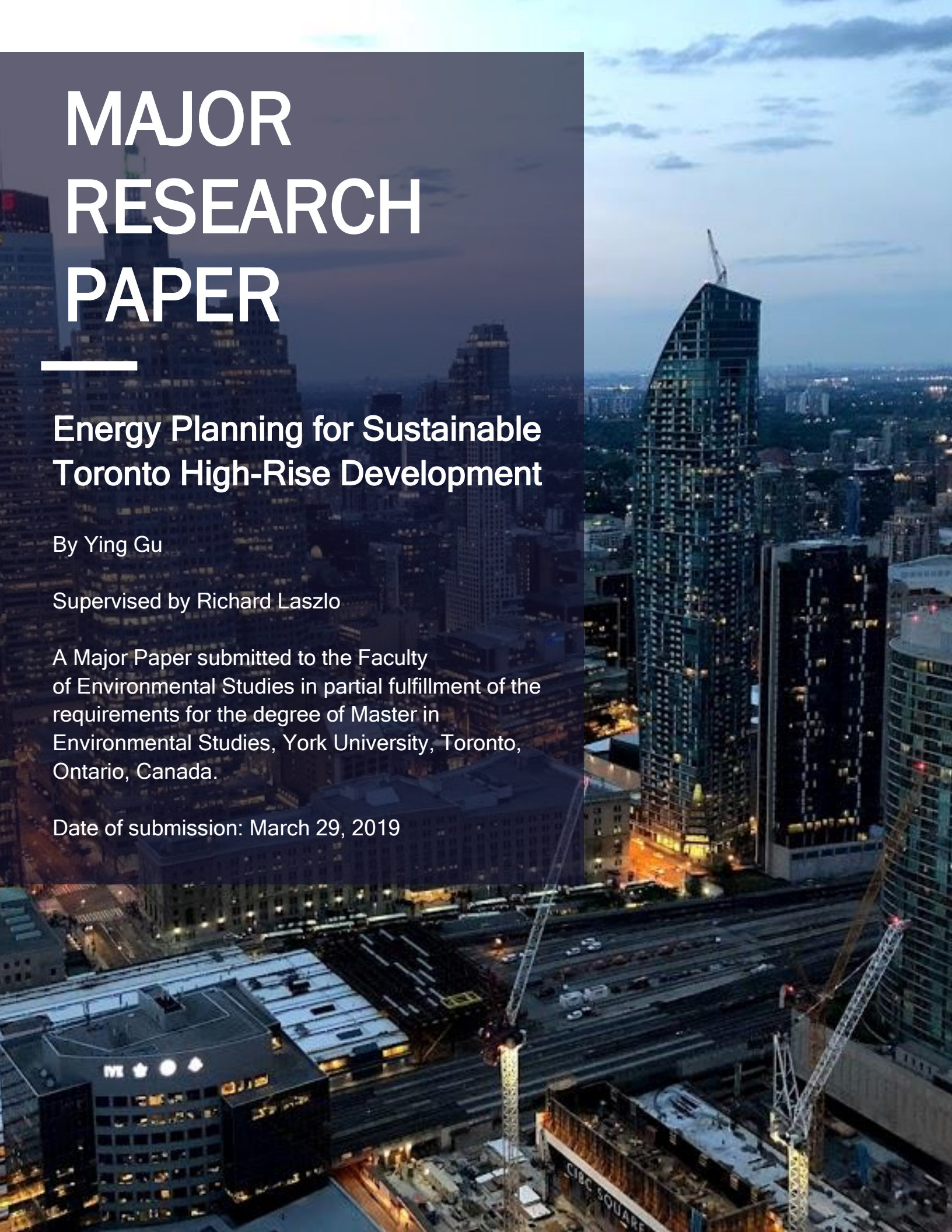

MAJOR RESEARCH PAPER

Energy Planning for Sustainable Toronto High-Rise Development

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A Major Paper submitted to the Faculty of Environmental Studies in partial fulfillment of the requirements for the degree of Master in Environmental Studies, York University, Toronto, Ontario, Canada.

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Abstract

The research topic that I wish to examine is climate change adaptation and mitigation through sustainable energy planning transformation. The focus is how high-rise multi-unit residential building trends in Toronto are impacted by government codes, standards and policies. The landscape I will be focusing on is existing, developed, high density, post-industrial urban areas. This issue is important and worth researching, specifically within the urban context, because climate change is one of the biggest issues faced globally today. Greenhouse gases (GHG) saturating the earth's atmosphere is at an all-time high in human history (Freedman 2018). In Canada, communities account for 60% of energy-use and over 50% of the country's GHG emissions (Gilmour et al 3). It is estimated that by 2030, five billion people will be living in urban areas (Rizwan et al 120). In Toronto, condominium development saw an all-time high in 2018. Toronto's crane count is the highest in the world. The result of my analysis will show the correlation between policies, codes, and standards, and the sustainability trends of Toronto condominium developers. The assessment will also include recommendations for community mobility to push the shift toward a more sustainable future.

Acknowledgements

I would like to firstly thank my course instructor and supervisor, Richard Laszlo, who has been a huge support to me throughout my MES major research, and to my aspirations in the field of energy planning. I would like to thank my advisor Liette Gilbert, for taking over in the advisory role in my last couple terms of MES; without her motivation, availability, and encouragement throughout these months, this research may not have been possible. I also would like to thank all the individuals I interviewed, for privileging me with their, expertise, stories, and insight.

Foreword

This Major Paper is submitted to the Faculty of Environmental Studies (FES at York University, to satisfy all the Masters in Environmental Studies (MES) Urban Planning program requirements. My research topic was developed through the Plan of Study (POS). Although the POS has evolved many times throughout my MES journey, over the course of my studies, my interest in energy planning in relation to high-rise construction, sustainable urban development, and community energy have all grown. The literature included in my major research stemmed from a combination of field research, course work, and personal interest collected throughout the duration of MES enrollment.

Component 1 of my POS relates to renewable energy for climate change adaptation in Toronto. Although my major research paper focuses more on energy efficiency than renewable, I have satisfied the objectives of this component to become familiar with different forms of renewable energy, and to further my knowledge on how we can use energy for climate change adaptation. I have also gained the knowledge and skills necessary to meet the program requirements for OPPI and CIP candidate membership. Component 2 involves green buildings and planning; objectives include broadening my understanding of sustainable building and planning processes in Ontario, sustainable building projects in Toronto and innovations on this topic around the world. Using literature, attendance of expos and tradeshows, and interviews with a private industry planning professional and a public policy maker, the objectives in this component are satisfied. Component 3 involves bottom-up approaches in community energy planning (CEP). Objectives include methods for successful incorporation of communities into planning and decision-making process, and continuing success. Through course literature, workshop abroad, field experience, and interviews with board members of a neighborhood association, I have satisfied the learning objectives in this component.

