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## Local Government Strategies to Reduce Greenhouse Gas Emissions

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*This article discusses the various multi-disciplinary strategies that have been adopted by six leading cities in terms of reducing greenhouse gas (GHG) emissions and meeting their targets to help prevent and adapt to climate change. The cities that have been chosen are all part of a leadership programme titled “c40 Cities”, which are cities (both developed and less developed alike) around the world that are making a meaningful impact in reducing both GHG emissions and the risks from climate change through the creation of strategies and other measures.<sup>1</sup> The network was created to facilitate interactions between the cities, and encourage learning and collaboration in combating climate change at the local level. Each city has one or more overarching strategies for GHG emission reduction and/or climate change adaptation, and within these are ground-level implementation strategies (also referred to as policies, measures or tactics) that have been, or will be, implemented to reach the cities’ goals that have been set. The strategies that the cities have created to help reduce GHG emissions range from simple steps to robust programmes or services that each city will offer or collaborate with the public/private sector to implement. This article will outline the GHG emission reduction target which is discussed in terms of each city,*

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1 Taedong Lee and Susan van de Meene “Who teaches and who learns? Policy learning through the C40 cities climate network” (2012) 45(3) Policy Sciences 199.

*with the relevant strategies stated. The strategies are then allocated into a list of categories, which are all related to methods used to reduce GHG emissions. By doing this, the similarities that the cities' strategies possess are brought to light, and it also shows why some cities might be doing better than others in terms of covering all reduction methods. The article concludes by evaluating the cities' strategies that are the most effective and innovative. This entails at least one strategy from each country that has proven results in terms of real-world impact on GHG emissions for that city.*

## 1. INTRODUCTION

Local government plays a key role in implementing climate change policies that aim to create a regional discourse around mitigation, resilience and adaptation measures in a rapidly changing world. Climate change policies at local government level create a devolved discussion and community awareness, ensuring that effective policies are implemented from bottom-up focused approaches.

Given the global pressure to reduce greenhouse gas (GHG) emissions, expectations are rising for local authorities to develop and implement climate change reduction and adaptation strategies.<sup>2</sup> Because local governments are placed directly in the community, they have a good base to develop and implement effective policies.<sup>3</sup> Local government can also be the crucial link between international climate change discourse and the general public.<sup>4</sup> Local politicians also have a greater ability to facilitate public participation, to ensure that citizens are consulted with and kept up to date on climate issues in their city.<sup>5</sup>

The purpose of this article is to identify strategies being used by leadership cities around the world to create a regional discourse around climate change adaptation and to ultimately work towards reducing GHG emissions. Further,

2 Gregory Trencher, Vanesa Castán Broto, Tomoko Takagi, Zoe Sprigings, Yuko Nishida and Masaru Yarime "Innovative policy practices to advance building energy efficiency and retrofitting: Approaches, impacts and challenges in ten C40 cities" (2016) 66 *Environmental Science & Policy* 353 at 353.

3 At 353.

4 Annabelle Jaeger "Five reasons why local government should influence climate change plans" *The Guardian* (online ed, London, 6 January 2015) <<https://www.theguardian.com/public-leaders-network/2015/jan/06/local-government-climate-change-plans>>.

5 Jaeger, above n 4.

this article will discuss the strategies used as the base for this discourse, and targets that have been set by these cities, and seek to evaluate the most effective and innovative in the process. The six cities that this article will discuss are Sydney, Rotterdam, New York, Edmonton, Stockholm and San Francisco.

These cities are all part of the leadership programme “c40 Cities”, which includes a global network of cities around the world that are making a meaningful impact in reducing both GHG emissions and the risks from climate change via the creation strategies aimed at adapting and responding to climate change.<sup>6</sup> The network was created to facilitate interactions between the cities, and encourage learning and collaboration in combating climate change at the local level.<sup>7</sup> Similarities in the strategies can be seen as evidence that the network is working. It is of interest to note that the 2018 c40 Cities and Climate Change Science Conference will be hosted in Edmonton, one of the cities that this article will discuss.

## **2. CITIES’ GHG REDUCTION TARGETS AND STRATEGIES**

### **2.1 Sydney**

#### *2.1.1 Adapting for Climate Change — A long term strategy for the City of Sydney*<sup>8</sup>

As part of its Sustainable Sydney 2030 plan, Sydney has set a target of a 70 per cent reduction in GHG emissions across its local government area and in its own operations by 2030. To achieve this target, the City of Sydney has created a series of innovative master plans for energy efficiency, renewable energy, and tri-generation. This plan covers 2015 to 2070, and was founded on five principles which are based on recommendations from the Citizens’ Panel, and are:

1. Resilient and long-term: politically sustainable, economically efficient and socially inclusive.
2. Flexible and dynamic: able to evolve and respond to unexpected trends and consequences.
3. Based on the most up-to-date data.
4. Able to harness natural environmental systems.

6 Lee and van de Meene, above n 1.

7 At 215.

8 City of Sydney *Adapting for Climate Change — A long term strategy for the City of Sydney* (2015).

5. Delivered via a comprehensive and effective communication strategy.

In developing the strategy, a thorough approach was adopted that was inclusive of scientific evidence and public concern. The following steps were used:

1. Establish the scientific baseline with oversight from the City's Science Reference Group.
2. Conduct a risk assessment and analysis with specialist consultants RPS and KPMG, City staff and external stakeholders.
3. Identify actions to respond to risks with City staff and external stakeholders.
4. Engage community to capture residents' perspectives and feed them back into the actions.
5. Meet and communicate with key business stakeholders to capture their perspectives and feed them back into the actions.
6. Prepare the Climate Adaptation Strategy for endorsement by Council.
7. Put strategy on exhibition for public comment.

Both public participation and external stakeholder involvement were key elements in preparing and shaping the climate adaptation strategy. A key player in the creation of the strategy was the Citizens' Panel, convened in November 2014 in collaboration with the University of Sydney. During the plan-making process, the Panel met over two and a half days, conducting in-depth conversations with residents to hear their concerns in relation to climate change. The Panel also helped to educate the public and provided overarching principles for the strategy.

The City of Sydney has a range of strategic policies and strategies that sit under the City of Sydney's Sustainable Sydney 2030 plan. These are:

1. Community Strategic Plan.
2. Delivery Programme.
3. Operational Plan.
4. Resourcing Strategy.

To support the community's objectives, as expressed in Sustainable Sydney 2030, a long-term resourcing strategy is required as part of the Integrated Planning and Reporting framework. It includes four components:

- Long Term Financial Plan
- Workforce Strategy
- Asset Management Strategy
- Information and Communication Technology Strategic Plan.

## 5. City Plan.

The City Plan is a set of planning controls that guide development in the City of Sydney. The plan consists of two further plans — the Local Environmental Plan (LEP) and the Development Control Plan (DCP). The LEP is the main document used by Council for controlling development and guiding local planning decisions. The DCP supports the LEP with more detailed planning guidelines. The City’s planning controls are the main tool used for ensuring that the development of Sydney is done in a way that aligns with the goal of remaining resilient to the changing climate.

The strategy also discusses other existing policies that are intended to be maintained to help implement the climate adaptation strategy as follows.

### (i) Urban Forest Strategy

The City of Sydney’s Urban Forest Strategy was adopted in February 2013. This strategy provides for extensive and innovative landscaping in the streets and parks of Sydney and creates beautiful streets and public spaces that contribute to the health and well-being of everyone. Urban forestry is one of the most effective ways to reduce the urban heat island effect, generate fresh air, absorb stormwater, and provide cool spaces and respite during extreme heat — all of which help adaptation to climate change.

### (ii) Cool Pavements trial

The City of Sydney is trialling a lighter-coloured pavement, as part of an investigation into ways of reducing temperatures in urban areas. Lighter-coloured surfaces generally do not absorb as much light or retain as much heat as dark surfaces, and therefore have the potential to reduce temperatures, resulting in lower energy bills for surrounding buildings, and improved road strength. The project examines how and if lighter-coloured pavements and other hard surfaces can reduce the urban heat island effect, and the potential benefits of doing so.

### (iii) Green Square project

The Green Square project is aimed at converting an old industrial area of Sydney into a green sustainable community. Green Square is going to be a new town centre, creating developments linked to recycled water, parks, gardens, and public transport. The idea is to incorporate residential dwellings, parks and shopping centres in the same vicinity, and connect them in a sustainable way.

### (iv) LED lighting project

The key aim of the project was to replace standard street lights with LED fixtures in a bid to reduce energy use in the City of Sydney. The project’s trial,

being the first of its kind in Australia, ran from 2010 to 2012, and in 2011, after seeing the initial results of the trial, the City of Sydney entered into an agreement with a contractor to install 6,448 LED light fixtures.

