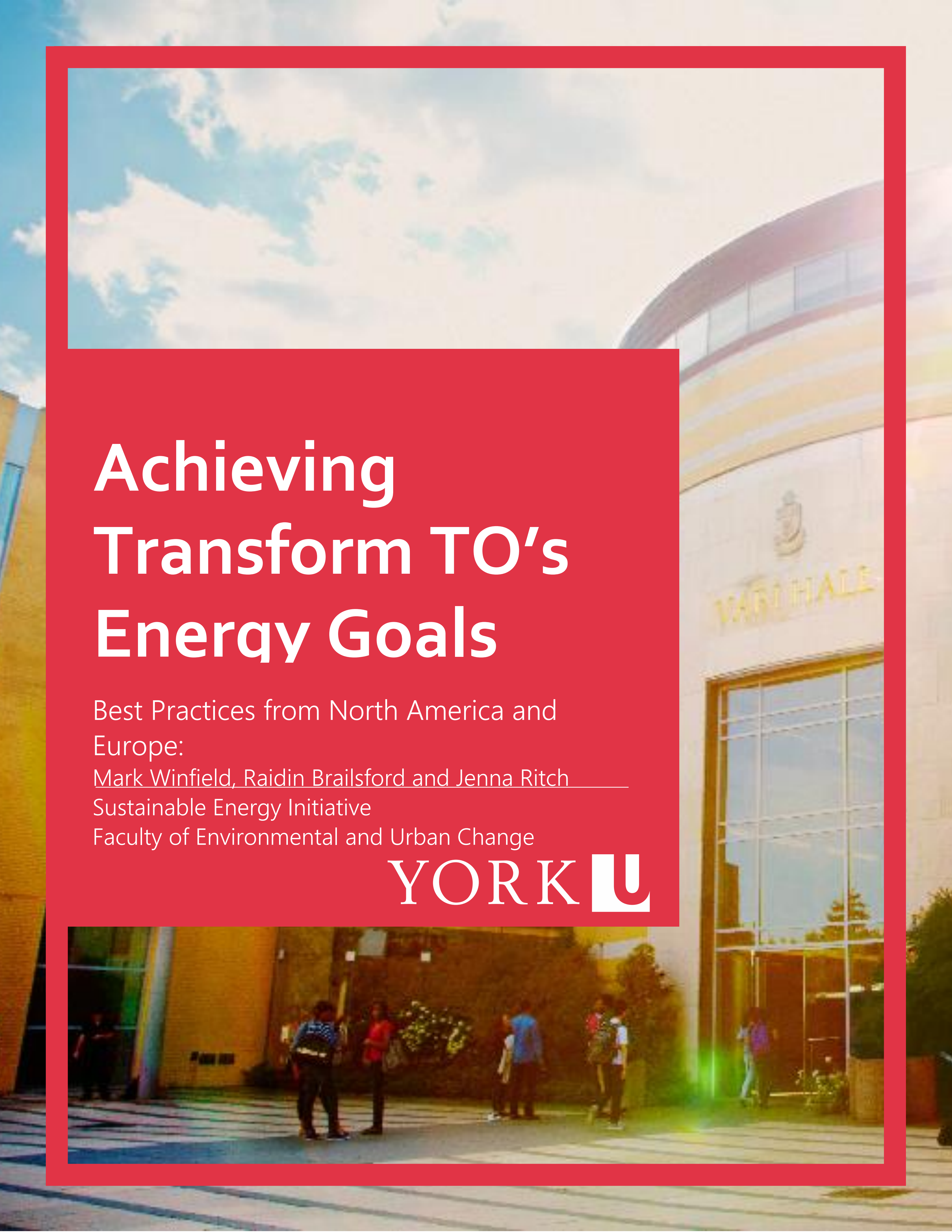

Achieving Transform TO's Energy Goals

Best Practices from North America and Europe:

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Implementing TransformTO: Energy Options
Best Practices from North America and Europe

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1. Introduction

This report is part of a series of studies highlighting best-practice municipal climate strategies, prepared under the auspices of the Climate Advisory Committee for Toronto (ACT). ACT is a joint initiative of York University, the University of Toronto, Ryerson University and OCAD. The present report focusses on energy issues as they relate to the City of Toronto's TransformTO climate change plan. Other reports prepared through the ACT process deal with the waste diversion, transportation, and buildings elements of TransformTO.

The energy study was a joint project of York and Ryerson Universities. The University of Toronto developed a study on buildings issues, and the Ontario College of Art & Design University (OCAD) focused on transportation. This study also draws on previous research on climate change policy, renewable energy, energy efficiency, distributed energy resources (DERs), energy storage and community energy and climate change planning conducted through the York University, Faculty of Environmental and Urban Change Sustainable Energy Initiative.

The report highlights key climate change and energy themes and strategies from eight North American and European cities comparable to Toronto (Lyon, Vienna, Munich, Manchester, Vancouver, New York, Portland, and San Francisco). The report identifies elements of their plans and activities which may be relevant to the implementation of the TransformTO plan.