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Chapter 1: Introduction

1.1 Research Background

The main research question I will strive to answer is the following: **How can municipal policies (impacted by community energy planning) influence developers to build with accordance to the adaptation and mitigation of climate change?**

This is an important topic to discuss because there is no denying that climate change, caused by greenhouse gas (GHG) emissions, is one of the most distressing large-scale global issues we face today with social, political and environmental implications. Effects of the change in climate that have already been observed in recent decades indicate the sensitivity of human and natural systems (Pachauri et al, 6). While there are many environmental, social, and economic benefits to dense, compact, urban living, it can also cause higher levels of pollution. With buildings being responsible for over 40%of total energy consumption in developed countries (Huang et al 97), it is clear that the construction, operation, and maintenance of buildings has strong implications on the wellbeing of the planet. A 2018 study by the Fraser Institute shows that while the population density of Toronto is low compared to other cities in high income countries, with approximately 4,457 inhabitants per square kilometer (compared to New York which has approximately 10,935 inhabitants per square meter, and Hong Kong which has 25,719 inhabitants per square meter), it is still Canada's second most densely populated city, behind Vancouver with 5,493 inhabitants per square meter. The United Nations (UN) Department of Economics and Social Affairs (DESA) states that the shift of human population from rural to urban areas is projected to continue with the overall growth of the world's population. According to UN DESA statistics, currently 55% of the population of the world lives in urban areas. This number is projected to grow to 68% by 2050. In addition to Toronto being the second most densely

populated city in Canada, the 2016 census revealed that approximately 82% of Canada's population lives in urban areas (Press 2017). Some of the threats identified by the National Geographic for the demands of urban intensification include air pollution with substantial impact on human health, poor water quality and availability, and concentrated energy use. With all these negative environmental impacts caused by urban areas, and with a majority of the world's population projected to be living in urban areas in the next couple decades, does civil progression have to come at the expense of environmental sustainability?

The growing population of Toronto is also occurring alongside increased rates of high-rise development; the condo boom Toronto has been experiencing since the late 1990s is still ongoing (Lehrer et al 84). Increased urban intensification will also increase the need for energy. Climate change has stimulated profound change in ways of thinking about the production and consumption of energy (Blowfield, 4). Energy transformation and smart community energy planning can improve energy efficiency, cut costs, and reduce the levels of GHG emissions of residential energy consumption at the community level (Gilbert et al 9). More sustainable, green, high-efficiency building design and construction is crucial for the mitigation and adaptation of climate change in urban areas. Without action toward developing cities more sustainably, cities simultaneously contribute to and experience the vulnerabilities and threats imposed by climate change. Designing and building with sustainability in mind can help in the fight to combat climate change- developers are businesses and are therefore driven by a profit motive. While there is a niche market for sustainable spaces, the housing market in the GTA is in constant high demand regardless of the marketed eco-efficiency of a building. Recent changes to codes, standards and policies introducing more stringent environmental standards have made it mandatory for developers to build more sustainably. Some of the questions guiding my research are as follows:

- ✓ What are the drivers for green building development in Toronto?
- ✓ What are incentives and barriers for developers pertaining to green buildings?
- ✓ How can society push for more high-efficiency building?
- ✓ How much influence does the role of government play in the sustainability trends of this industry in Toronto?

While most believe that economic prosperity and urban expansion are synonymous with the deterioration of the environment and the natural world, my research strives to find a solution that will contribute to both positive urban intensification while avoiding immense ecological degradation. Social and economic progress, and environmental wellbeing do not have to be mutually exclusive. While we are all aware that sustainable technologies exist, the barrier of seeing wide-spread realization of these technologies is often

not an issue of accessibility, but of developers being willing to get them into implementation. There is not much available literature on how government codes, policies, and standards can influence the sustainability or voluntary performance standards of the building development market. By addressing ways that policy can affect developers to build in accordance with the adaptation and mitigation of climate change, we can find ways to help propel the proliferation of green buildings.

Energy planning makes up a large portion of this report. Because we will only be looking within the borders of Toronto, the scope of energy planning that will be focused on is community energy planning (CEP). traditional primary energy planning (PEP) will also be touched upon, but the focus will primarily be on CEP. CEP is defined by Huang et al as secondary energy planning, compared to PEP. The difference between the two are the objectives. In energy planning, traditional PEP is the supply-side, while CEP is the demand-side (energy that can be used directly, like electricity, household fuels, and hot water) (1337).

It is important to focus on the beneficiaries of an energy project. The endless potential benefits for community members of sustainable development are well documented and widely available, however, there is a research gap on how community members can help perpetuate this shift. Consumer demand may play a role, but in Toronto, the lack of sustainable condo development does not seem to be slowing down demand in the industry. Condo construction in Toronto is currently at an all-time high (Powell 2018). A lot of available research and resources for community mobility in city development involves affordability, such as the case with the affordable housing project in Parkdale let by the non-government organization (NGO) Parkdale Neighbourhood Land Trust (PNLT). There is research gap in how community members can lead their own energy projects. The process of developing and revising policies, codes, and standards often involves community engagement- incorporation of the voice and needs of the community. By knowing how policy can influence and push condominium developers to build more sustainably, and what community members can do to help influence policy change, we can find ways community members can influence in the condo development industry in both individual projects and the overall practice of development.

1.2 Context and Methodology

This paper focuses on energy planning policies, codes, and standards for high-rise condominium development in Toronto. I chose to focus on this diverse and populous city because I have lived here for the past 20 years and witnessed its rapid grow and develop, and now am witnessing it transform through

advancing progressive energy and climate policies. The boundaries of the area of focus are as outlined in the map on Figure 1.1. The historic context of the geographic boundaries of Toronto involves the amalgamation of Toronto's former six boroughs. On January 1st, 1998, the cities of Old Toronto, Etobicoke, North York, Scarborough, York, and the Borough of East York, which together made the then Municipality of Metropolitan Toronto, joined to form today's unified City of Toronto (Reddy, 69). This was done as part of the 1997 City of Toronto Act, in response to addressing challenges of rapid growth and demand for municipal services. While the Ontario Building Code (OBC) applies to all of Ontario, some of the strategies, codes, and policies this paper looks at are applicable only within the bounds of the City of Toronto.

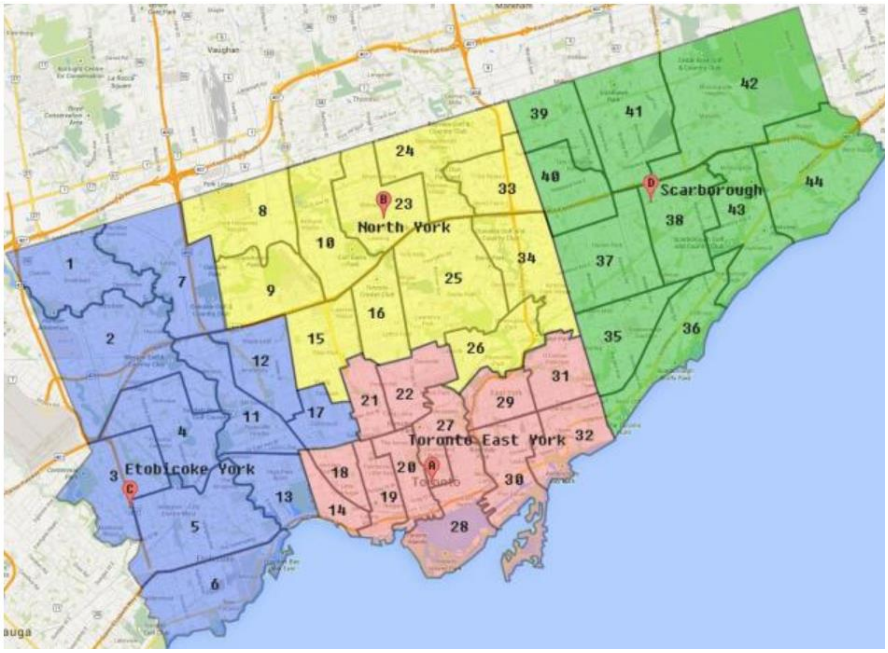


Figure 1.1: Boundaries of Toronto including the boroughs amalgamated in 1998 (Landau, 2017)