As part of the climate adaptation strategy, a series of master plans were created in terms of green infrastructure:

- The **Energy Efficiency Master Plan** demonstrates how energy can be used more efficiently in buildings across the local government area and suggests alternatives to fossil fuel generation.
- The **Renewable Energy Master Plan** discusses how renewable energy can replace conventional electricity generation, and shows that by 2030 renewable energy can provide 30 per cent of the electricity used in the local government area.
- The **Advanced Waste Treatment Master Plan** outlines a solution where waste is treated as a valuable resource, examining a range of technologies that can turn waste into gas and avoid it going into a landfill.
- The **Decentralised Energy — Trigeneration Master Plan** discusses how local energy generation is twice as efficient as coal-fired power stations that currently produce around 80 per cent of Sydney's electricity.
- The **Decentralised Water Master Plan** aims to help the City of Sydney adapt to a drier future with a strategic blueprint:
  1. Reduce mains water consumption across the local government area (LGA) by 10 per cent of 2006 levels by 2030 through water efficiency programmes.
  2. Reduce mains water consumption in Council's own buildings and operations to 10 per cent below 2006 levels by 2030 through water efficiency and connection of Council facilities to park-based or precinct-scale recycled or alternative non-potable water supplies.
  3. Replace 30 per cent of mains water demand across the City of Sydney LGA with recycled or alternative non-potable water generated from local water resources by 2030.
  4. Reduce sediments and suspended solids by 50 per cent and nutrients by 15 per cent discharged into the waterways from stormwater runoff generated across the LGA by 2030. Although not climate-related, reducing pollution in waterways is a significant outcome that will improve the environment.

## 2.2 Rotterdam

### 2.2.1 Rotterdam Climate Change Adaptation Strategy<sup>9</sup>

In 2008 the Rotterdam City Council ratified the Rotterdam Climate Proof programme, as part of the Rotterdam Climate Initiative. This consists of three main sectors: development and knowledge; implementation of climate adaptation measures; and presenting Rotterdam internationally as an innovative delta city. These sectors are the guiding principles for the creation of other policies and strategies, in terms of ensuring that Rotterdam stays resilient in the face of climate change. From this, the Rotterdam Climate Change Adaptation Strategy was created as a vital action. The strategy establishes the framework for helping the City become climate proof.

Being a delta city, Rotterdam is focusing heavily on climate change adaptation in terms of climate change proofing their water systems, which provide valuable resources to the City. The strategy is inclusive and brings together both the private and public sector to ensure that both large-scale and small-scale solutions are implemented across the City. There is a heavy focus on “green adaptation” — a term which refers to climate-proofing urban development through a range of measures such as encouraging the residents of Rotterdam to make their gardens greener through the “tile out, green in” initiative.

As part of Rotterdam’s Climate Initiative, a target has been set at 100 per cent climate proof by 2025. This is the goal expressed in the City’s climate change adaptation programme. This means that by 2025 measures will already have been taken in Rotterdam to ensure that there is minimal disruption caused by climate change. This goal of a climate-proof Rotterdam is in line with the Rotterdam implementation strategy and is also a prerequisite for achieving the City’s more wide-reaching aims. The primary objectives outlined in the Climate Change Adaptation Strategy are:

1. The City and its inhabitants are protected from the rivers and the sea.
2. The City and its inhabitants experience minimal disruption from too much or too little rainfall.
3. The Port of Rotterdam remains safe and accessible.
4. The inhabitants of Rotterdam are aware of the effects of climate change and know what they themselves can do to adapt to them.
5. Climate change adaptation contributes to a comfortable, pleasant and attractive city in which to live and work.
6. Climate change adaptation strengthens the economy of Rotterdam and its image.

9 Rotterdam Climate Initiative *Rotterdam Climate Change Adaptation Strategy* (2013).

The strategy discusses how working together and linking projects will ensure that the City of Rotterdam becomes more resilient and flexible in relation to climate change adaptation. While it is traditionally local and national government who have worked together to form and implement climate change adaptation measures, the local citizens are vital in ensuring a robust system is in place. The strategy notes that most of the buildings and land in the City are private property, which means that implementing adaptation measures often requires cooperation with other parties. A shared vision and ambition for a climate-proof city are both vital for success, which involves the City Council actively gathering information and providing residents and businesses with actions to take to protect against river water, excessive and insufficient rainfall, and periods with extremely high temperatures.

Thanks to readily available information, the public is becoming more aware of the effects of climate change, and how it affects their everyday lives. Because of this, citizens are being more active in the community and are taking measures to help reduce their impact and adapt to climate change. This active participation is leading to a better relationship between the local government and the public.

The Climate Change Adaptation Strategy also discusses introducing more trees and plants into the City in an attempt to make it less vulnerable to extreme rainfall, drought and heat stress. At the same time, this “green adaptation” will make the living environment more attractive, become the motor for other investments, and will, in turn, inspire the residents of Rotterdam to play an active role.

The Climate Change Adaptation Strategy lists policies aimed at simply adapting to climate change, such as creating floating communities in response to the threat of sea-level rise and replacing/reinforcing dikes. In this case, we instead have to look at other documents created by the City of Rotterdam to understand what they are doing to help work towards their climate change reduction target. A downfall of the Climate Change Adaptation Strategy is an attitude of unurgency due to the slow effects of climate change, and the opinion that there is plenty of time to adapt.

### *2.2.2 Rotterdam Resilience Strategy<sup>10</sup>*

Rotterdam also has a Resilience Strategy, which contains goals for specific policies that will be undertaken in response to climate change and reducing GHG emissions as follows.

10 Gemeente Rotterdam, 100 Resilient Cities, Rotterdam Climate Initiative and Rotterdam Make it Happen *Rotterdam Resilience Strategy: Ready for the 21st Century — Consultation Document* (2016).



(i) Rotterdam Energy Infrastructure Plan

The Rotterdam Energy Infrastructure Plan (REIP) will set out a roadmap for how Rotterdam can deliver on its clean energy transition. This will reduce its emissions, improve its energy security and ensure it is future proof. It is also a key area of resilience where the City will collaborate with the Port authority and a range of other utility stakeholders and technology providers.

(ii) PLUS Programme on Sustainability and Climate Change

In order to support the Government's COP21 climate commitments, Rotterdam is required to implement additional emissions-saving measures such as the installation of solar panels, switching to more efficient vehicles, reducing energy consumption, and encouraging renewable energy generation.

(iii) Port transition focused on bio-based economy

Making the transition from fossil-based fuels to bio-based fuels.

(iv) Embedding climate adaptation into the urban fabric of the City

Measures included within this action are in line with projects already completed in Rotterdam such as Benthemplein (water squares, storage facilities in urban areas), and will be designed to support community learning — specifically in respect of understanding the urgency of the need to take action on climate change. There is a strong focus on the small-scale projects being implemented at the citizen level.

Other strategies include:

(i) Green Roofs Programme

A green roof is essentially a roof covered in soil and plants, and it has a range of environmental benefits. A subsidy scheme is in place from 2017 onwards for residents of Rotterdam, to encourage more people to convert their roofs to green.

(ii) Floating Pavilion<sup>11</sup>

The Floating Pavilion is a 12-metre-tall structure consisting of three floating squares. The Pavilion is full of sustainable technology — for example, the building's power is entirely sourced from solar energy and surface water. The Floating Pavilion is an innovative idea that will help the design of other similar buildings throughout Rotterdam.

11 Rotterdam Climate Initiative "Floating Pavilion in the centre of Rotterdam" (2017) RCI <[http://www.rotterdamclimateinitiative.nl/uk/file/climate-adaptation/projects-climate-adaptation/floating-pavilion-in-the-centre-of-rotterdam?project\\_id=19&p=1](http://www.rotterdamclimateinitiative.nl/uk/file/climate-adaptation/projects-climate-adaptation/floating-pavilion-in-the-centre-of-rotterdam?project_id=19&p=1)>.

### 2.2.3 *Rotterdam Programme on Sustainability and Climate Change*<sup>12</sup>

The Rotterdam Programme on Sustainability and Climate Change 2015–2018 was developed after extensive consultation with the public and stakeholders to create projects and measures to implement over three years to help achieve sustainability.

#### 1. **Aim 1**

- clean air
- more green spaces
- dry feet
- sustainable areas

#### 2. **Aim 2**

- energy savings for residents
- energy savings for entrepreneurs
- wind energy benefits
- the sun as a source of energy

#### 3. **Aim 3**

- opportunities for clean technology
- stronger competitive position due to energy efficiency
- frontrunner of the circular economy
- development of the bio-based economy
- cleaner transport and logistics

## 2.3 **New York**

### 2.3.1 *OneNYC Plan 2015*<sup>13</sup>

Since the first PlaNYC in 2007, the City has made considerable progress in reaching its goals. It has reduced GHG emissions 19 per cent since 2005, invested billions of dollars into protecting its water supply, planted nearly a million trees, installed 300 miles of bike lanes, and passed regulations and developed programmes to phase out polluting heating oils. The City has also strengthened coastal defences, improved the city's important infrastructure such as wastewater treatment facilities, and worked to make buildings and neighbourhoods more resilient. With the implementation of the OneNYC Plan 2015, four principles were devised as follows.

12 City of Rotterdam *Rotterdam Programme on Sustainability and Climate Change* (2015).

13 City of New York *OneNYC Plan* (2015).

(i) Growth

Vision 1 — New York City will continue to be the world’s most dynamic urban economy, where families, businesses, and neighbourhoods thrive.

(ii) Equity

Vision 2 — New York City will have an inclusive, equitable economy that offers well-paying jobs and opportunity for all New Yorkers to live with dignity and security.

(iii) Sustainability

Vision 3 — New York City will be the most sustainable big city in the world and a global leader in the fight against climate change.

(iv) Resiliency

Vision 4 — New York City’s neighbourhoods, economy, and public services will be ready to withstand and emerge stronger from the impacts of climate change and other 21st-century threats.

