council decided not only to codify the targets but also to require annual climate change planning and reporting from the mayor's office. Their aim was to "hardwire" climate change policy into the City, and ensure that the climate change work would continue beyond Bloomberg's tenure.

This decision has contributed to consistent monitoring and significant policy attention to climate change in New York City and, combined with Bloomberg's passion for data, perhaps the most sophisticated data on its GHG emissions of any city in the world. Moreover, climate change remained a policy focus of Mayor Bill de Blasio when he was elected to office in 2014. His administration subsequently released a climate change plan of its own, *OneNYC*, and committed the City to an even more ambitious target of reducing GHG emissions 80 percent by 2050. The Mayor recently requested proposals to completely power city government operations through renewable sources.

Institution-building can itself be seen as an innovative response to climate change mitigation. In Los Angeles, electricity and gas are managed separately: LADWP has responsibility for electricity while the Southern California Gas Company (SCG), a private utility, has responsibility for gas. The City realized that the separation created barriers to innovation and redundancy in programmatic offerings. Undertaking joint projects required negotiating responsibility and financial contributions on an individual basis.

To solve the problem, the two utilities developed a "master inter-utility agreement" to foster greater collaboration on energy and water efficiency. As one manager at LADWP describes it, "The lawyer stuff is handled in one large master agreement, a set of general rules, and then the programs all adhere to them. It outlines who does what and who pays for what."²⁹ Currently, 13 joint programs are in place. Institutionalizing cooperation cleared the way for innovative energy and water efficiency solutions.

The lesson here is that the innovation needed to address climate change is intimately linked to the institutions of urban governance: innovation can and should lead to institution-building and urban institutions should reflect the need for new practices and partnerships in mitigating climate change.

Measuring Effectiveness in Climate Change Mitigation

How should city governments evaluate their effectiveness in mitigating climate change? All three cities examined in this paper have used GHG reduction trends as the primary basis for evaluating and reporting on their effectiveness.

There are two main reasons why reduced GHG emissions provide a valuable metric of effectiveness. First, GHG emissions form the basis of city pledges. In this sense, a city government that had reduced its city's GHG emissions by 10 percent over a 10-year time frame would be deemed less effective than a city government that had reduced its city's GHG emissions by 25 percent over the same time period. Second, changes in GHG emissions are a politically useful metric: this is the claim decision makers want to make publicly after investing city resources into mitigating climate change. The plans themselves are typically oriented around an emissions reduction goal. For example, if a city government pledges to reduce GHG emissions 20 percent below 1990 levels by 2020, it is important to know the depth of GHG emissions reductions that have been achieved as of 2016.

Yet judging effectiveness solely on the basis of GHG emissions can be misleading. For one thing, GHG emissions are difficult for cities and scholars to monitor. Many cities, even those that have been engaged with climate change

mitigation for a decade or more, have completed only one or two GHG emissions inventories (if any). While New York City and Toronto have provided annual GHG emissions inventories since 2007, Los Angeles reported only twice: in 2007 and 2015. This makes comparisons difficult and unreliable.

Moreover, even with meticulous tracking, it can be challenging to attribute changes in a city's GHG emissions to a given project, program, or policy. A city's GHG emissions are the product of a complex web of factors, including the weather, economic conditions, policy choices made by other governments, individual behavioural choices, and the actions of city governments. Even identifying the potential GHG emissions savings from a particular program or policy can be technically challenging, and attributing a percentage decrease (or increase) in the city's GHG emissions to the implementation of a particular city government program is almost impossible.

Relying on GHG emissions as a single metric of effectiveness therefore provides an overly optimistic or an overly pessimistic view of how effective the city government has been in implementing its climate-change mitigation plan.

Cities can use three additional metrics to evaluate effectiveness.³⁰ One is the city's progress on its stated climate-change mitigation goals. Such goals may include conducting an annual GHG emissions inventory, building a waste-to-energy plant, conducting a feasibility assessment for solar energy, or developing a reporting platform for commercial building energy use. This measure of effectiveness has been the one most commonly used in external and academic evaluations of mitigation implementation in cities. New York City has used this means of tracking effectiveness through its PlaNYC annual reports, providing detailed reporting on the progress it is making toward each individual initiative in its overall strategy to reduce GHG emissions.

A second is behaviour change, which is considered "closer in the causal chain to institutions than is environmental quality. This means there are fewer – even if not few – alternative explanations of why behavior changed than of why environmental quality changed."³¹ Evidence of behaviour change is also more readily obtainable than evidence of GHG emissions reductions. For example, a city's climate change plan may call for behavioural change within the city government itself, such as increased resource allocation to climate change programs, increased inter-agency collaboration, and energy conservation in municipal activities.

Other changes need to take place outside city government, such as changes in household commuting

patterns, compliance with voluntary or regulatory energy efficiency programs, and installing solar panels on commercial, institutional, and residential buildings. Measurements such as use of public transportation, the number of companies reporting their energy use, and the proportion of the city's energy supply coming from renewable sources can also be very useful.