This paper examines the trends in Toronto's residential condominium development market, and how it is evolving with respect to green performance standards, government mandates and incentives for voluntary higher green performance. I focus on several Government documents and reports including the Toronto Green Standard (TGS), the Zero Emissions Building Framework Study, and Transform TO. Other Government documents relating to the development and amendments of TGS are also investigated. The incentives explored are financial and non-financial, governmental and non-governmental. Voluntary green building standards that are touched on include TGS V3 Tier 2 and higher, LEED, and BOMA BEst. BOMA will not be focused on in much detail, because due to the rating structure, it pertains more to commercial buildings than residential.

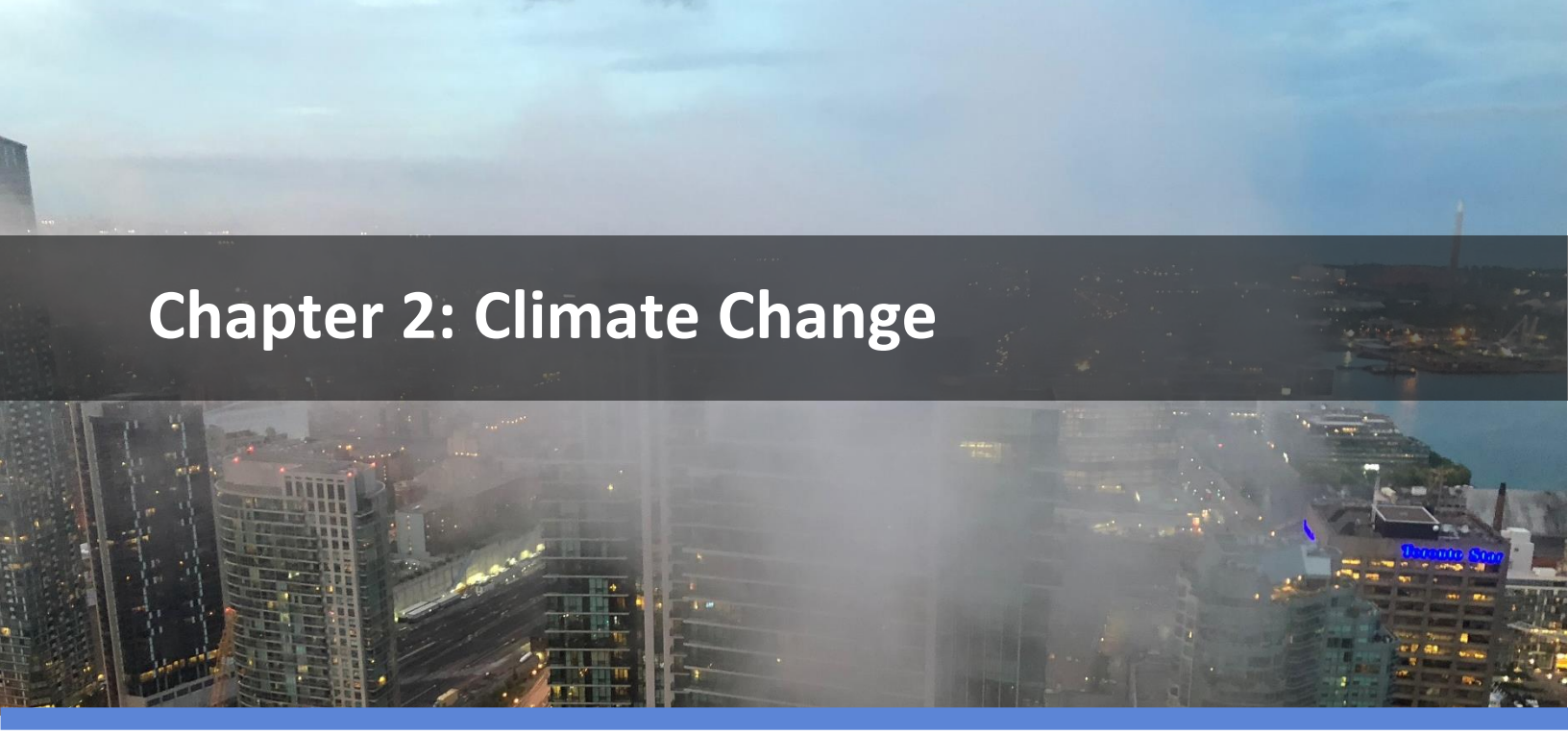
This paper also explores the potential of green building technology, and how well these technologies are being integrated into Toronto's development market. In this paper, I explore the concepts of climate

change adaptation and mitigation, as these concepts are necessary for understanding how development can influence the impacts of climate change. These concepts will be examined in the context of urban spaces; what is being done in Toronto, and around the world? Counter arguments of climate research and green building transformation are touched upon.

To answer my main research question, I rely primarily on secondary data on, with some primary data. This paper uses available statistics and existing literature to identify Toronto's green building trends. The secondary data collected primarily consist of literature review from academic sources, statistics and inventories collected from private and Governmental organizations, sustainability reports from private and Government organizations, and Government reports. The literature review is largely related to the following topics: climate change mitigation and adaption in urban areas, sustainable/ high performance/ green buildings, high-rise building trends, grassroots development and planning initiatives, and community energy planning. These topics will also be explored by attending the following expos, talks, and trade shows: The Building Show by Construct Canada at the Metro Toronto Convention Centre, The City Building Expo hosted by Ryerson University and the University of Toronto, and the 2019 United Nations (UN) Sustainable Development Goals (SDG) Advocacy Training presentation at York University.

There are some technical, social, economic, and regulative barriers to successful implementation of sustainable energy planning policies and renewable energy. I will look at some of these barriers in the Canadian and Toronto context, and investigate how these barriers can be overcome. Anecdotal experience from both the side of a private high-rise developer as well as a neighborhood association are used to in this report to paint some of the barriers undergone by stakeholders of this topic in Toronto. Once all the data on these topics are collected, I will summarize the information with the aim of informing the audience of the magnitude of the global climate issue we are facing, followed up potential options for solutions.