Summaries of the regional level findings for the European and North American cities are included in the report. Recommendations for action by the City of Toronto are presented on the basis of these findings. The detailed city-specific case studies are included as appendices and are available on-line.

2. Transform TO and Energy

The Transform TO strategy adopted by Toronto City Council in 2017 establishes a series of overall and sector-specific targets for reducing the city's greenhouse gas (GHG) emissions between 2020 and 2050.

At a city-wide level the plan sets GHG emissions reduction targets, relative to 1990 of:

- a 30 per cent reduction by 2020;
- a 65 per cent by 2030; and
- Net zero GHG emissions by 2050, or sooner.

At the sectoral level, the TransformTO sets the following targets in the areas of energy, buildings, and transportation:

Energy

- By 2050, 75 per cent of the energy we use will be renewable or low-carbon; 30 per cent of total floor space across Toronto will be connected to low-carbon heating and cooling energy.

Homes and buildings:

- By 2030, all new buildings will be built to produce near-zero greenhouse gas (GHG) emissions.
- By 2050, all existing buildings will have been retrofitted to improve energy performance by an average of 40 per cent.

Transportation:

- By 2050, 100 per cent of vehicles in Toronto will use low-carbon energy; 75 per cent of trips under 5 km will be walked or cycled.

The achievement of these targets will require substantial shifts from the existing situation in the City and a substantial expansion of current programs and initiatives.

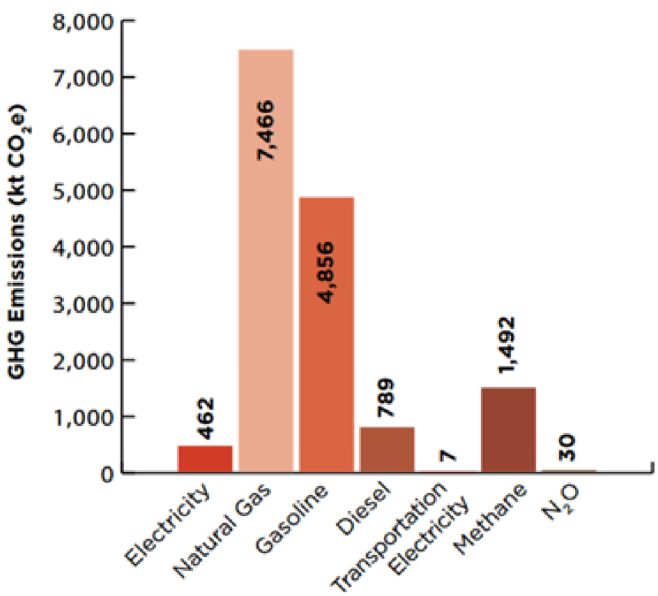
Toronto energy sources, uses and GHG emissions.

Figure 1, below summarizes the city's major sources of GHG emissions as of 2017 (Toronto 2020). Buildings, principally due to energy use related to space heating and cooling, account for more than half of Toronto's emissions. Transportation-related sources, particularly the use of fossil fueled vehicles such as private automobiles, commercial vehicles and trucks, and transit buses, are the second largest source of emissions.

Figure 1: Toronto's Greenhouse Gas Emissions (2017) (City of Toronto 2020)

Figure 2 illustrates the specific fuel sources associated with the city's GHG emissions. Consistent with the sectoral breakdown in **Figure 1**, natural gas usage, principally for building space heating, constitutes the single largest source of GHG emissions. The use of gasoline as a transportation fuel, and methane by-products from waste management operations follow as major emission sources.

Figure 2: City of Toronto GHG Emissions by Source (2017) (City of Toronto 2020)



The city's emission profile makes it clear that any strategy intended to achieve emissions reductions on the scale and timeframe set out in TransformTO will require a strong focus on energy related emissions sources, and more specifically the use of energy for building space heating and cooling, and transportation purposes. The importance of these sources is reflected in TransformTO's sub-targets in these sectors.

3. The Case Studies

For the purposes of this study, a total of eight cities – four North American and four European - were identified potential leaders in municipal-level climate change and energy strategies.

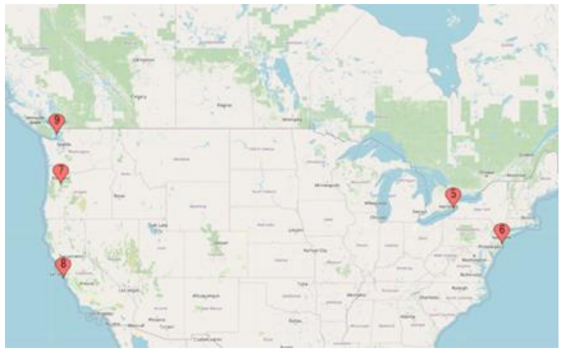
The eight cities were selected on the basis of a wider search of North American and European cities as potential candidates for best practices approaches to reducing GHG emissions related to energy, with the intention of identifying four cities in each region for detailed study. The overall goal was to identify initiatives and approaches to reducing energy related GHG emissions among cities that were broadly comparable to the City of Toronto in terms of population, urban structure, economy and climate. These models might be applied in a Toronto context to advance Transform TO's overall emission reduction targets.