The City of New York credits the creation of this robust strategy to the community. During the drafting process, it met with the community in one-on-one meetings, discussions and forums. It also met with a range of different businesses and heard about their needs in relation to transportation, infrastructure, and the importance of culture in the community, among other things.

### 2.3.2 *New York Cities Roadmap 80x50*<sup>14</sup>

The Roadmap 80x50 is part of the overarching New York One Plan and is part of Vision 3 of that plan — sustainability.

In 2014 New York City emitted 52.9 million metric tonnes of carbon dioxide equivalent of GHG emissions. The vast majority of these emissions are the result of the combustion of fossil fuels, including natural gas and petroleum, to generate utility-scale electricity and steam, provide heat and hot water for buildings, and power vehicles. A small amount of the emissions are also attributed to solid waste and waste management.

Most of the reductions to date are a result of improvements to the electricity supply, which includes switching from oil or coal to less carbon-intensive natural gas, improved operational efficiencies at existing power plants, and the construction of new, highly efficient natural gas power plants both within and

14 New York City Mayor’s Office of Sustainability *New York Cities Roadmap 80x50* (2015).

outside the city. New York City's GHG emissions will be 80 per cent lower by 2050 than in 2005 and there will be zero waste to landfills by 2030.

In September 2014 New York City committed itself to 80 x 50 — to reduce GHG emissions 80 per cent by 2050, with an interim target to reduce GHG emissions 40 per cent by 2030 (40 x 30), and took immediate steps to achieve that goal. The City is moving forward immediately with strategies to reduce GHG emissions from energy supply, buildings, transportation, and waste. Building on its strong climate action track record, the City has already launched a concrete set of initiatives since 2014 that will allow it to achieve its interim target of 40 x 30 and put it on a path towards 80 x 50.

These targets have been developed with a practical sense of what is doable today and a vision of what must be accomplished by 2050. While it is not possible to predict every change that will occur between now and 2050, the analysis provides a platform for its near-term actions and direction for the long-term policies and innovations that will ultimately be necessary to achieve 80 x 50 and the OneNYC vision of a stronger and more just city. A general list of the strategies that the City of New York lists in Roadmap 80x50 are as follows.

(i) Energy

- Increase direct and indirect investments in large-scale renewable energy and energy storage.
- Increase efficiency and emissions requirements for in-city generators.
- Make an unprecedented commitment to promoting clean, distributed energy resources.
- Clean Energy Standard (CES): adopted by the Public Service Commission in 2016, this policy was developed to lower GHG emissions and reduce air pollution from the state's energy generation resources and ensure a reliable and diverse energy supply; the CES is an enforceable mandate that will require 50 per cent of New York's electricity to come from renewable energy sources by 2030.

(ii) Buildings

- Implement cost-effective upgrades in existing buildings to improve energy efficiency in the near term.
- Scale up deep energy retrofits that holistically address heating systems, cooling systems, and building envelopes, and transition buildings away from fossil fuels.
- Expand distributed solar energy and install 1,000 MW of solar capacity by 2030.
- Ensure building decision-makers have access to building energy use information.

- Provide assistance to the private sector to accelerate adoption of energy efficiency and clean energy.
- Streamline regulatory processes for building energy efficiency and clean energy.
- Ensure building owners can finance energy efficiency projects.
- Achieve exceptional energy performance for new buildings and substantial renovations.
- Lead by example in City-owned buildings.
- Prepare New York City's workforce to deliver high-performance buildings.
- Position New York City as a global hub for energy efficiency and clean energy technology.

#### (iii) Solarize CB6

The NYC Solar Partnership developed a pilot Solarize campaign in Brooklyn Community Board 6 (Solarize CB6) in 2015. The Partnership and community representatives selected two solar installers through a competitive process. Solarize CB6 held public educational workshops and participated in community events, ultimately reaching more than 660 residents and businesses. More than 350 people signed up for solar siting assessments, representing over 400 buildings. As a result, over 140 kW of solar capacity was installed at 25 per cent less than the average cost for residential installations in the area.

#### (iv) Solar curriculum

The City has also established a solar curriculum that is being incorporated into classroom learning in public schools to help bring the benefits of solar energy to life. The Department of Citywide Administrative Services (DCAS) and the City's Department of Education (DOE) partnered with Solar One, a non-profit organisation, to provide curriculum, classroom supplies, and professional development training to teachers whose schools received solar PV installations.

#### (v) Kathleen Grimm School for Leadership and Sustainability

The Kathleen Grimm School for Leadership and Sustainability at Sandy Ground (Public School 62) is the first "net-zero energy" school constructed in New York City and one of the first of its kind worldwide. The two-storey school is 68,000 square feet and serves 444 pre-kindergarten through fifth-grade students. The school is designed to reduce energy use by roughly 50 per cent as compared to a standard new NYC public school by using an ultra-tight high-performance building envelope, day-lit corridors, energy recovery, a geothermal well field, and demand-control ventilation. The building offsets the rest of the energy use with wrap-around solar PV panels that are placed on the entire roof area and the south façade, giving the building its iconic skin, and includes solar thermal panels to provide domestic hot water and supplement the heating system.

(vi) Transportation

- Modernise, expand, and reduce crowding on the city's transit system.
- Make walking and biking safer, more convenient options for all New Yorkers.
- Ensure that the City's policies prioritise walking, biking, and transit.
- Leverage technology and data to expand travel options and optimise the transportation network.
- Better manage and price parking to encourage efficient travel choices.
- Support new mobility options that reduce GHG emissions and prepare for autonomous vehicles.
- Accelerate purchases of zero-emission vehicles.
- Encourage the use of renewable and low-carbon fuels where electric vehicles are not an option.
- Encourage increased efficiency of local and "last mile" freight delivery.
- Invest in rail, maritime, and other infrastructure to increase the efficiency of freight movement.

(vii) NYC Clean Fleet

NYC Clean Fleet is the most comprehensive and ambitious blueprint for municipal fleet sustainability in the nation. Unveiled by Mayor de Blasio in December 2015, Clean Fleet expands on NYC Fleet's substantial strides in sustainability by setting concrete targets to reduce its consumption of GHG-emitting petroleum-based fuels — 50 per cent by 2025 and 80 per cent by 2035. In the near term, Clean Fleet committed New York City to add 2,000 electric vehicles (EVs) to its sedan fleet by 2025 — the largest such commitment of any US city. In less than a year since the announcement of Clean Fleet, the City has increased the size of its EV fleet by more than 60 per cent with more than 500 total EVs. In April 2016 the City reinforced its EV commitment by announcing it would only purchase plug-in vehicles for all non-emergency sedan orders beginning in the fiscal year 2017. This should bring NYC Fleet near 1,000 total EVs by the end of 2017.

(viii) Waste

- Engage all New Yorkers in reducing waste disposal to landfills.
- Minimise waste generated by all City agencies.
- Launch outreach campaigns to reduce food waste.
- Implement proven incentive-based systems to minimise waste generation.
- Support increasing citywide reuse and donation.
- Accelerate diversion of recyclable materials from landfills.
- Capture organics and ensure sufficient capacity to facilitate beneficial reuse in both the residential and commercial sectors.
- Expand energy recovery from wastewater processing operations.
- Reduce emissions from the collection and disposal of commercial waste.

(ix) Zero waste

In OneNYC the City committed to the ambitious goal of sending zero waste to landfill by 2030. In conjunction with this goal, initiatives were developed that will not only help the City achieve zero waste but also improve air quality and reduce GHG emissions.

## **2.4 Edmonton**

### *2.4.1 City Operations Greenhouse Gas Emissions Management Plan*<sup>15</sup>

The City of Edmonton Greenhouse Gas Emissions Management Plan aims to achieve a 50 per cent reduction in GHG emissions from City operations by 2020 (from 2008 levels), an 80 per cent reduction by 2050, and carbon neutrality as the eventual long-term outcome. Reaching the plan's 2020 target will require City Operations to reduce its emissions from 330,000 tonnes of carbon per year to 165,000 tonnes. On 27 June 2012 the Executive Committee accepted the Greenhouse Gas Emissions Management Plan on the understanding that further implementation plans will be developed for each of the individual initiatives.

(i) Green power purchases

Net reduction of 111,000 tonnes a year annual purchases of green power (from renewable energy sources) will be the largest contributor to the 50 per cent reduction target. Amounts of green power purchased will increase proportionally from 2013 to 2020, contributing to an 111,000-tonne reduction in 2020.

(ii) Building retrofits

Net reduction of 26,000 tonnes a year GHG emissions from existing City buildings will decline by 19,000 tonnes a year through energy efficiency upgrades that are currently planned and by an additional 7,000 tonnes a year through new efforts proposed in this plan.

(iii) Roadway lighting

Net reduction of 25,000 tonnes a year GHG emissions from the City's 100,000 street lights will decline by 10,000 tonnes a year by 2020 through light fixture conversions that are currently planned and by an additional 15,000 tonnes a year through accelerated conversion efforts proposed by this plan.

<sup>15</sup> City of Edmonton *City Operations Greenhouse Gas Emissions Management Plan* (June 2012). Author's note: since this article was written, Edmonton's strategy to achieve a 50 per cent reduction (from 2005 levels) in greenhouse gas emissions from City operations by 2030 has been updated in the *Civic Operations Greenhouse Gas Management Plan 2019–2030* (May 2018).