Interviews for qualitative and anecdotal data about current development trends, how the high-rise industry has changed throughout the years, as well as the pattern of community engagement, were collected from stakeholders involved in the Toronto condo development market. After completing the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research Ethics (TCPS 2: CORE), obtaining ethics approval for my Application to Conduct Human Participants Research, and getting written consent from participants, stakeholders interviewed include a private sector planner for a condo developer, policy planner from the City of Toronto, and board members from an NGO neighborhood association.



Chapter 2: Climate Change

2.1 Overview

Human activities such as transportation, industrial, and domestic fossil fuel consumption are causing climatic changes such as rising temperatures (Harlan and Ruddell, 127). Since the 1950s, there have been observations of rising sea levels, warming of the ocean and atmosphere, and diminishing ice and snow (Pachauri et al, 5). More successive warming of each of the last three decades at the Earth's surface has been observed than any preceding decade since 1850 (ibid). Human influence on the climatic system is evident; more than half of the increase in the earth's surface temperature observed from 1951 to 2010 is likely caused by the increase in GHG concentrations along with other anthropogenic forcing (Pachauri et al, 5). According

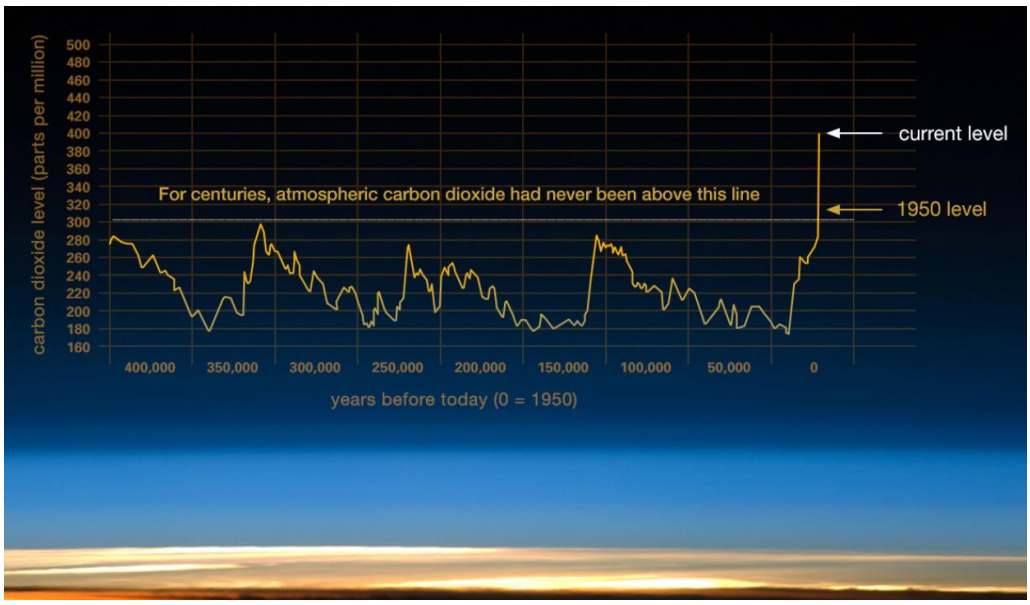


Figure 2.1: A graph showing the spike in temperature. Data collected from comparing recent direct measurements and atmospheric samples from ice cores (NASA).

to the Global Climate Change page on NASA's website, since the late 19th century, the average surface temperature of the planet has risen about 0.9 degrees Celsius (1.62 degree Fahrenheit). Driven by heat-trapping human-made emissions in the atmosphere, such as carbon dioxide, a majority of this warming took place in the past 35 years, as mapped on Figure 2.1. The five warmest years in this drastic temperature increase occurred since 2010, with 2016 being the warmest and 8 out of 12 months being the warmest on record for those corresponding months.

Literature regarding the topic of climate change exists across all disciplines and geographic regions. Evidence of the warming of the climate system is observed through many different research methods, such as qualitative, quantitative, or indigenous research methods. It is worth mentioning the counter arguments; academic and scientific literature also exists in identifying holes in climate science. A majority of these articles I have come across critique the way evidence for climate change is acquired. One of such critical pieces is Quirin Schiermeier's article "The Real Holes in Climate Science" in the Nature – International Weekly Journal of Science. Schiermeier expresses that models used for regional climate prediction are not reliable (284). The author argues that although regional simulations are not worthless, they have limitations (285). Despite inconsistencies, the author concludes that the tree ring divergences are restricted to only a few high-latitude regions in the Northern Hemisphere, and many other lines of evidence show that warming since the mid-twentieth century is very like due to human-induced GHG concentration. Articles such as these do not claim that climate change is not real, but merely challenges some of the research practices used to acquire data. On the unfiltered world wide web however, climate change denialists run rampant. For this paper, those claims and conspiracy theories will not be explored.

Prevalent concepts in climate change literature are the ideas of climate change vulnerability. Füssel and Klein defines vulnerability as,

> "*The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity" (306).*

In academic literature, concept is often related to, or used synonymously with, concepts such as marginality, susceptibility, exposure, sensitivity, coping capacity, criticality, risk, fragility, and susceptibility (Füssel and Klein 305). The term 'vulnerability' is used in many different contexts by different research communities (303). While there is a broad use of the term, Füssel and Klein identifies the following main models generally used for assessing and conceptualizing vulnerability:

- The risk-hazard framework – this is characteristic for technical literature on topics of disaster and risk management. It regards vulnerability as the response relationship between an exogenous hazard and its adverse effects to a system (305).
- Social constructivist framework – this prevails in human geography and geography and regards social vulnerability of a community or household as determined by political and socio-economic factors (305).

Unfortunately, the weight of climate change impacts is not experience evenly. Entire schools of literature studying climate justice exists across all spectrums. The uneven distribution of the weight of climate change is experienced on all scales, from locally to globally. Those to contribute most to climate change, are not often those who experience the highest capacity of negative consequences. The ones experiencing the bulk of the burden of climate change often do not have the tools for resilience.

Climate change resilience is a very prevalent topic in climate change literature. The resilience of an area to climate change impacts relies heavily on its ability to mitigate and adapt to the effects. Adaptation and mitigation are the two fundamental response options for dealing with the risks posed by anthropogenic climate change (Füssel and Klein, 303). It is important to first define and identify the difference between climate mitigation and climate adaptation. According to the UCAR Center for Science Education, climate change mitigation consists of attempts to decelerate the process of climate change, often by reducing GHG levels in the atmosphere. Adaption on the other hand, involves the development of methods to protecting people and places from the impacts of climate change by reducing their vulnerability (ibid). While mitigation and adaptation are both strategies for addressing climate change, the objectives of the two have notable differences (Locatelli 1). Mitigation tackles the causes of climate change, while adaptation tackles the impacts of climate change; a combination of both approaches is needed for tackling the issue. For instance, strong adaptation efforts would not eliminate all the negative impacts- mitigation would still be necessary for limiting the changes in the climate system (Locatelli 1). Conversely, despite strong mitigation efforts, the climate will continue to change in the proceeding decades, and adaptations to these changes are necessary (ibid). Mitigation strategies are primarily efforts for reduction of GHG emissions and increase of carbon sequestration to slow the rate of climate change (Harlan and Ruddell, 128). Adaptation strategies aim primary to increase the ability to adjust and reduce the vulnerability of a system to climate change effects (Harlan and Ruddell, 128). Figure 2.2 shows a table comparing the difference characteristics of adaptation vs mitigation.