The features of the cities identified for in-depth study included:

- The adoption or advanced stage development of a climate change mitigation and adaptation plan. These plans should incorporate elements relevant to Transform TO, including initiatives around building energy supply and use, including the roles of electricity, renewables, natural gas, and other fuels, energy efficiency, district heating and cooling, the integration of distributed energy resources (DERs) (Winfield and Gelfant 2020) into energy systems, and transportation and energy linkages, such as the role of electric vehicles (EVs);
- The incorporation of a relatively urbanized area with mix of high and low-density zones, similar to Toronto, with total population of over 500,000;
- A climate broadly comparable to Toronto's (e.g. warm/hot summers, cool/cold winters);
- An economic structure broadly comparable to Toronto's, including a mix of service/knowledge based economic activities, financial services, post-secondary education, major health care and government/public administration centres, information technology communications (ITC) activities, creative sectors, as well as some (potentially declining) manufacturing and warehousing/distribution activities.

On the basis of these criteria, four North American cities (Vancouver, Portland, New York City and San Francisco), shown in **Map 1**, and four European cities (Manchester, Lyon, Munich and Vienna) shown in **Map 2**, were identified for detailed study.

Map 1 – North American Case Study Cities.



Map 2 – European Case Study Cities.

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The detailed case studies, presented in **Appendices 1** and **2** where designed to examine the following themes:

- Does the city have a comprehensive energy or climate change plan?
- Does the city have formalized energy or climate change targets?
- What are the key features/areas addressed by the plan (e.g. buildings, transportation, energy sources, energy efficiency, marginalized communities)?
- What tools and approaches are employed within the plan? To what degree does the plan rely on tools the city itself has vs. having to rely on actions by senior levels of government.? Has the city been given any specific mandates, tools or supports by senior levels of government?
- Who are the major partners around the energy/climate change plan, such as utilities, major consumers, institutions/MUSH (municipalities, universities, schools and health care) sector organizations, community organizations, and other levels of government)?
- Is the plan being implemented? What mechanisms are there to ensure implementation and report on and assess effectiveness? Is there any evidence of plan impacts/effectiveness?

The primary research method employed for the development of the case studies, was the review of primary documents, such as legislation, policy statements, plans and performance reports, from the case study cities available on-line. Where possible these primary reports were supplemented with materials from third party observers or participants in the implementation of the city plans. Follow-up questions were sent to city staff and other participants in plan development and implementation via e-mail with videoconferencing follow-up as needed.

Once the individual city case studies were completed, regional summaries of the key themes and initiatives that were generally common among the case study cities in each region were developed. Major overall themes and commonalities among the cities were identified, and the applicability or form of these elements in a Toronto context examined.

The research also builds on recent York University Faculty of Environmental and Urban Change (FEUC) Sustainable Energy Initiative (SEI - https://sei.info.yorku.ca/) research in the areas of community energy and climate change planning (Winfield, Harbinson and Wyse, 2020), distributed energy resources (DERs) (Winfield and Gelfant 2019), advanced energy storage (Winfield, Shokrzadeh and Jones 2018); smart grids (Winfield and Weiler 2018), electricity policy in Ontario, (MacWhirter and Winfield 2019) and climate change policy (Winfield and Macdonald 2020, Winfield and Kaiser 2020).

SEI also offers a professional development course in community energy and climate change planning for municipal staff, developed in conjunction with QUEST (Quality Energy Systems of Tomorrow) with the support of the Ontario Independent Electricity System Operator (IESO), Electricity Distributors' Association (EDA) and Federation of Canadian Municipalities (FCM). The course consists of two days of live (now on-line) instruction featuring leading practitioners in the field in Ontario, and three on-line modules.

4. The Regional Summaries

In the course of the development of the regional summaries, a number of common themes emerged among the case study cities. These included emphases on building energy efficiency, low-carbon options for building heating and cooling, renewable energy development, district energy systems and community energy planning, and innovative financing models. As a result, the regional summaries were broadly structured around those themes.

Regional Summary: North America

The major initiatives among North American cities tend to be city-initiated and led, with varying degrees of support from state or provincial governments.

Energy Efficiency

North American cities are increasing energy efficiency through retrofitting, building emission caps and strict local energy codes. New York City (NYC) is increasing funding, eligibility, and tax incentives for city-wide retrofitting particularly in low-income housing and municipal facilities (NYC, 2019b; ACEEE, 2020b). NYC passed a law to limit emissions from buildings over 25000 sq. ft, representing 60% of the total building area in NYC (Capps, 2019; Urban Green, 2020a; Urban Green Council, 2020). Emissions above the limit will be charged $268/carbon tonne and up to $1 million in annual fines (Capps, 2019).