(iv) Composter retrofits

Net reduction of 6,000 tonnes a year GHG emissions from Waste Management Services' Composter Facility will decline by 4,000 tonnes a year through an energy efficiency upgrade that was performed in 2011 and another that is recommended in this plan prior to 2020.

(v) Sustainable municipal fleet

Net reduction of 4,000 tonnes a year GHG emissions from the City's fleet (which does not include Transit Service vehicles) by 2020 as a result of improvements that are currently anticipated through the Sustainable Fleet Management Plan, including measures such as driver education, vehicle right-sizing, increased use of biofuels, hybrid vehicle purchases, and trailer skirt installation. No new efforts beyond these are proposed in this plan.

(vi) Urban forest

Efforts to double the City's urban forest canopy by 2090 will result in an annual reduction of 2,000 tonnes a year by 2020.

(vii) New buildings

Net increase of 19,000 tonnes a year GHG emissions will increase by 22,000 tonnes a year as a result of new City-owned buildings that are planned for construction from 2013 to 2020. However, this amount will be reduced by 3,000 tonnes a year through higher energy efficiency.

- **Principle:** Communities must aim to not increase the net amount of carbon dioxide and other GHGs in the atmosphere. Community design and planning must be based on low fossil fuel use in both building construction and operation.
- **Principle:** A sustainable society does not subject nature to systematically increasing concentrations of substances extracted from the earth's crust.
- **Principle:** Use of non-renewable natural resources must decline at a rate that is equal to or greater than the rate of depletion.

#### *2.4.2 Edmonton's Community Energy Transition Strategy*<sup>16</sup>

Under this 2015 strategy the City of Edmonton states that by 2035 Edmonton's GHG emissions will be reduced by approximately 35 per cent below 2005 levels. The strategy lists the following strategic actions:

<sup>16</sup> City of Edmonton *Edmonton's Community Energy Transition Strategy* (August 2015).



1. Edmonton will accelerate its energy transition efforts to become an energy sustainable city by mid-century.
2. Edmonton will focus its energy transition efforts on opportunities it controls and influences:
  - (a) accelerating the greening of Alberta's electricity grid.
  - (b) attracting a greater proportion of Edmonton's growth to established neighbourhoods.
  - (c) improving the energy efficiency of local industry.
  - (d) increasing the uptake of distributed energy generation.
  - (e) increasing energy efficiency in buildings.
  - (f) reducing gasoline and diesel used in vehicles.
3. Edmonton will achieve its energy transition goals and targets by:
  - (a) avoiding wasteful energy and carbon-intensive practices.
  - (b) improving energy efficiency.
  - (c) replacing high-carbon energy sources with low-carbon sources where justification exists.

To help achieve this, four strategic approaches will be adopted:

    - AVOID — Avoid using unnecessary energy.
    - REDUCE — Improving energy efficiency of vehicles and buildings.
    - REPLACE — Replacing high-carbon energy sources with low-carbon sources.
    - OFFSET — Not recommended at this time.
4. The City of Edmonton will take a lead role in supporting Edmonton's energy transition efforts. In doing so, it will lead by example in its own civic operations.
5. The City of Edmonton will apply a market transformation approach to achieve the changes that are needed to become an energy sustainable city.
6. The City of Edmonton will determine the level and types of financial investment that are needed to achieve Edmonton's energy transition goals. It will take a lead role in finding solutions to advance initiatives that are economically justified.
7. The City of Edmonton will apply best management practices to ensure its investment and operating decisions are aligned with Edmonton's energy transition goals.
8. The City of Edmonton will strive, where possible, to achieve Edmonton's energy transition goals in partnership with other municipalities and the Province of Alberta.
9. The City of Edmonton will create and provide ongoing support for a community leadership body that will play a key role in leading Edmonton's Community Energy Transition Strategy.
10. The City of Edmonton will apply the advice of the Citizens' Panel on Edmonton's energy and climate challenges.

11. The City of Edmonton will pursue the goals in Edmonton's Community Energy Transition Strategy using a dynamic/adaptive steering approach.
12. The City of Edmonton will work collaboratively with federal/provincial governments to address federal/provincial legislation and policies that are barriers to Edmonton's energy sustainability goals and encourage federal/provincial legislation and policies that support Edmonton's energy sustainability goals.

To achieve these strategic actions, this strategy also lists tactics in the form of an eight-year action plan. A selection of the tactics is listed below.

(i) Energy use in buildings

- Establish a long-term awareness and education campaign to inform citizens about the benefits of green buildings.
- Expand on the Green Building Plan.
- Establish a Green Renovation Programme.

(ii) Generation of electricity and heat

- In partnership with government, industry and academic institutions, establish and maintain an Alberta Fusion Energy directorate aimed at taking a leadership role to position Alberta for the fusion future.
- Establish programmes to encourage uptake of solar PV technology.

(iii) Energy use in industry

- Advocate the Government of Alberta for a province-wide energy efficiency programme aimed at small and medium-size industry.

(iv) Land use, transportation and development

- Implement the TOD Implementation Strategy in order to achieve the full Transit Orientated Development (TOD) potential of existing and future Light Rail Transit (LRT) stations in a timely manner.

(v) Water and waste water

- Pursue energy efficiency upgrades at the water treatment plant and reservoirs — for example, LED lighting conversion, HVAC (heating, ventilation, and air conditioning) upgrades, building envelope assessments.

(vi) Waste reduction and recycling

- Advocate the Province of Alberta for stronger regulations to reduce the landfilling of non-residential waste.
- Expand public education and social marketing programmes to encourage waste reduction and reuse among residents.

(vii) Leadership

- Establish and implement an energy education programme for City operations stakeholders who have responsibilities that affect or influence the energy consumption in City infrastructure and assets.
- Conduct daylight harvesting and LED lighting pilot projects.
- Utilise Edmonton Transit Service (ETS) land space to install wind and solar power generation to assist in powering Transit Centres and Transit Garages.

2.4.3 Energy Transition Strategy — 2016 Annual Report<sup>17</sup>

(i) To engage Edmontonians

- Energy transition marketing and communication campaign: to establish an overarching marketing and communication strategy to engage/mobilise Edmontonians.
- Sustainability showcase programme: to provide Edmontonians with hands-on opportunities to learn about and experience innovations that are essential for achieving Edmonton's energy transition goals.
- Green Leagues — Edmonton Federation of Community Leagues (EFCL) energy efficiency and solar programme: to encourage the adoption of solar PV and energy efficiency upgrades in Community League buildings and raise awareness about the benefits of such improvements.
- EcoCity Edmonton — community sustainability grants: to support community-based energy transition projects.
- Property assessed clean energy (PACE): to explore the value-case for property assessed clean energy (PACE) programmes in Alberta, and using it to advocate for provincial government action.

(ii) To advance wise energy use in buildings

- EnerGuide assessment and labelling programme for residential buildings: to inspire Edmontonians to improve energy efficiency in new and existing homes, using energy labels that provide information about home energy performance.
- Large building energy reporting and disclosure programme: to inspire Edmonton's large building owners to improve the energy performance of existing large buildings through the expansion of energy reporting, benchmarking and disclosure practices.
- Community energy consumption information platform: to establish an information and analytical tool to help citizens understand their personal energy use and the actions they can take to conserve energy and use it more efficiently.

17 City of Edmonton *Energy Transition Strategy — 2016 Annual Report* (2016).

## (iii) To advance clean electricity generation

- Streamlining the City's solar panel permitting process: to streamline the approval and permitting process for building-mounted solar panel systems, while providing clarity on building safety requirements, allowable impacts and allowable exemptions. 2016 projects — to advance wise energy use in local industry.
- Eco industrial pilot project: to evaluate ways in which Edmonton's industrial sector can improve individual and collective environmental performance (including reducing energy consumption and GHG emissions).
- Anaerobic digestion facility (Edmonton Waste Management Centre): to apply anaerobic digestion technology to decompose the organic fraction of municipal solid waste to produce biogas (a mixture of methane, carbon monoxide, and other gases).

## (iv) To advance energy-efficient land use, development and transportation

- Establishment of Edmonton's electric vehicle strategy: to establish an evidence-based, action-oriented plan that will encourage a market-shift towards the purchase of battery electric and plug-in hybrid vehicles in Edmonton.
- Valley Line LRT and other expansion projects: to build an LRT system that is an efficient and environmentally friendly way to move Edmontonians.
- Blatchford redevelopment: to transform 535 acres in the heart of Edmonton into one of the world's largest sustainable communities.

## (v) To lead by example in corporate operations

- Update of City Policy C532 — Sustainable Buildings: to update the City's Sustainable Buildings Policy C532 to ensure the City of Edmonton leads by example in establishing, implementing and maintaining sustainable building practices for the buildings it owns, leases and funds over the course of their entire lifecycle.
- Update of the City (corporate) Operations GHG inventory: to establish ambitious, cost-effective plans for reducing GHG emissions in City (corporate) Operations.
- Electric vehicle charging station pilot project: to advance the uptake of electric vehicles within the City's municipal fleet and the provision of electric vehicle charging stations.
- Community GHG inventory: to improve methodologies used by the City to calculate Edmonton's community GHG emissions as per the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories.
- Sustainable building practices: efforts led by Integrated Infrastructure Services in 2016 to advance sustainable building practices in City buildings.