TABLE I
Characteristics of mitigation and adaptation

	Mitigation of climate change	**Adaptation** to climate change
Benefited systems	All systems	Selected systems
Scale of effect	Global	Local to regional
Life time	Centuries	Years to centuries
Lead time	Decades	Immediate to decades
Effectiveness	Certain	Generally less certain
Ancillary benefits	Sometimes	Mostly
Polluter pays	Typically yes	Not necessarily
Payer benefits	Only little	Almost fully
Monitoring	Relatively easy	More difficult

Figure 2.2: A comparison of the characteristics of climate change adaptation vs mitigation (Füssel and Klein 303).

2.2 Urban Areas

Particularly in nations of high income, urban areas are a major source of GHG emissions (Harlan and Ruddell, 127). According to the Canada Green Building Council (CaGBC), the operation of buildings account for up to 35% of all GHG emissions in Canada. Statistics from the Government of Canada website show that GHG emissions from buildings in Canada increased from 73.7 megatons in 1990 to 81.4 megatons in 2016; that is an increase of over 10% in 26 years. In the Northern Hemisphere, 1982-2012 has likely been the warmest 30-year period in the last 1400 years (Pachauri et al, 2). The conversion to heat-retaining impervious surfaces and building materials of urban settlement from native landscapes inhibit nighttime cooling (Harlan and Ruddell, 127). These conditions, at the building scale, cause increased energy demands in the summer months. Extreme heat events (EHEs), known also as heat waves, are further elevating warmer urban baseline temperatures. Heat exposure and air pollution are major global urban health burden and is intensively investigated worldwide. The increased number of urban buildings in the past few decades has drastically affected energy consumption of this sector (Santamouris et al. 201). The dark surfaces and lower levels of vegetation in urban areas affect the habitability, energy use, and climate of cities (Rosenfeld et al 255). The exposed darker exterior surfaces of buildings, in combination with reduced vegetation, causes air to be warmer in the summer over urban areas. The higher air temperatures in densely built urban areas than surrounding rural country is a phenomenon referred to as the urban "heat island" effect (ibid). High levels of heat in urban areas is caused mainly by anthropogenic heat released from power plants, vehicles, air conditioners, and etc., as well as the heat stored and re-radiated by large and complex urban structures

(Rizwan et al 120). This effect is both caused by, and contributes to, high GHG emissions in cities. The air temperature on a summer afternoon in a typical city is approximately 2.5 degrees Celsius hotter than that of nearby rural areas (Rosenfeld et al 255). Meteorology has strong influence over air quality, wherein elevated temperatures during summer months can contribute to exacerbating harmful effects on human health due to air pollution (Harlan and Ruddell, 127).

On the contrary, one interesting study done in Toronto show that high-rise development may aid in relief for the urban heat island effect. This study of the urban climate was completed along the Yonge-Church corridor in downtown Toronto. The study simulated and compared the before and after temperatures of new high-rise constructions and found that new constructions can reduce the urban heat island effects in summer mid-days by lowering surrounding air temperature by almost 1◦C (Berardi and Wang 10). This is due to the shadow-casting abilities of tall buildings. Figure 2.3 shows the air temperature map in the study at ground level. (a) is before, and (b) is after new construction during summer mid-day.

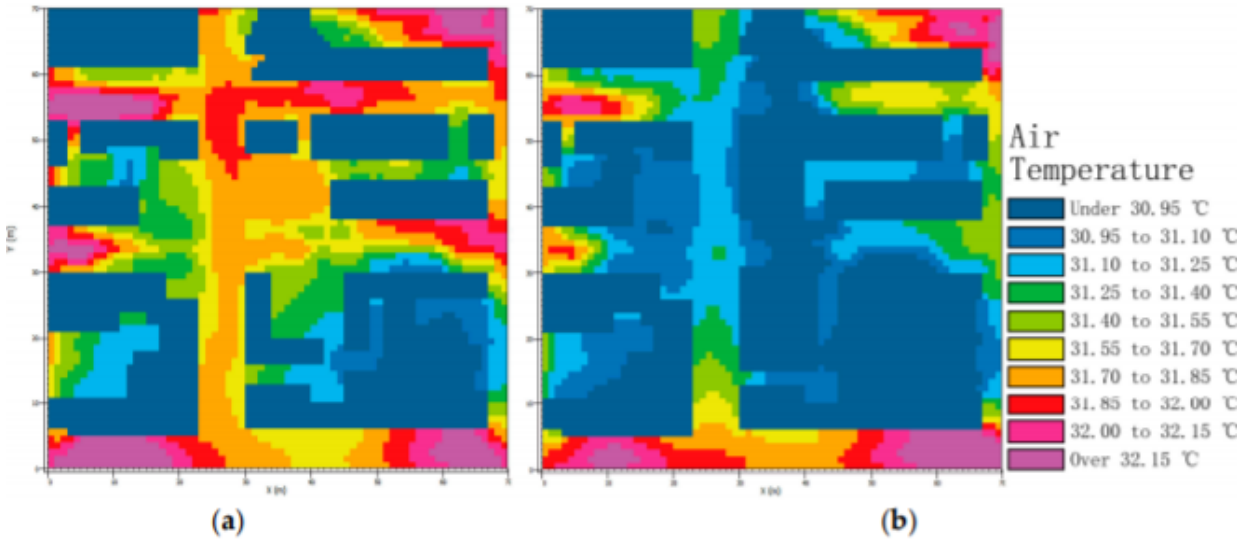


Figure 2.3 : A comparison of the cooling abilities of high-rise shadow casting (Berardi and Wang 7).

Despite these potential cooling effects, the current building practices of high-rise buildings in Toronto are causing more harm than good. Many condos are GHG emitting giant thermal holes (Vasil). While houses can be padded with extra insulation, and old concrete towers can be cladded with foam, these options cannot be applied to floor-to-ceiling-glass-condo towers (ibid).

The Government of Canada has climate assessment reports available on their website. Urban vulnerabilities in the reports often involve stormwater management and infrastructure damage as a result of flooding, affecting all sectors such as transportation, housing, and more (Natural Resources Canada). In

Ontario, since 1948, the average annual temperatures have increased by as much as 1.4°C. Ontario's physical infrastructure, human health and wellbeing, water quality, and ecosystems are all highly sensitive to climate (ibid). Critical infrastructure that has experienced disruption in all parts of the province include water treatment and distribution systems, energy transmission and generation, and transportation. Flooding associated with severe weather in recent years has disrupted communication and transportation lines, with damage costing over $500 million (ibid). The estimated costs, injuries, evacuations, and deaths caused by events affiliated with extreme weather can all be found on the Government of Canada website under Climate change publications.