Vancouver increased retrofitting amongst residential buildings working with a building association to design a program that engages building owners & managers through education, building energy assessments, framing energy conservation through a business lens, and fostering connections with suppliers, contractors & utility company incentives (C40 Cities, 2016). 18 buildings participated in the first year and 69% of participants adopted at least one retrofitting measure (C40 Cities, 2016). Vancouver will be initiating a building emissions cap in 2030, escalating in five-year intervals (City of Vancouver, n.d. b).

NYC, Vancouver, and San Francisco have all been granted authority by their state or provincial governments to adopt local energy efficiency codes for buildings that are more stringent than the relevant provincial or state requirements. These requirements are central elements of their building energy efficiency strategies, particularly with respect to new-build structures.

Building Heating & Cooling

Vancouver, Portland, and San Francisco are planning shifts from high-carbon (specifically heating oil and natural gas) sources of building heating to heat pumps. Heat pumps are highly efficient devices that expel & draw heat into homes from ground, air, or water sources (The Atmospheric Fund, n.d.; Grant-Braid, 2018). Typical heat pumps are less efficient operating below -10 °C but cold climate heat pumps may be able to function efficiently down to -24 °C (Peterson et al., 2019; Grant-Braid, 2018). Add-on heat pumps that work with a gas, electric, propane or hydrogen fueled back-up heating systems would be required for Toronto's coldest days (Grant-Braid, 2018; Committee on Climate Change, 2018).

When heat pumps are combined with tight insulation and rooftop solar PV in cold climates, it has been argued that their utility bill costs may be comparable to those of higher carbon alternatives (Peterson et al., 2019). The Atmospheric Fund found that heat pumps would initially be most economically beneficial in electrically heated multi-residential buildings (The Atmospheric Fund, n.d.). A San Francisco assessment determined the transition to low-carbon heating resulted in emission reduction potential of 43 000 tonnes (San Francisco, 2016). In Vancouver, heat pumps were estimated to be able to reduce emissions 18% and energy usage 16% by 2050 (North Vancouver, 2019).

Renewable Energy Development

Toronto has promised to install 24 MW of solar capacity by 2020 and derive 75% of city energy from renewable/low-carbon sources by 2050, with 100 solar installations currently present on city facilities (Environment & Energy Division, 2018). NYC requires solar or green roof installations on new buildings or buildings replacing roof decking, solar-ready infrastructure on new single or double family homes, and "requires the City to identify, and assess the potential of, all solar-ready rooftops at City-owned buildings 10,000 gross square feet and larger," (ACEEE, 2020b; Zielinski et al., 2016; DCAS, 2019).

San Francisco requires 15% of roof area to be designated for solar installations on residential, commercial, and municipal buildings, and requires non-residential buildings over 50 000 sq. feet to derive all on-site electricity from renewables by 2030 (ACEEE, 2020c; SF Environment, 2019; City & County of San Francisco, 2017; Shean & Trotz, 2019).

San Francisco provides incentives for solar panel installation up to $100/kW for homes, $1000/kW for businesses, and $2000/kW for low-income families (SFWater, 2020; ACEEE, 2020c). NYC installs solar panels and heat pumps in low-income communities and enrolled residents receive credits for power generated on their utility bills (ACEEE, 2020c; NYC, 2019a).

Portland derives 100% of the electricity for city operations from renewable sources. From 2016-2018, the city sourced its electricity through onsite & offsite renewables in addition to the use of renewable energy credits (REC's) (City of Portland, 2017; ACEEE, 2020a; City of Portland, 2020b). REC's are purchased from wind facilities in the US as a transitional strategy until more renewable energy infrastructure is established (City of Portland, 2020b).

Community Renewable Utility Models

San Francisco operates a city-owned utility company which provides electricity to city departments (ACEEE, 2020c). San Francisco and Portland both operate programs that allow customers (residential and commercial) to opt-in to renewably sourced energy at no extra cost (ACEEE, 2020c; SFPUC, 2011; Pacific Power, n.d., PGE, 2019; City of Portland & Multnomah County, 2020).

Vancouver's Neighborhood Energy Utility utilizes recycled energy for heat in four neighborhoods, reducing emissions by 60% and operates on 70% renewable energy (City of Vancouver, n.d. a; City of Vancouver, n.d. b). This project was partially financed through a city reserve and will be repaid over 25 years as a charge on customers energy bills (Cairns & Baylin-Stern, 2016). Toronto has committed to feasibility studies for community energy plans and could benefit from incorporating a neighborhood energy utility system or initiate a program to permit residents to affordably opt-in to renewable energy.