#### 2.4.4 Climate Change Adaptation and Resilience Strategy<sup>18</sup>

The City of Edmonton is in the process of drafting a climate change adaptation and resilience strategy, which will be an update on the current Greenhouse Gas Emissions Reduction Plan, with an aim to having it finalised by 2018. While the plan is not currently finalised, there are discussion papers that are based on steps that have been undertaken by the City of Edmonton in three phases: investigation, setting direction, and taking action.

### 2.5 Stockholm

The City of Stockholm's climate efforts to tackle greenhouse gases are ongoing since 1995, with two five-year programmes having already been successfully implemented (1995–2000 and 2000–2005) and a new 10-year action plan launched in 2010. The City has long-term plans for the continuation of the initiatives with follow-up programmes scheduled until 2050, envisioning becoming fossil fuel free.

#### 2.5.1 The City of Stockholm's Climate Initiatives<sup>19</sup>

The City's strategy is that companies and administrations themselves should choose the most cost-effective climate actions to take to achieve the targets. These can include avoiding or reducing energy consumption, using energy more efficiently, and using renewable energy. As part of the journey towards a fossil fuel-free Stockholm in 2050, an ambitious new emissions target was established in the City budget for 2009. Emissions are to be reduced to 3 tonnes CO<sub>2</sub>e (carbon dioxide equivalent) per resident by 2015, which will entail a 44 per cent reduction from 1990 levels. Prior to the decision, an analysis was carried out of the most cost-efficient actions to reduce emissions by 2015.

1. Energy-efficient buildings.
2. Investing in clean vehicles.
3. Congestion tax.

To deal with congestion and traffic disturbances, a congestion tax was implemented in Stockholm in 2007.

18 City of Edmonton *Climate Change Adaptation and Resilience Strategy* (in development).

19 City of Stockholm *The City of Stockholm's Climate Initiatives* (2010).

### 2.5.2 Stockholm Action Plan for Climate and Energy<sup>20</sup>

The Stockholm Action Plan for Climate and Energy provides an overview of the City's climate work. The goal of the plan is to outline measures for achieving the climate and energy objectives of the Stockholm Environment Programme for 2012 to 2015. Apart from these short-term goals, the plan also incorporates the wider goals of the City's Vision 2030.

The targets relating to climate and energy in the Stockholm Environment Programme affect four sectors: transport, building, energy use, and energy production within the Stockholm geographic area. The actions mentioned in this plan aim to reach the goals within these sectors. The action plan also suggests numerous measures that will prepare the City for future action plans as well as for new climate and energy goals. The interim targets are as follows.

Interim targets 3.1 and 3.4 of the Stockholm Environment Programme:

- The City will, through energy efficiency measures, reduce energy use in its own operations by at least 10 per cent. Energy efficiency will be increased in the City's properties in connection with major renovations.

Interim target 3.5 of the Stockholm Environment Programme and the climate target of achieving a fossil fuel-free city by the year 2050:

- The City will strive to reduce emissions of greenhouse gases to a maximum of 3.0 tonnes of CO<sub>2</sub>e per citizen by the end of 2015. Emissions of greenhouse gases in the City will continue to be reduced at the same rate, which means that the City will be fossil fuel-free no later than 2050.

Measures:

1. Eco-efficient transport
  - Increase the proportion of cyclists and pedestrians.
  - Develop attractive and low-carbon public transport.
  - Increase accessibility for pedestrian, bicycle and public transport.
  - Increase the proportion of green vehicles.
  - Promote alternatives to journeys by private cars.
2. Sustainable energy use in buildings
  - Energy efficiency improvements.
3. Sustainable energy production
  - Production of electricity from wind turbines.
  - The City buys electricity that meets the demands of eco-labelling.
  - Electricity production from solar cells.

<sup>20</sup> City of Stockholm *Stockholm Action Plan for Climate and Energy* (2012).

4. Reduced energy use in city activities
  - Develop guidelines for the City that can be used in procurements of, among other things, energy-efficient goods and services.
  - Delivery of more goods and services in a more limited area to the City's activities.

## **2.6 San Francisco**

### *2.6.1 San Francisco Climate Action Strategy*<sup>21</sup>

In 2010 the City of San Francisco adopted the Greenhouse Gas Reduction Strategy in compliance with the California Environmental Quality Act (CEQA) Air Quality Guidelines. This served to evaluate the air quality impacts of the projects and plans proposed in the San Francisco Bay Area according to the Bay Area Air Quality Management District (BAAQMD) thresholds of significance. The report was a compilation of implementation efforts to address the strategies outlined in the 2004 Climate Action Plan.

Since the 2010 Greenhouse Gas Reduction Strategy, the Department of the Environment has published the 2013 Climate Action Strategy, the City's 2012 emissions report has been released, and the Planning Department has introduced new measures to address greenhouse gas emission reduction strategies. A brief timeline of city and state greenhouse gas reduction goals is outlined below.

- 2002: San Francisco's original GHG reduction targets were passed by the Board of Supervisors in 2002 with Resolution 158-02. This resolution establishes a goal of reducing GHG emissions to 20 per cent below 1990 levels by 2012.
- 2004: In September 2004 the San Francisco Department of the Environment (SF Environment) and the Public Utilities Commission (SFPUC) published the Climate Action Plan for San Francisco: Local Actions to Reduce Greenhouse Gas Emissions (Appendix A). The Climate Action Plan included both an emissions inventory and projections.
- 2005: Governor Schwarzenegger adopted Executive Order S-3-05 to set a greenhouse gas reduction target of 2000 emission levels by 2010, 1990 emission levels by 2020, and an 80 per cent reduction below 1990 levels by 2050.
- 2006: Assembly Bill 32, the California Global Warming Solutions Act of 2006 (CA Health and Safety Code Section 38,500 et seq) was signed into law in 2006. AB32 calls for the following:

21 San Francisco Department of the Environment *San Francisco Climate Action Strategy* (2013).

- Reduce GHG emissions to 1990 levels by 2020.
- The California Air Resources Board (CARB) to develop a Scoping Plan that outlines the state's strategy to achieve compliance with the targets. This Scoping Plan must be updated every five years (the most recent update was approved in 2014).
- 2008: In May 2008 San Francisco adopted ordinance 81-08 amending the San Francisco Environment Code to establish City GHG emission targets, superseding Resolution 158-02. In addition to reduction goals, ordinance 81-08 mandated City departments to publish annual reports and reduction plans to achieve compliance. The following GHG emission reduction limits and target dates remain the goals for the City and County of San Francisco:
  - Determine 1990 City GHG emissions by 2008, the baseline level with reference to which target reductions are set.
  - Reduce GHG emissions by 25 per cent below 1990 levels by 2017.
  - Reduce GHG emissions by 40 per cent below 1990 levels by 2025.
  - Reduce GHG emissions by 80 per cent below 1990 levels by 2050.
- 2015: On 29 April 2015 Governor Brown signed executive order B-30-15, pursuant to Senate Bill 32 (2014), which established a mid-term target of 40 per cent reduction of 1990 greenhouse gas emissions levels by 2030. This goal was implemented to help the state achieve 80 per cent reduction by 2050.

As San Francisco's economy continues to grow and its population increases, the City believes it can simultaneously reduce emissions and improve the quality of life by implementing the following strategies.

(i) Energy use in buildings

1. Move 100 per cent of residential buildings and 80 per cent of commercial electricity consumption to 100 per cent renewable electricity.
2. Achieve 2.5 per cent annual increase in energy efficiency in the commercial and residential building sectors through efficiency measures and behaviour change.

(ii) Transportation

3. Shift 50 per cent of trips to non-automobile trips by 2017 and 80 per cent by 2030.
4. Grow public transportation options and expand alternative transit infrastructure.
5. Expand access to clean vehicles and fuels, including:
  - (a) Move Bay Area Rapid Transit (BART) to 100 per cent renewable electricity.



(b) Move the taxi fleet and San Francisco Municipal Railway (Muni) buses to 100 per cent renewable fuels.

(iii) Zero waste

6. Achieve zero waste to landfills through recycling and composting.
7. Reduce upstream waste through material management and producer responsibility policies.

(iv) Urban forest

8. Secure funding to maintain existing urban forest.
9. Increase the canopy of the urban forest to 25 per cent of city land area.

(v) Municipal operations

10. Reduce natural gas use by 30 per cent.
11. Move Muni buses to 100 per cent renewable fuels.

If the plans and policies described in the 2013 Climate Action Strategy are implemented, by 2030 San Francisco's GHG emissions will be 52 per cent below 1990 levels, achieving the targets set by the San Francisco Board of Supervisors. Specifically, these goals will be achieved by:

- sourcing 100 per cent of residential and 80 per cent of commercial electricity from renewable sources, coupled with energy efficiency improvements to reduce usage;
- reducing natural gas use through energy efficiency improvements;
- making 50 per cent of all trips outside of personal vehicles; and
- achieving San Francisco's zero waste goal (reducing emissions from this sector to zero).

Should each of these goals be achieved San Francisco's carbon footprint will not only be much lower, it will look substantially different with natural gas contributing 48 per cent, cars and trucks contributing 45 per cent, electricity use in buildings contributing 6 per cent, and other transportation (BART, Caltrain, and ferry) making up the remaining 1 per cent in 2030.