The US National Climate Assessment report summarizes the impacts of climate change across all sectors and regions and includes response strategies. This assessment was created by a team of over 300 experts with a 60-mmeber Federal Advisory Committee, and expensively reviewed (National Climate Assessment). The report claims that essential urban infrastructure will increasingly be compromised by climate change impacts. As impacts of climate change increases, climate-related events will have huge consequences for a substantial number of people living in suburban areas and cities (National Climate Assessment). A common misconception is nature and city are separate entities, and that climate change is an "environmental" issue, affecting the natural world separate from human activity. Extreme events caused by climate change can have profound impacts of urban infrastructure, which urban dwellers are heavily dependent on. With the ever-growing population increase, existing built infrastructure is expected to become increasingly stressed in the upcoming decades, especially when climate impacts are added to the equation (ibid). Cities are in fact particularly vulnerable to disruptions in essential infrastructure services because many of these essential infrastructure systems, even though seemingly individual, are heavily reliant on each other (National Climate Assessment). For instance, a failure in the electrical grid can impact transportation services, public health, and water treatment. Due to the highly interdependent nature of essential services, failure

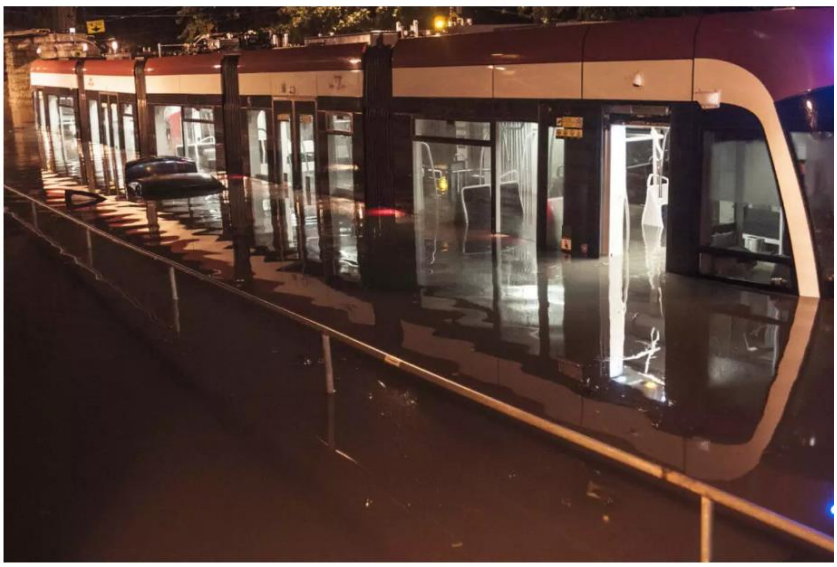


Figure 2.4: Toronto street car half submerged under storm water during summer 2018 flood (Flack)

in a particular sector will cause cascading effects on most aspects of urban economies. An example of seemingly unrelated sectors being deeply interdependent is wastewater management and transportation. In metropolitan Toronto, flashfloods are experienced, causing chaos to commuters. This has occurred on many occasions, with the most recent being in late summer of 2018, when transit systems were submerged, as shown on Figure 2.4 (Flack). Floods during this hefty record-setting storm, when a month's worth of rain hit the city, also caused people to be trapped in elevators and the flooding of sewage systems caused huge quantities of garbage to be spilled onto the streets (ibid.)

An experience of great vulnerability in Toronto was the great North America blackout of 2003, which shows the interconnectedness and interdependency of our urban systems. Anecdotal experience of this event can be found all over the internet. On August 14, 2003, over 50 million North Americans went without power (CBC Archives). This event was caused when Ohio-based FirstEnergy Corporation had a shutdown. A technical issue caused the proper alarms to not appear on their control system, thus FirstEnergy was not able to warn or react until it was too late. This led to cascading effects on the electricity systems of a number of cities including Toronto, Ottawa, and New York, across Ontario and eight U.S. states (ibid). More than 100 power plants in northern U.S. and Ontario experienced the ensuing power failure. In Toronto, some of the experienced urban disruptions to the city flow included the loss of many forms of transit necessities, such as traffic lights, streetcars, and subways (Batemen 2013). This was such a major historical disruption for the city, new articles remembering this event are still being written in 2018. Figure 2.5 shows some of the news headlines and photos from this incident. The blackout caused significant indirect damage, including the shutting down of water treatment plants and pumping stations (National Climate Assessment).


SPECIAL EDITION

TORONTO STAR

BLACKOUT

Eves declares state of emergency and warns of rolling power outages for 'weeks to come'

SPECIAL EDITION

THE GLOBE AND MAIL

Day of the blackout

It hit us, too

New Yorkers unfazed by power cut

Toronto emergency plan is triggered by Lastman

Figure 2.5. Headlines of newspaper archived from time of 2003 blackout (Bateman 2013).

The vulnerability to the risks and hazards associated with climate change in different urban areas depend on three main characteristics: the exposure to stressors, the sensitivity to the impacts of the stressors, and the ability to adapt to changing conditions (National Climate Assessment). The vulnerability of urban dwellers is amplified for those who are "socially vulnerable". Social vulnerability refers how sensitive a population is to the impacts of climate change (National Climate Assessment). The characteristics most often influencing the differential impacts and uneven distribution of the effects of climate change and adaptive capacity include socioeconomic status, age, special needs, gender, ethnicity, and race (ibid).

Another notion related to this topic that has prominence within climate change literature is the idea of urban resilience. This idea, often also referred to as climate resilience, climate-proofing, and resilient city, is the idea that urban systems and constituencies need to have the ability to quickly recover from climate related stresses and shocks (Leichenko 164). There is a large and diverse array of literatures surrounding this topic that can been broadly sorted in the following categories:

1. Urban ecological resilience
2. Urban hazards and disaster risk reduction
3. Resilience of urban and regional economics
4. Promotion of resilience through urban governance and institutions (164).

The fourth category of resilience will be focused on, because this paper centers on how municipal policy, codes, and standards can help in the adaptation and mitigation of climate change. This branch of work on urban resilience emphasizes governance and institution (165). It focuses on how the resilience of local environments is affected by different types of institutional arrangements, and how resilience thinking can help influence the development of improved governance mechanisms which can promote climate change adaptation. Common characteristics of urban governance identified as promoting resilience in include accountability, polycentricity, transparency, flexibility and inclusiveness. For enhancing climate resilience while reducing the vulnerability of urban citizens most at risk of shocks and stresses related to climate change, governance literature also advocates a diversity of approaches, suggesting that many different forms of effective institutional arrangements take place, rather than a single 'best practice' arrangement (Leichenko 165). The enhancement of resilience is the key goal for both adaptation and mitigation efforts in urban regions (Leichenko 164).

2.3 Adaptation and Mitigation in Urban Areas

The preparation efforts in cities for climate change include planning for the ways infrastructure systems, buildings, municipal services, and residents will be affected (National Climate Assessment). An important planning and implementation tool for preventing and overcoming the urban challenges presented by climate change is by "mainstreaming" the concept of climate change. This includes the integration of climate action into everyday city and infrastructure operations as well as governance (ibid). Strategic risk management action plans are being designed and implemented in many cities in attempt to lessen the impacts of climate change (Harlan and Ruddell 126). These plans include mitigation and adaptation strategies (128). Implementation of these strategies will contribute to positive environmental impacts and health co-benefits, improving the overall wellbeing of urban residents (ibid).