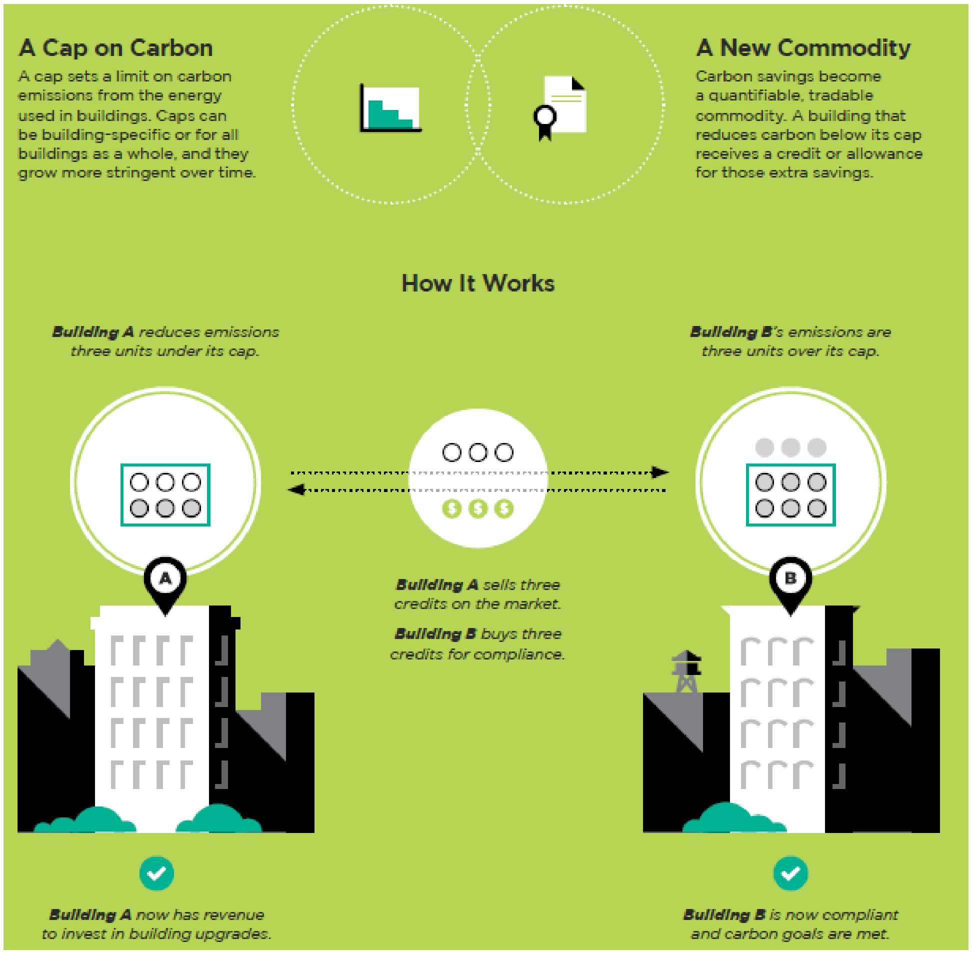
Revenue Sources to Finance Climate Initiatives

NYC is developing a building carbon trading scheme to facilitate the phase in of emission limits as discussed above and provide a source of retrofit funding. The basic premise is buildings that exceed the carbon cap can buy credits from buildings with emissions below the cap and use their revenue to invest in efficiency upgrades as displayed in **Figure 3** or alternatively, "it can be a permit or allowance to emit one unit of carbon, with all buildings required to buy or receive enough allowances to cover their annual emissions," (Urban Green Council, 2020, p. 3). The program could be limited to buildings within the emission limit regulations or permit all buildings in the city to participate (Urban Green Council, 2020). The trading scheme could be designed to benefit low-income populations by offering incentives of additional carbon credits for retrofits completed in these communities (Capps, 2019).

North American cities are utilizing various funding models which could be applicable in Toronto. Property Assessed Clean Energy (PACE) is a model of financing utilized in New York, Portland, and San Francisco in which loans for building energy efficiency retrofits are paid back on property bills and are linked to the property rather than the owner (Capps, 2019; NYC, 2017; SF Environment Factsheet, n.d). NYC engages in Energy Services Agreements (ESA) with third party companies which has led to financing for 57 energy efficiency projects in residential buildings (NYC, 2019b).

In Portland, a 1% retail sales surcharge led to $44-61 million of additional revenue to establish the *Portland Clean Energy Community Benefits Fund* which provides "clean energy funding, job training programs and green infrastructure projects," for low-income communities (PCEF, n.d.). In Portland, one community organized a co-operative to facilitate the bulk purchase of ductless heat pumps to assist homeowners' transition to low-carbon heating (Living Cully, 2018).

Figure 3: What carbon trading may look like in New York City (Urban Green Council, 2020)



Regional Summary – Europe

In contrast to the relatively locally-led character of US and Canadian city climate change initiatives, European municipal energy strategies tend to combine top-down funding and coordination with bottom-up implementation. This strategy is shown through the Smart City Lighthouse projects in Lyon, Munich, and Vienna. Funded through the Horizon 2020 European Union research and innovation program, *Smarter Together* aims to contribute to the achievement of the COP21 Paris Agreement greenhouse gas emission reduction targets and the implementation of the 2030 Agenda for Sustainable Development Goal 11 “Make cities inclusive, safe, resilient and sustainable” (*We Are Smarter Together*, 2020).