Scaling up energy efficiency programmes and policies in San Francisco is estimated to reduce GHG emissions by 301,979 metric tonnes (mT) of carbon dioxide equivalent (CO<sub>2</sub>e) per year by 2030.

(i) Strategies being implemented

(a) *Green Building Ordinance*

Launched in 2004, this strategy is to ensure that all buildings use electricity, water and material resources intelligently. As of the summer of 2013 the Green

Building Ordinance achieved the highest per capita density of Leadership in Energy & Environmental Design (LEED)-certified square footage among US cities.

*(b) GoSolarSF*

San Francisco's GoSolarSF is the first of its kind as a municipally operated incentive programme for solar energy. Approved by the Board of Supervisors in 2007, it has helped propel San Francisco from laggard to leader in rooftop solar power, by offering financial incentives to residents, businesses and community-based organisations to install rooftop solar systems. It offers a one-time incentive payment for local solar electric projects, to reduce the cost of installation borne by the customer.

*(c) Land use integrated planning*

Integrating land uses is a method of leveraging development to minimise the need for driving and maximise the viability of walking, transit, bicycling, and car sharing. Major development agreements have resulted in reduced transportation demand with increased sustainable transportation services, innovative policies to provide condo households with transit passes, increased car sharing and bicycle parking, walkable streets, parking supply and road congestion management (on Treasure Island), and better transit services.

*(d) Green Taxi Ordinance*

In 2008 the City passed the Green Taxi Ordinance, specifying a reduction of average fleet GHG emissions by 20 per cent below 1990 levels within four years (the standard amount of time it takes taxi companies to turn over fleet inventory). The City also produced a Green Taxi Guide, to help the companies select appropriate vehicles. Although the number of taxis has almost doubled, San Francisco achieved a 10 per cent reduction in emissions by 2011. Hybrid vehicles have proven popular with taxi drivers because of how much fuel they save.

### **3. ALLOCATION OF STRATEGIES INTO CATEGORIES**

This part of the article simply categorises the strategies that were discussed in part 2 in order to recognise the areas that cities are focusing on and identify any similarities between the cities themselves.

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### **3.1 Building green buildings**

#### *3.1.1 Sydney*

- Green Square project.

#### *3.1.2 Rotterdam*

- Building retrofits.

#### *3.1.3 San Francisco*

- Green Building Ordinance.

#### *3.1.4 Edmonton*

- Green Building Plan.
- Update the City's Sustainable Building Policy C532 to ensure the City of Edmonton leads by example in establishing, implementing and maintaining sustainable building practices for the buildings it owns, leases and funds over the course of their entire lifecycle.

### **3.2 Reducing energy use in buildings**

#### *3.2.1 Sydney*

- The Energy Efficiency Master Plan.

#### *3.2.2 New York*

- Implement cost-effective upgrades in existing buildings to improve energy efficiency in the near term.
- Scale up deep energy retrofits that holistically address heating systems, cooling systems, and building envelopes, and transition buildings away from fossil fuels.
- Expand distributed solar energy and install 1,000 MW of solar capacity by 2030.
- Ensure building decision-makers have access to building energy use information.
- Provide assistance to the private sector to accelerate adoption of energy efficiency and clean energy.

#### *3.2.3 Stockholm*

- Sustainable energy use in buildings.

### *3.2.4 Edmonton*

- Establish a long-term awareness and education campaign to inform citizens about the benefits of green buildings.
- Expand on the Green Building Plan.
- Establish a Green Renovation Programme.
- EnerGuide assessment and labelling programme for residential buildings: using energy labels that provide information about home energy performance.
- Large building energy reporting and disclosure programme: expansion of energy reporting, benchmarking and disclosure practices.
- Community energy consumption information platform: to establish an information and analytical tool to help citizens understand their personal energy use and the actions they can take to conserve energy and use it more efficiently.

### *3.2.5 San Francisco*

- Move 100 per cent of residential buildings and 80 per cent of commercial electricity consumption to 100 per cent renewable electricity.
- Achieve 2.5 per cent annual increase in energy efficiency in the commercial and residential building sectors through efficiency measures and behaviour change.

### *3.2.6 Rotterdam*

- Floating Pavilion.

## **3.3 Reducing general energy use**

### *3.3.1 Sydney*

- Cool pavements trial — trialling a lighter-coloured pavement as part of an investigation into ways of reducing temperatures in urban areas.
- LED lighting project — replacing standard street lights with LED fixtures.

### *3.3.2 New York*

- Increase direct and indirect investments in large-scale renewable energy and energy storage.
- Increase efficiency and emissions requirements for in-city generators.
- Make an unprecedented commitment to promoting clean, distributed energy resources.
- Streamline regulatory processes for building energy efficiency and clean energy.

- Ensure building owners can finance energy efficiency projects.
- Achieve exceptional energy performance for new buildings and substantial renovations.
- Lead by example in City-owned buildings.
- Prepare New York City's workforce to deliver high-performance buildings.
- Position New York City as a global hub for energy efficiency and clean energy technology.

### *3.3.3 Stockholm*

- Reduced energy use in city activities.

## **3.4 Increasing renewable energy**

### *3.4.1 Sydney*

- The Renewable Energy Master Plan.

### *3.4.2 Rotterdam*

- Rotterdam Energy Infrastructure Plan.

### *3.4.3 Edmonton*

- Green power purchases.
- Streamlining the City's solar panel permitting process: to streamline the approval and permitting process for building-mounted solar panel systems, while providing clarity on building safety requirements, allowable impacts and allowable exemptions.
- Eco industrial pilot project: to evaluate ways in which Edmonton's industrial sector can improve individual and collective environmental performance (including reducing energy consumption and GHG emissions).
- Anaerobic digestion facility (Edmonton Waste Management Centre): to apply anaerobic digestion technology to decompose the organic fraction of municipal solid waste to produce biogas (a mixture of methane, carbon monoxide, and other gases).

### *3.4.4 Stockholm*

- Sustainable energy production.

### *3.4.5 San Francisco*

- Moving to 100 per cent renewable energy.
- GoSolarSF.

### 3.4.6 *New York*

- Solarize CB6.

## **3.5 Increasing energy efficiency**

### 3.5.1 *Sydney*

- The Decentralised Energy — Trigeneration Master Plan.

### 3.5.2 *Edmonton*

- Composter retrofits.

### 3.5.3 *San Francisco*

- Reduce natural gas use by 30 per cent.
- Move Muni buses to 100 per cent renewable fuels.

## **3.6 Energy ordinances**

### 3.6.1 *San Francisco*

- Green Building Ordinance.

## **3.7 Transportation**

### 3.7.1 *Rotterdam*

- Bio-based fuels — replacing fossil fuels with bio-based fuels in ports.

### 3.7.2 *New York*

- Modernise, expand, and reduce crowding on the city's transit system.
- Make walking and biking safer, more convenient options for all New Yorkers.
- Ensure that the City's policies prioritise walking, biking, and transit.
- Leverage technology and data to expand travel options and optimise the transportation network.
- Better manage and price parking to encourage efficient travel choices.
- Support new mobility options that reduce GHG emissions and prepare for autonomous vehicles.
- Accelerate purchases of zero-emission vehicles.
- Encourage the use of renewable and low-carbon fuels where electric vehicles are not an option.
- Encourage increased efficiency of local and "last mile" freight delivery.

- Invest in rail, maritime, and other infrastructure to increase the efficiency of freight movement.
- NYC Green Fleet.

### *3.7.3 Edmonton*

- Sustainable municipal fleet.
- Implement the TOD Implementation Strategy in order to achieve the full Transit Orientated Development (TOD) potential of existing and future Light Rail Transit (LRT) stations in a timely manner.
- Establishment of Edmonton's electric vehicle strategy: to establish an evidence-based, action-oriented plan that will encourage a market-shift towards the purchase of battery electric and plug-in hybrid vehicles in Edmonton.
- Valley Line LRT and other expansion projects: to build an LRT system that is an efficient and environmentally friendly way to move Edmontonians.
- Blatchford redevelopment: to transform 535 acres in the heart of Edmonton into one of the world's largest sustainable communities.

### *3.7.4 Stockholm*

- Eco-efficient transport.
- Increase the proportion of cyclists and pedestrians.
- Develop attractive and low-carbon public transport.
- Increase accessibility for pedestrian, bicycle and public transport.
- Increase the proportion of green vehicles.
- Promote alternatives to journeys by private cars.
- Congestion tax.

### *3.7.5 San Francisco*

- Green Taxi Ordinance.
- Shift 50 per cent of trips to non-automobile trips by 2017 and 80 per cent by 2030.
- Grow public transportation options and expand alternative transit infrastructure.
- Expand access to clean vehicles and fuels, including:
  - Move Bay Area Rapid Transit (BART) to 100 per cent renewable electricity.
  - Move the taxi fleet and San Francisco Municipal Railway (Muni) buses to 100 per cent renewable fuels.

### **3.8 Land use planning**

#### *3.8.1 San Francisco*

- Land use integrated planning.

#### *3.8.2 Sydney*

- City Plan planning controls.