Long-term mitigation efforts in cities include policies that reduce industry, transportation, and household energy consumption (128). When fully valuing the co-benefits of improved air quality and preventing heat-related illnesses and deaths, the estimated net costs of climate policies would be significantly reduced (128). Mitigation is about limiting global climate change through the reduction of GHG emissions (Füssel and Klein 303). Some examples of these mitigation tactics for risk management strategies seen in the following table in Figure 2.5:

Figure 2.5: Climate Change Mitigation Efforts

Location	Mitigation Efforts
Sao Paulo (Brazil)	insulating homes for heat retention in the winter and staying cool in the summer to improve energy efficiency (Harlan and Ruddell, 129).
Portland, (USA)	Increasing reflectivity and emissivity of building materials to reduce the amount of solar energy absorbed by urban surfaces (Harlan and Ruddell, 129).
Cape Town (South Africa)	utilizes rating systems such as LEED to recognize and reward impact of building design(Harlan and Ruddell, 129).
Chigago (USA)	implemented Urban Forest policies to increase vegetation and urban canopy to improve air quality and mitigate heat stress.
Copenhagen (Denmark)	using wind energy as primary source for electrical and hydrogen powered cars to lower dependence on fossil fuels (130)
New Hampshire (USA)	Replacement of concrete and asphalt with pervious surfaces to increase cooling capacity of urban surfaces by enabling the transmission of moisture (129)
Boston (USA)	Captures carbon by using urban gardens. Benefits include increase cooling and production of local vegetables and fruits (129)

City preparation efforts for adaption to climate change is defined as any activity that addresses impacts climate change could have on a community (National Climate Assessment). The primary aim of adaptation to climate change is to moderate the adverse effects through a wide range of actions targeted at a specific vulnerable system (Füssel and Klein 303). Adaption efforts include heat warning systems, better weather forecasting, air quality alerts, and emergency preparedness for extreme events (Harlan and Ruddell 128). Adoption of warning, surveillance, and alert systems for triggering of emergency responses to EHEs and days of poor air quality can be seen in many cities (131). Some adaptation examples can be seen in the below table in Figure 2.6:

Figure 2.6: Climate Change Adaptation Efforts

Location	Adaptation Efforts
New York (USA)	Air quality alert system employed to inform residents of days with poor outdoor air quality with high emissions (129). Developing a Climate Change Assessment and Action Plan which improves responses to present climate variability, and projected future conditions (National Climate Assessment)
Boston (USA)	Promote green lifestyles and expand climate education for residents through developing a five-point engagement strategy. Strategy is grounded in education, action, and collective responsibility to prepare for climate change impacts (Harlan and Ruddell 130)
Dresden (Germany)	For dealing with impacts of floods, heat waves, droughts and heavy rain, there is the creation of the 2013 Dresden Region Climate Change Adaptation Programme (Climate ADAPT).
Sofia (Bulgaria)	The Climate Change Adaptation Strategy was created in 2016 in response to extreme heat and floods (ibid).
Helsinki (Finland)	Helinki Metropolitan Area Adaptation Strategy adopted in 2012 in response to floods, rising sea levels, and heat waves (ibid).
Ontario (Canada)	Mainstreaming climate change adaptation in legislation such as the Clean Water (Natural Resources Canada).
Shanghai (China)	Monitoring regional weather patterns using a heat/health watch warning system to alert citizens of upcoming periods of raised temperatures (Harlan and Ruddell 129)

The climate change publications released by the Government of Canada mentions that Ontario has a strong capacity to adapt to climate change (Natural Resources Canada). This is due to a variety of indicators, such as economic wealth, information and skills, institutions, technology, infrastructure, and social capital. It is important to note that despite this, the capacity for adaptation is not uniform across all subregions and sectors. In Canada, resource-dependent remote communities and Indigenous communities are particularly vulnerable to climate changes (National Resources Canada).

2.4 Future Trajectory

It is estimated that by 2030, 60% of the globe's population will live in urban centers (Harlan and Ruddell, 126). The health challenges faced from climate change in cities is unique due to the complexity of the built environment, higher population density, and survival dependence on technological systems (ibid). The trajectory of the changing climate conditions differs from case to case as specific driving factors cannot be replicated. One thing they all have is common is that there will be irreversible detrimental forecasted effects. The projected rise of surface temperature over the next century will likely cause heat waves to last longer and occur more often (Pachauri et al, 10). There will be intensified and more frequent extreme precipitation events in many regions. The global sea level will continue to rise, as the ocean increasingly warms and acidifies (ibid). All of this and more, will result in higher risk of impact from the interaction between the vulnerability and exposure of human and natural systems, with climate related hazards (13). If climate continues to rise as incrementally as it has in the past decades, we are sure to face irreversible detrimental effects. These impacts for the future include food insecurity and increase species extinction (13). The scale and complexity of responses required for severe climate change impacts, and with greater frequency and intensity, will likely over the long term require major expenditure and structural changes (National Climate Assessment). A shift toward green building development and sustainable urbanism is imperative for avoiding furthering these detrimental effects.

Disruptions to critical infrastructure in all parts of the province are likely to become increasingly frequent (Natural Resources Canada). Water shortages in southern regions of the province that have been documented, are projected to become more frequent due to increased summer temperatures and evaporation rates. The projected decreases in the fresh water levels in the Great Lakes may reduce hydroelectricity output by more than 1100 megawatts and compromise shipping (ibid). Health risks, injuries, and premature death from climate-related events such as heat waves, extreme weather, smog episodes, and spread of vector-borne diseases supported by ecological changes, are all projected to increase. By 2050, heat-related mortality rates in southern and central Ontario could more than double, and air pollution mortality could increase by 15-25% (ibid). The implementation of climate change adaptation and mitigation plans will result in positive environmental impacts as well as health co-benefits and will improve overall well-being of urban residents (Harlan and Ruddell, 128). The integration of climate change considerations into daily operations can prevent the need to develop new, more costly, and isolated sets of climate change-specific procedures and polices (National Climate Assessment).

Chapter 3: High-Rise Condominiums and Green Buildings

3.1 What is a Green Building?

The construction industry has significant impacts on society, both positive and negative (Zuo and Zhao 272). Positive impacts include providing facilities and buildings to satisfy human requirements (live, work, and play), providing employment opportunities, and contributing toward the economy (ibid). Negative impacts include water pollution, dust, traffic congestion and noise during the construction stage, as well as impacts after completion throughout the lifecycle such as GHG emissions. It is estimated that by 2035, global building carbon emissions will reach 42.4 billion tonnes (ibid). In developed countries, buildings are claimed to be responsible for over 40%of total energy consumption (Huang et al 97). A significant way to mitigate impacts of building stock on society, the environment, and the economy is to develop green buildings (Zuo and Zhao 271).