All three cities have used behaviour change to track program effectiveness. This includes participation in city programs and evidence of spending on the part of city government. For example, Toronto reports projects underway in 53 households through the HELP program; New York City boasts an 80 percent compliance rate with its benchmarking program; and Los Angeles reports that it has given \$280 million in rebates for solar panels.

Finally, measures of effectiveness should account for the broader consequences of reorienting systems, or what has been called catalytic impact. For example, if a city is partnering with large commercial building owners to promote energy efficiency, smaller operations may see their successes and adopt efficiency measures of their own. Local environmental organizations may feel empowered to develop programs that build on city-led efforts. The efforts and successes of city governments may also compel state, provincial, or federal governments to follow their lead.

Cities can also have catalytic impact through the city-to-city transmission of ideas, experience, and strategies. Climate-change networks such as the CCP or C40, or other city networks such as the U.S. Sustainability Directors Network, are often explicitly created to help cities share experience and ideas.

This type of effectiveness tracking has not received as much attention from the three cities, although it may be mentioned. For example, in its first PlaNYC annual report in 2008, New York City writes that, "most of all, we have changed the way many New Yorkers think about their city, its environment – and our future." Los Angeles and Toronto can also point to city-level policies or initiatives that have changed practices at the state or provincial level, such as the green building standards in Los Angeles and public housing partnerships in Toronto. More work is needed to track the catalytic impacts of urban climate change policies.

Rethinking the Role of City Governments in Climate Change Mitigation

The interventions used by these cities may serve as examples for cities embedded in similar contexts to follow: strong city governments may benefit from replicating New York City's

efforts to require energy conservation in privately owned buildings; city governments with municipal utilities may learn from the solar energy incentives provided by LADWP; city governments that lack authority or political backing can pursue strategies similar to Toronto's. However, there are two reasons to avoid blanket replication in other cities.

First, the three cities have so far achieved fairly modest GHG emissions reductions. While these cities are largely on track to meet their interim goals, each city is currently developing ways to achieve much larger reductions: on the order of 80 percent by 2050. Such deeper, more transformational GHG emissions reductions will require renewed commitment and new approaches. The low-hanging fruit is now gone. The next round of GHG reductions will require more effort. New York City is focusing on renewable energy through its renewable energy Request for Information, Los Angeles is focusing on building energy use, and Toronto is getting serious about transit improvements. Cities will need to overcome the tension between where they have formal authority and where the majority of their emissions come from, because very often these are not the same.

Second, it is not just *what* city governments do, but also *how* they do it that matters. Building coalitions, aligning incentives with capacities, and combining innovation and institutionalization allow city governments to steer by mobilizing and coordinating the resources and actors necessary to reshape the city. These strategies should guide other cities interested in pursuing GHG emissions reductions, and be incorporated into efforts to bring about deep emissions reductions in New York City, Los Angeles, and Toronto. These cities' initial experiences with their steering strategies are likely to serve as launching points for more aggressive reductions. One City official, speaking about the effect that coalition-building has had for New York City, says, "We are in a position to propose things now that we couldn't before, now with a layer of experience and broad support among the industry."

These strategies can serve as guidance for those in other levels of government or in the non-profit sector who are seeking to support and expand the efforts of city governments. Administrators and policy makers can act as coalition partners or help frame interventions in ways that facilitate coalition-building. Financial or regulatory programs should support the development and deployment of capacity-building and institutionalization alongside new incentives and innovations. Helping cities navigate the "how"

of mitigating climate change is just as critical as helping them identify what interventions might be necessary or feasible.

While city government action might not be sufficient for reducing global GHG emissions to acceptable levels, it is certainly necessary. City governments are critical climate change actors, and will be for the foreseeable future. The question is whether these governments are willing to leverage the multiple sources of authority they have to build coalitions, change incentives, build capacity, and institutionalize important innovations.

Endnotes

1 Joining the Compact of Mayors requires that cities make a commitment to address climate change, publicly report the city's GHG emissions and vulnerabilities to climate change, establish GHG reduction targets and plans, and measure progress. See www.compactofmayors.org

2 As members of the Partners for Climate Protection program, cities commit to reduce GHG emissions and are supported in their efforts "through a five-milestone process that guides members in creating GHG inventories, setting realistic and achievable GHG reduction targets, developing local action plans, and implementing plans using specific, measurable actions to reduce emissions." See <http://www.fcm.ca/home/programs/partners-for-climate-protection.htm>

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4 For example, after Los Angeles introduced green building standards in 2008, the City worked with the State of California to adopt

some of the City's measures. New York City is increasingly strategic and specific about its desire for renewable energy sources and, as one of the largest energy purchasers in the region, has influenced the energy choices and policies of the state government and ConEd, the region's private energy supplier.

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