The *Smarter Together* lighthouse cities focus on five areas:

1. Citizen engagement. Partnerships with citizens and local stakeholders are essential to ensure greater public uptake of innovations and programs. The lighthouse cities establish living labs that involve businesses, IT providers, knowledge holders, and citizens to build a platform for outreach with the public.
2. District heating and renewables. Through the use of smart PV systems, district heating systems with connected heat substations, and improved battery storage capacity, *Smarter Together* intends to install 17.2 MW of renewable heat and power capacity maximizing the use of local energy resources.
3. Holistic refurbishment. Through the refurbishment of the existing building stocks, the implementation of energy recovery measures, and improved management systems, the program aims to reduce the energy consumption of buildings by 60%.
4. Smart data. Data collection and analysis are critical tools for improving the efficiency of community infrastructure. The lighthouse cities integrate energy and mobility into their smart data platforms to develop innovative and user-oriented services. Data also comes with many privacy concerns which are why *Smarter Together* includes measures to protect citizen privacy and the misuse of their data.
5. E-mobility. E-mobility solutions in the lighthouse cities range from e-car sharing, e-bike sharing, e-forklifts, integrated mobility points, and charging stations which benefit lighthouse cities by lowering carbon emissions, decreasing congestion, reducing noise pollution, and improving air quality.

Energy Efficiency

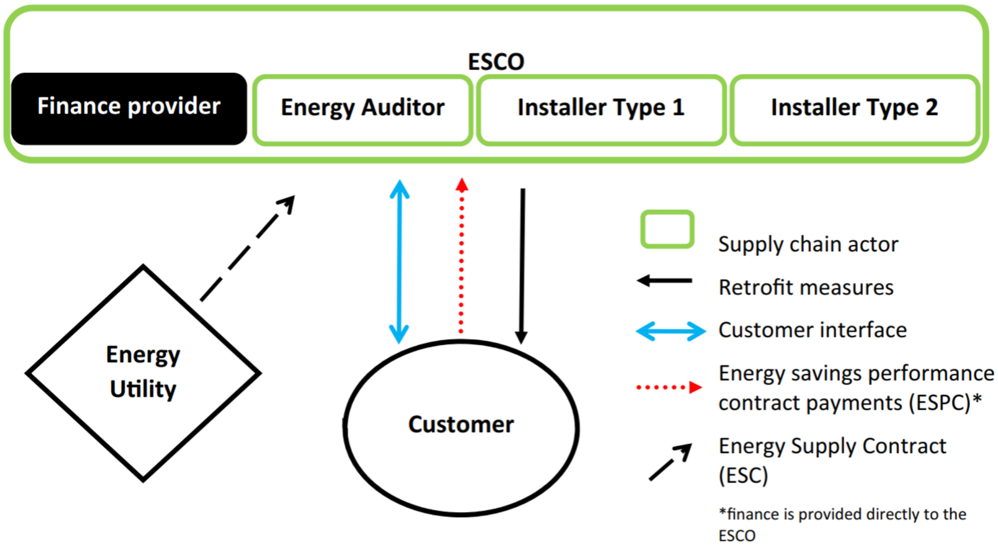
A major commonality between Lyon, Munich, Vienna, and Manchester is their drive to increase building energy efficiency. It is particularly important to reduce inefficiencies in an energy system as municipalities look to incorporate local renewable energy production, as it can lower energy demand and will reduce requirements for renewable energy installations and peak load.

Energy efficiency retrofits of public housing and government-owned buildings are an excellent starting point for increasing energy efficiency, followed by subsidies to support retrofits and updated building codes to ‘carrot and stick’ the private sector. The metropolis of Grand Lyon alone intends to retrofit 200,000 homes, 75% of buildings over 2,000 m^2, and 25% of all buildings under 2,000 m^2 by 2030 with their ECORENO’V program (Grand Lyon 2019a; Grand Lyon 2019b). Research shows that whole-of-house retrofits cost less than piecemeal retrofits, and are more cost-effective in terms of carbon emissions reductions by dollar (or euro) invested (Brown, Sorrell, & Kivimaa, 2019).

As shown with the *Smarter Together* initiative, as well as academic research, retrofit operations are the most successful and benefit from greater uptake when there is a market intermediary that can coordinate contractors, financiers, and customers to ease customer journey (Brown, Kivimaa, & Sorrel, 2018). In practice, the best business model for delivering large scale retrofits is the Energy Service Agreement (ESA) in which the customer signs a contract with an energy supply company (ESCO) for guaranteed water temperature, building temperature, and power supply over 15+ years (Brown, 2018). In exchange, the ESCO designs and builds a comprehensive retrofit and is responsible for the operation of the energy services. Additionally, the capital costs and debt accrued in designing and building the retrofit and in the operation costs are financed by the ESCO or a third party; the customer is only responsible for paying an energy saving performance contract (ESPC) payments to the ESCO plus their energy bill to the utility company--which will be greatly reduced from the comprehensive retrofit.