### **3.9 Reducing GHG emissions**

#### *3.9.1 New York*

- Engage all New Yorkers in reducing waste disposal to landfills.
- Minimise waste generated by all City agencies.
- Launch outreach campaigns to reduce food waste.
- Implement proven incentive-based systems to minimise waste generation.
- Support increasing citywide reuse and donation.
- Accelerate diversion of recyclable materials from landfills.
- Capture organics and ensure sufficient capacity to facilitate beneficial reuse in both the residential and commercial sectors.
- Expand energy recovery from wastewater processing operations.
- Reduce emissions from the collection and disposal of commercial waste.
- Clean Energy Standard.
- Zero waste.

#### *3.9.2 San Francisco*

- Zero waste.
- Reduce upstream waste through material management and producer responsibility policies.

#### *3.9.3 Edmonton*

- Update of the City (corporate) Operations GHG inventory: to establish ambitious, cost-effective plans for reducing GHG emissions in City (corporate) Operations.
- Electric vehicle charging station pilot project: to advance the uptake of electric vehicles within the City's municipal fleet and the provision of electric vehicle charging stations.
- Community GHG inventory: to improve methodologies used by the City to calculate Edmonton's community GHG emissions as per the Global Protocol for Community Scale Greenhouse Gas Emission Inventories.



- Sustainable building practices: efforts led by Integrated Infrastructure Services in 2016 to advance sustainable building practices in City buildings.

### **3.10 Educating civil society about climate issues**

#### *3.10.1 New York*

- GreenNYC.
- Solar curriculum.
- Kathleen Grimm School for Leadership and Sustainability.

#### *3.10.2 Edmonton*

- Establish a long-term awareness and education campaign to inform citizens about the benefits of green buildings.
- Energy transition marketing and communication campaign: to establish an overarching marketing and communication strategy to engage/mobilise Edmontonians.
- Sustainability showcase programme: to provide Edmontonians with hands-on opportunities to learn about and experience innovations that are essential for achieving Edmonton's energy transition goals.
- Green Leagues — Edmonton Federation of Community Leagues (EFCL) energy efficiency and solar programme: to encourage the adoption of solar PV and energy efficiency upgrades in Community League buildings and raise awareness about the benefits of such improvements.
- EcoCity Edmonton — community sustainability grants: to support community-based energy transition projects.
- Property assessed clean energy (PACE): to explore the value-case for property assessed clean energy programmes (PACE) in Alberta, and using it to advocate for provincial government action.

### **3.11 Incentivising private-sector climate strategies**

#### *3.11.1 New York*

- Provide assistance to the private sector to accelerate adoption of energy efficiency and clean energy.

### **3.12 Cooperative government climate change strategies**

#### *3.12.1 Edmonton*

- In partnership with government, industry and academic institutions, establish and maintain an Alberta Fusion Energy directorate aimed at taking a leadership role to position Alberta for the fusion future.

### **3.13 Miscellaneous**

#### *3.13.1 Sydney*

- Urban Forest Strategy.
- The Decentralised Water Master Plan.

#### *3.13.2 Rotterdam*

- PLUS Programme on Sustainability and Climate Change.

#### *3.13.3 Edmonton*

- Roadway lighting.
- Urban forest (carbon sinks).

#### *3.13.4 San Francisco*

- Secure funding to maintain existing urban forest.
- Increase the canopy of the urban forest to 25 per cent of city land area.

## **4. EVALUATION**

The six cities and respective strategies that this article has discussed are all leading-edge examples of local governments creating and implementing effective strategies for adapting to and helping to reduce the effects of climate change. Although all these strategies appear to address climate change adaptation and mitigation in a robust sense, they do not all have the same merits when it comes to effectiveness and innovativeness. This part of the article will evaluate the strategies being deployed by the cities which hold the best hope of significantly reducing GHG emissions at the local government level. In evaluating the strategies, a discussion will surround why the top strategies in each city are efficacious or notably innovative.

### **4.1 Sydney**

#### *4.1.1 LED lighting project*

An effective and innovative strategy that the City of Sydney has implemented is their LED street lighting project. The project was recognised for leadership and innovation at the 2014 Institute of Public Works Engineering Australasia (NSW) annual awards. The key aim of the project was to test the performance of a variety of LED light products in real-world conditions, comparing them

with standard street lighting that is currently used.<sup>22</sup> The project was part of a global trial run by The Climate Group and ran from 2010 to 2012.<sup>23</sup> The City of Sydney tested three LED luminaires along St George Street in the central business district and compared them with baseline 250-watt metal-halide lamps previously employed on the same street.<sup>24</sup>

The City originally began trials of LED street lights in 2008 in Alexandria Park, Kings Cross, Circular Quay and Martin Place. Initial data from this trial suggested that using LEDs could reduce electricity consumption by up to 74 per cent, reducing Sydney's carbon footprint extensively. In 2010 Sydney began a one-year trial of three LED products on St George Street in the business centre. This trial ended in 2012, and it was found that all three LED lights achieved significant energy savings, ranging from 63 per cent to 85 per cent.<sup>25</sup>

In December 2011 the Sydney City Council entered into a contract with an organisation to supply, fit and maintain an LED lighting retrofit of the City's 6,448 lighting assets.<sup>26</sup> The City of Sydney believes that utilising LED technology best meets its needs, and will help to achieve the goals of Sustainable Sydney 2030.<sup>27</sup> The Sydney City Council states that it has already saved almost \$800,000 and reduced energy use by more than 48 per cent per year since March 2012.<sup>28</sup> It also states that more than 90 per cent of people surveyed by the City said they found the new lights appealing and three-quarters said the LEDs improved visibility.

## 4.2 Rotterdam

### 4.2.1 Green Roofs Programme

Rotterdam has a unique roof landscape, consisting of 14.5 km<sup>2</sup> of flat roofs.<sup>29</sup> The City of Rotterdam is utilising this opportunity and encouraging citizens to actively use their rooftops to create a green landscape. Rotterdam is promoting the construction of green roofs in a number of ways, such as with a subsidy scheme that provides financial incentive to have the roof converted into a green

22 The Climate Group *Sydney LED Trial: Final Report* (2012) at 3.

23 At 3.

24 At 3.

25 At 11.

26 At 3.

27 At 3.

28 City of Sydney *LED Lighting Project* (8 December 2015) CoS <<http://www.cityofsydney.nsw.gov.au/vision/towards-2030/sustainability/carbon-reduction/led-lighting-project>>.

29 Rotterdam Climate Initiative "Green Roofs Programme" (2017) RCI <[http://www.rotterdamclimateinitiative.nl/uk/city/ongoing-projects/green-roofs-programme?project\\_id=249&p=1](http://www.rotterdamclimateinitiative.nl/uk/city/ongoing-projects/green-roofs-programme?project_id=249&p=1)>.

space.<sup>30</sup> There are a number of benefits of planting gardens on roofs — they absorb rainwater and delay the peak in water discharge, they have an insulating effect on homes, keeping them cooler in summer and warmer in winter, they reduce noise, they absorb and filter outdoor pollutants and dust particles from the atmosphere to form a buffer against pollution, and they contribute to the sustainable qualities of the City as a whole.<sup>31</sup> With this process, green roofs contribute to the reduction of CO<sub>2</sub> emissions.

With the incentives and encouragement from the City of Rotterdam, 220,000 m<sup>2</sup> of green roof has now been constructed.<sup>32</sup> The target is to install 40,000 m<sup>2</sup> of green roofs every year, in partnership with the water boards. The tools used to achieve this goal include a grant scheme (that will gradually be phased out over the next few years), campaign periods, information days and personal advice.<sup>33</sup>

### 4.3 New York

#### 4.3.1 *GreenNYC*

One of the most effective and equally innovative strategies that has been discussed in this article is the GreenNYC tool in the New York One Plan and Roadmap 80x50. The reason for this is not only because of the extensive community consultation that went into the drafting of the roadmap strategy, but also the methods being used to implement it, including further education of the community. GreenNYC was created to be New York City's public education programme to engage and mobilise New Yorkers to take simple yet meaningful steps to reduce their energy use, generate less waste, and live more sustainable lifestyles. Through data- and marketing-driven strategies, the City of New York has been able to achieve meaningful engagement with citizens, and measurable reductions in solid waste and greenhouse gas emissions.<sup>34</sup>

It is widely accepted in academia that public participation and directly engaging with the local community creates effective and robust local policies and strategies, and ensures their implementation and effectiveness. There is a large body of work that supports this theory, and local governments are incorporating it into their everyday planning framework. An early author of

30 City of Rotterdam, above n 12, at 24.

31 At 24.

32 Gemeente Rotterdam, 100 Resilient Cities, Rotterdam Climate Initiative and Rotterdam Make it Happen *Rotterdam Resilience Strategy: Ready for the 21st Century — Consultation Document, Extended Version* (2016) at 92.