The best theorized business model is the Managed Energy Service Agreement (MESA) (**Figure 4**) (Brown, 2018). Under the MESA model, the ESCO simplifies the customer interface by coordinating with the supply chain actors and finance providers with the additional service of coordinating with the utility company to pay the energy bill for the customer, leaving the customer with no energy utility bill. Rather the consumer pays a rate under a ESPC which is normally at the price of the energy bill prior to the retrofit project.

Figure 4 – Managed Energy Service Agreement (MESA) model extracted from (Brown, 2018).



District Heating/Energy Systems

Once buildings are retrofitted to increase airtightness, managing heating and cooling becomes drastically less energy intensive. This has reinforced the long-standing interest of European cities in creating district heating grids.

13,358 GWh of Vienna's end use energy (36%) is used for space heating (City of Vienna, 2019) To ensure a sustainable, efficient supply of heat, Vienna built one of the world's most remarkable district heating networks. Vienna's district heating system supplies over 30% of Vienna's households with space heating and hot water (Wien Energie, n.d.). Using combined heat and power technology, the 1,200 km long network collects waste heat from electricity generation at the Simmering and Donaustadt natural gas power plants and the Spittelau waste incineration plant and delivers it to residential and commercial buildings. Vienna's approach is estimated to reduce emissions by 1.5 million tonnes of carbon dioxide annually.

Munich's publicly-owned energy provider is using district cooling to lower the city's carbon footprint (Stadtwerke München, n.d.) In Munich, the natural coldness of groundwater and urban streams is tapped to drastically reduce the power consumption in the cooling and air conditioning process. By comparison with individually generated cooling – especially in terms of conventional domestic air conditioning systems – electricity requirements can be reduced by 70 percent.

Renewable Energy Production

After increasing energy efficiency, cities should prioritize increasing the production of renewable energy. In European cities, the first step in this process is creating a solar map of the city overlaid with a map of publicly owned buildings so city planners and energy consultants can predict how much solar thermal or photovoltaic energy can be produced. Focusing on public sector buildings serves to ensure increased renewable energy production rather than attempting to motivate households or the private sector. In addition, public sector leadership can add curbside value that may, in fact, motivate citizens and businesses to invest, which will then be facilitated more readily with financing programs and market organization by the municipal government.

The City of Vienna is aiming to have 30 per cent of the city's energy consumption coming from renewable sources, and 70 per cent by 2050 (Homeier et al., 2019). Vienna's transition to renewable energy will be expedited firstly through investment in energy generation plants within the city and secondly by importing renewable energy via long-distance cables.

5. Conclusions and Recommendations

As noted earlier, a number of common themes emerged among the case study cities. These included emphases on building energy efficiency, low-carbon options for building heating and cooling, renewable energy development, district energy systems and community energy planning, and innovative financing models.

Specific technical recommendations have been made regarding buildings in the University of Toronto report. Many of these recommendations overlap with the findings of York University's city case studies. As a result, the recommendations presented here in relation to TransformTO are organized around the three broader policy and governance level themes of: City Authority and Capacity; Governance Structures for the Implementation of Transform TO; and Financing.

These recommendations also draw on earlier FEUC SEI research and professional development course offerings on community energy and climate change planning (Winfield, Harbinson and Wyse 2020). This research has noted that locally-led initiatives like TransformTO, offer substantial potential to advance community and energy sustainability, while reducing GHGs emissions and strengthening local resiliency in the face of the impacts of climate change.

At the same time, the research found that while local leadership is essential to the successful development and implementation of initiatives like TransformTO, stable and consistent enabling and supportive policies from senior levels of government are also crucial. These types of policies include appropriate enabling legislative and policy frameworks, and financial supports and incentives either from provincial or federal sources. Support in terms of data access and modelling capabilities also emerge as crucial elements.

Recommendations

City Authority/Capacity

One of the striking features of all of the case studies was the extent to which major cities have been granted substantial autonomy relative to the City of Toronto in areas like setting building energy efficiency and PV-ready standards over and above the requirements set at the state, provincial or national levels.

Recommendation

1.The City of Toronto should seek authority from the province to set building energy efficiency, and renewable/PV- energy ready standards above those set through the Ontario Building code, as is the case with the British Columbia Step Code, and is common among leading US states including New York and California.

Other jurisdictions, notably British Columbia, provide substantial support to municipal governments engaged in climate change and energy planning. These supports include assistance with energy use data access from utilities and modelling capacity. Current approaches in Ontario rely in the efforts of individual municipal staff to access and analyze energy use and transportation related data. There are no standardized or commonly used models for municipal or community level energy and climate change planning in Ontario ((Winfield, Harbinson and Wyse 2020).