33 City of Rotterdam, above n 12, at 24.

34 New York City Mayor's Office of Sustainability *Small Steps, Big Strides, Insights from GreenNYC: The City of New York's Behaviour Change Program* (2017).

this theory is Arnstein, in her article “A Ladder of Citizen Participation”.<sup>35</sup> The theory in this article is that there are eight levels of citizen participation and that as you work your way up the ladder, you go through non-participation, tokenism participation and degrees of citizen power.<sup>36</sup> The higher up the ladder, arguably the more effective the form of citizen participation is, and in turn the more effective the outcome is. Collins and Ison discuss Arnstein’s theory in relation to climate change, highlighting that participation of citizens is now prevalent for local governments in tackling climate change.<sup>37</sup>

They do not entirely agree with Arnstein’s theory, however, contending that it constrains the way we think about and undertake participation in a climate change context, given the complexities that are involved.<sup>38</sup> They argue that complete citizen power is not ideal, nor is sole government control, and that it is crucial that different policy problems are given different levels of public participation.<sup>39</sup> Collins and Ison also discuss the theory that the more interest the public has in a situation, the more involved they will be and the higher sense of power and control they have. Thus, empowering citizens to make real-world changes in relation to climate change gives them in return a higher sense of power and a degree of responsibility.<sup>40</sup>

Since GreenNYC’s inception, the City of New York has stated that it has proved a vital tool in engaging the local community to achieve their sustainability and GHG reduction goals. By undertaking a marketing-centric approach, which includes multimedia, social media and visually aesthetic campaigns, the tool has become accessible and effective.<sup>41</sup> GreenNYC has also been successful because of its focus on strategic partnerships with corporations, NGOs, institutions and small businesses.<sup>42</sup> Through these partnerships, GreenNYC has been able to expand its reach and ability to connect with the public in a systematic way, which promotes behavioural changes of the public.<sup>43</sup> Because of the partnership with local organisations, GreenNYC is seen more in citizens’ everyday lives, encouraging them to undertake their daily activities in a more efficient and sustainable manner.<sup>44</sup>

35 Sherry R Arnstein “A Ladder of Citizen Participation” (1969) 35(4) *Journal of the American Institute of Planners* 216.

36 At 217.

37 Kevin Collins and Ray Ison “Jumping off Arnstein’s Ladder: Social Learning as a New Policy Paradigm for Climate Change Adaptation” (2009) 19(6) *Environmental Policy and Governance* 358.

38 At 358.

39 At 361.

40 At 362.

41 New York City Mayor’s Office of Sustainability, above n 34.

42 At 8.

43 At 8.

44 At 8.

## 4.4 Edmonton

### 4.4.1 EcoCity grants

The City of Edmonton, in cooperation with Alberta Ecotrust, has created the EcoCity scheme to provide grants to support community-based sustainability projects.<sup>45</sup> Approximately \$150,000 a year is allocated through the programme, with a maximum of \$50,000 a project.<sup>46</sup> These grants, which are available to nonprofits, community leagues, schools and charities, are aimed at engaging citizens to work on these challenges and provide them with support to collaborate and to create positive environmental change.<sup>47</sup> The focus will be on community projects that help to reduce GHG emissions.<sup>48</sup> In 2016 EcoCity Edmonton grants were awarded to:

- Kate Chegwin Junior High School (\$30,000) for solar panels, energy audit kits, community information sessions and field trips to Northern Alberta Institute of Technology (NAIT).
- Evansdale Community League (\$28,750) for a 12.5 kW solar photovoltaic (PV) system and related public events.
- Old Strathcona Farmers' Market Society (\$48,750) for a 17 kW solar PV system and related stakeholder outreach efforts.
- NAIT (\$20,000) for evaluating current outreach programmes and developing/delivering more educational tours.

Over its first two years of operation, the grant programme awarded \$247,500 for eight different projects which are in various stages of completion.<sup>49</sup> The three projects that were first completed engaged more than 4,000 people and more than 400 volunteer hours.<sup>50</sup> As well, the City's funding for these projects has helped to leverage an additional \$200,000 from other funding sources.<sup>51</sup> In these projects alone, the programme has facilitated the installation of 35.5 kW of solar PV, with an additional 42 kW of solar PV systems planned.<sup>52</sup> The City of Edmonton has continued this project in 2017, with seven grants recipients so far in this year.

45 City of Edmonton, above n 17, at 10.

46 At 10.

47 At 10.

48 At 10.

49 At 10.

50 At 10.

51 At 10.

52 At 10.

## 4.5 Stockholm

### 4.5.1 Congestion tax

An effective strategy that has been implemented by the City of Stockholm to help reduce GHG emissions is the congestion tax.<sup>53</sup> To deal with congestion and traffic disturbances in the City, a congestion tax was implemented in Stockholm in 2007.<sup>54</sup> Before the tax was implemented, there was wide public negative disagreement that it would actually work and whether it was worth what it would cost.<sup>55</sup> Because of this, a trial was undertaken in 2006, which showed a decrease in the number of cars in the city centre, with a reduced average in traffic of approximately 20 per cent. This, in turn, caused more positive attitudes from the citizens of Stockholm and resulted in an increase in popular support.<sup>56</sup>

The congestion tax is nationally implemented in Sweden and applies to all Swedish registered cars that drive in and out of the Stockholm city centre between the hours of 6 am and 6.30 pm on regular working days. Each passage costs €1 to €2 depending on the time of day, with a maximum amount of €6 per day.<sup>57</sup> Cars are automatically registered at payment stations, and the tax is paid monthly through a notice sent to the vehicle owner.<sup>58</sup> Since the tax was implemented, Stockholm has seen better air and reduced congestion, with nearly 75 per cent of the citizens experiencing reduced congestion at entrances and exits to the city centre, while nearly 70 per cent feel the air has improved, 65 per cent believe the traffic noise has declined, and more than 50 per cent believe that traffic safety has increased.<sup>59</sup>

Because of the success in achieving substantial congestion reductions, the system has received worldwide attention.<sup>60</sup> When the tax was introduced in January 2006 there was a noticeable change in the amount of traffic straight away, with a traffic reduction of 22 per cent across the cordon area. The attitude of the citizens and City alike has also changed exponentially, as they now realise that the tax is having a significant impact on traffic congestion.<sup>61</sup>

Despite external factors over the years, such as inflation, economic growth, a growing population and an increasing car fleet, traffic levels have remained

53 Jonas Eliasson *The Stockholm congestion charges: an overview* (KTH Royal Institute of Technology, Centre for Transport Studies, Stockholm, CTS Working Paper 2014:7).

54 At 2.

55 At 2.

56 At 2.

57 At 7.

58 At 6.

59 City of Stockholm, above n 19, at 22.

60 Eliasson, above n 53.

61 At 8.

roughly constant.<sup>62</sup> There is no sign that the effect of the charges is wearing off, as some may expect, and instead, it is increasing over time. In September 2012 the exemption for alternative-fuel vehicles was abolished.<sup>63</sup> This led to a further reduction of traffic; before that, 6 to 8 per cent of traffic across the cordon had been subject to that exemption.<sup>64</sup>

The reduced congestion from the tax has been noticeable. Travel time improvements occurred both in the City and on arterial roads.<sup>65</sup> The reduction in vehicle kilometres travelled and reduced congestion ultimately means that the emissions from traffic are reduced.<sup>66</sup> Overall, the results reveal that air quality was improved in many streets in the inner City, and carbon dioxide emissions from traffic in the City as a whole decreased by 2 to 3 per cent.<sup>67</sup>

A positive effect of the congestion tax is the increase seen in citizens using public transport and in turn the extension of those services. To meet the increased demand in the public transport system, which was around 4 to 5 per cent, the system had to be extended.<sup>68</sup> During the trial period, the public transport system was not prepared for the influx of citizens who were opting not to drive; however, there were signs of improved punctuality of the services.<sup>69</sup>

## **4.6 San Francisco**

### *4.6.1 GoSolarSF*

The City of San Francisco launched GoSolarSF in 2008, with the goal to encourage citizens to switch to solar power to reduce fossil fuel-based energy use, increase renewable energy generation, save residents and businesses money on utility bills, and create green jobs.<sup>70</sup>

GoSolarSF is the first of its kind as a municipally operated incentive programme for solar energy and has helped propel San Francisco from laggard to leader in rooftop solar power, by offering financial incentives to residents, businesses and community-based organisations to install rooftop solar systems.<sup>71</sup> It offers a one-time incentive payment for local solar electric projects,

62 At 9.

63 At 9.

64 At 9.

65 At 10.

66 At 10.

67 At 13.

68 At 15.

69 At 16.

70 San Francisco Department of the Environment, above n 21, at 20.

71 At 20.



to reduce the cost of installation borne by the customer. Additional incentives are provided to low-income residents, who spend a greater percentage of income on energy-related bills.<sup>72</sup>

GoSolarSF also helps community-based organisations save money and increase their funds, as their energy bills are substantially reduced.<sup>73</sup> GoSolarSF has helped to create jobs, as every new megawatt (MW) of solar energy installed as part of the scheme adds the equivalent of 10 full-time jobs for one year.<sup>74</sup>

GoSolarSF, and the City's broader efforts to grow a local solar market (including reducing solar permitting costs and educating residents about clean energy and providing new financing options), has helped attract nearly a dozen solar companies to San Francisco, solidifying the City's position as an emerging capital of the green economy.<sup>75</sup> These companies and their employees also add to San Francisco's economic vitality.

As of 2012, GoSolarSF has provided \$15.5 million in incentives towards 2,000 solar installations, with a combined capacity of nearly 7 MW, reduced GHG emissions by 1,900 mT annually, and saved participants of the scheme roughly \$2 million annually on their electricity bills.<sup>76</sup>

72 At 20.

73 At 20.

74 At 20.

75 At 20.

76 At 20.