2.The City of Toronto should seek provincial legislation and support for municipalities regarding access to energy use data from electricity and natural gas utilities for energy and climate change planning purposes. Modelling tools, capacity and support to assess options and emissions, cost impacts should also be provided.

Governance structures.

A number of the case study cities have been relatively successful in coordinating the roles of different municipal agencies, utilities and other actors in the development and implementation of climate change and energy plans. Local electricity distribution companies (LDCs), like Toronto Hydro, will for example, need to play significant roles in the development of distributed energy resources (DERs) (Winfield and Gelfant 2020). Other Ontario LDCs, like Alectra, have taken leadership roles in the development of DERs, but Toronto Hydro has not. Toronto Hydro's current mandate agreement with the City of Toronto makes no reference to contributing to the implementation of the TransformTO plan.

Recommendation

3.Toronto Hydro's role and mandate around microgrid and distributed energy resource (DER) development, and the implementation of TransformTO should be clarified and strengthened.

Transform TO provides a strong overall framework for climate change mitigation in the City of Toronto. However, it does not assign specific roles and expected outcomes to individual city agencies.

Recommendation

4.The accountability of city agencies and their senior management for the achievement of TransformTO's specific GHG emission reduction goals within their mandates and areas of operation should be strengthened, including regular progress reporting to council. The City Auditor should report regularly on progress in the implementation of TransformTO.

Natural gas usage for space heating constitutes the largest single source of GHG emissions in the City of Toronto. There are significant emerging debates over the future role of the gas grid in a low-carbon transition, and the potential roles of air and ground-source heat pumps, renewable natural gas (RNG), and hydrogen in space heating and cooling (Pollution Probe 2019).

Recommendation

5.The City of Toronto should initiate discussions with utilities, including ENWave, Enbridge, and Toronto Hydro and other relevant stakeholders around future roles of the natural gas grid, heat pumps, renewable natural gas (RNG), and hydrogen-based technologies in building space heating and cooling.

The Atmospheric Fund (formerly the Toronto Atmospheric Fund), is a critical asset in Toronto's low-carbon energy transition in terms of research, facilitation and financing.

Recommendation

6. *The City of Toronto should explore options for strengthening the role and mandate of the Atmospheric Fund in implementing TransformTO.*

Numerous studies on building energy efficiency have highlighted the importance of 'one-window' delivery of energy efficiency audit and retrofit services. Current services are fragmented among utilities, city agencies and federal and provincial programs (Winfield, Love, Gaede and Harbinson 2020).

Recommendation

7. *The City of Toronto should establish an Energy Service Company (ESCO) to ease customer journey in energy efficiency retrofits by providing one-window access to audit, financing, and retrofit services.*

Financing

Financing remains a significant barrier to the achievement of TransformTO's goals, particularly with respect to energy efficiency retrofits of existing buildings, large-scale transportation investments, like transit, and EV charging infrastructure.

Recommendation

8. *The City of Toronto should explore financing models for municipal climate change plan implementation that have been employed in other major cities in Canada and the United States. Potential models to be examined include:*

    - *The PACE (Property Assessed Clean Energy) model commonly employed by US cities.*
    - *A retail sales surcharge similar to Portland's 1% Clean Energy Community Benefits Fund.*
    - *An emissions cap and trade system for buildings similar to that proposed for New York City and Vancouver*

Conclusions

TransformTO has already established Toronto as a world leader in the development and implementation of a city-level climate change and energy strategy. This report has examined the approaches and initiatives being taken in other, comparable, leading cities in the areas of climate change and GHG emission reductions in North America and Europe. Drawing on their experiences it has identified a number of initiatives that might be considered by the City of Toronto to strengthen and accelerate the implementation of TransformTO and the achievement of its goals.

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Appendices

The detailed case studies are available on the EUC Sustainable Energy Initiative website at the following locations:

Appendix 1 – North American Case Studies

New York City, New York - Available at https://sei.info.yorku.ca/files/2020/09/New-York.pdf?x46177

Portland, Oregon – Available at https://sei.info.yorku.ca/files/2020/09/Portland.pdf?x46177

San Francisco, California – Available at https://sei.info.yorku.ca/files/2020/09/San-Francisco.pdf?x46177

Vancouver, British Columbia – Available at https://sei.info.yorku.ca/files/2020/09/Vancouver.pdf?x46177

Appendix 2 – European Case Studies

Lyon, France – Available at https://sei.info.yorku.ca/files/2020/09/Appendix-2.pdf?x46177

Manchester, United Kingdom – Available at https://sei.info.yorku.ca/files/2020/09/Manchester.pdf?x46177

Munich, Germany – Available at https://sei.info.yorku.ca/files/2020/09/Munich.pdf?x46177

Vienna, Austria – Available at https://sei.info.yorku.ca/files/2020/09/Vienna.pdf?x46177