The term "green buildings" is often used interchangeably with sustainable building and high-performance building (272). Robichaud and Anantatmula define a green building as having the following four pillars:

- ✓ Minimizing or eliminating impact on the environment, nonrenewable energy sources, and natural resources.
- ✓ Enhancing the health, wellbeing and productivity of not only occupants, but whole communities.
- ✓ Financial returns in investment for developers and cultivate economic development for community.
- ✓ Apply life cycle considerations during planning and development (49-50).

Some academics argue that while the terms "sustainable buildings" and "green buildings" are used interchangeably, the definitions are not synonymous (Doan et al 244). These academics state that *Green* describes strategies in building design that cause less environmental and ecological damage and meet certain criteria for performance (245). *Green* is seen as a term that encompasses techniques, strategies, and construction projects that are less pollution-producing and resource-intensive than traditional construction practices. *Sustainability* in development refers to development that meets the needs of the present without compromising the needs of future generations (245). Sustainability concerns diverse aspects, but the three main pills are environmental, social, and economic impacts (ibid). It is important to address that the context of these terms, due to the ambiguity and uncertainty of their nature, can differ from author to author. For the context of this paper, they will be used interchangeably.

Although standards for green buildings vary from place to place and the definitions of sustainability and green generally vague, the goal remains the same: an opportunity to innovative and re-imagine buildings sciences and sustainable design. Toronto is home to a variety of green buildings, each unique in their design, approach, and execution. The following are just a handful of internationally recognized structures in Toronto:

- The George Brown College Waterfront Campus is home to higher education and higher energy efficiency (George Brown College). The building's LEED Gold certification has been recognized on a variety of platforms throughout the city. The design combined green roofs, green housekeeping, natural lighting, information kiosks, and conveniently placed bike racks.

- The RBC Waterpark Place is not only a place for great views of Lake Ontario, but it's also home to a LEED Core and Shell Platinum building (Canada Green Building Council "LEED Spotlight"). It features a 7,500 square foot green roof, bike racks, efficient lighting, and other materials. The complex pursued a recertification in later years in order to continue the transformation of green policies and operations. By focusing on achieving new credits to the existing certification the upgrades also made financial sense, with utility savings visible in two years.

- The Barrymore Building Knoll Showroom set an industry standard, by being the first project in Toronto to achieve a LEED-CI Platinum rating (Knoll). To achieve LEED-CI Platinum, the building owners incorporated a number of environmental design elements, including natural light, fluorescent fixtures with optimized energy performance, post-consumer materials, Energy Star rated appliances, locally sourced wood products, recycled building materials, and

recycling programs. This project is an example of a building which was designed with attention to detail, and an awareness for the multi-disciplinary processes and elements that are involved in the construction of a building. By recognizing what is involved in the final product, in addition to the core building structure or envelope (i.e. furnishing, company culture, etc.), a building design begins to create the interaction of a building with its users, and vice versa.

3.2 Green Rating systems

3.3.1 LEED

LEED stands for Leadership in Energy and Environmental Design. The US Green Building Council (USGBC) oversees LEED, the world's most widely used rating system for green buildings. LEED provides project teams with a framework to create highly efficient, healthy, and cost-saving green buildings. These frameworks are available for buildings from new constructions, to interior retrofits and maintenance and operation. The five different categories are sustainable site development, water efficiency, energy efficiency, materials selection, and indoor environmental quality. Depending on the amount of points earned in each category, LEED will award the building with one of their four classifications (certified, silver, gold and platinum). Although the certification process is completed following an audit – once the building has been constructed and commissioned – building owners could recertify. This follows the principle that building efficiency and sustainable building design is a constant commitment to best practices that allows all of us - owners, managers, and occupants- to know that the buildings we occupy will always need improving.

The International Energy Agency (IEA) defines the building envelope as "parts of a building that form the primary thermal barrier between interior and exterior play a key role in determining levels of comfort, natural lighting and ventilations, and how much energy is required to heat and cool a building" (IEA). In order to design a building envelope in a way which reduces energy consumption, building science must be used in order to understand heat transfer through building elements such as walls and windows, as energy is a primary factor when discussing the thermal environment (IEA). All the components within a home work as a system, and therefore impact each other's thermal resistance and other thermal properties. This requires an approach which considers all parts of a building as opportunities to improve energy efficiency.

3.3.2 BOMA BEst

BOMA BEst is a certification program primarily designed for existing buildings, providing a unique opportunity and framework to give new life to office buildings, enclosed shopping centers, light industrial, and open-air retail spaces (BOMA Canada). The program promotes the ever-evolving building, where improvements to building operation and maintenance always have room to grow. What sets BOMA apart from other green building certifications, is the involvement of those using the space. BOMA combines both company and employee policies in order to implement the following nine assessment areas: Energy, Water, Electronic Waste, Recycling & Waste Diversion, Sustainable Spaces, Sustainable Travel & Commuting, Indoor Air Quality, Procurement, and Communication (BOMA Canada). The 2019 BOMA Best National Green Building Report provides an overview of building performance throughout North America. The various metrics throughout the report use external data and references to assist building managers to both evaluate their overall building performance, as well as identify opportunities for improvements when compared to other participants of the program. The program is therefore unique, as it encourages innovative building design while simultaneously transforming company culture. By involving building occupants, the building performance becomes a commitment not only made by the property managers, but those who make use of and interact with the space. The BOMA BEst 2019 National Green Building Report shows their data set from 2017, which reveals that from only 1 multi-unit residential building (MURB) in Ontario received certification in that reporting period (from April 1 2017, to March 30, 2018). Their online database reveals that there are 296 certified buildings in Toronto, however no way to filter out what of that is commercial and what is residential.

3.3 Criticisms of Green Rating Systems

As Toronto architect Brian Brisbin states, "Any glass box can get a LEED designation. But what is that glass box doing for the city? Probably just as much harm as it is good" (Kalinowski). Green rating systems are a common focus point for various researchers (Doan et al 258). From 1998 to 2016, 408 academic papers mentioned various green rating systems, while 202 of them focused on these ratings with in-depth approaches (258). A majority of the criticisms about green rating systems are not found in academia, but in news. Certification programs such a LEED, often receive a common criticism; certification can be expensive, the minimum requirements are insignificant, and new practice unpredictability (Lombard). In order to participate in LEED, the costs associated with completing mandatory paperwork, applications, and hiring qualified personnel, can at times feel daunting (Lombard). It is estimated that for soft costs alone, such as LEED consultant fees, new buildings are looking at incurring approximately $150,000 (Swearingen). The question always arises, why not use that money instead to invest in better building systems? Rather than

spending money on simply certifying a building – building owners could take the costs and upgrade systems in order to achieve Gold or Platinum efficiency, without the decorative green label (Bowen). Is it therefore wise to allocate money to applications and third-party audits, over higher building efficiency? Being recognized as a green building comes with its recognition, an advantage with the lower maintenance, energy efficiency, and respect in present day culture. With the praise that green buildings receive – can the minimum certification requirements be adequate? The failure of new products to meet their advertised performance levels is more likely to occur, compared to proven materials found in traditional buildings (Bowen). Taking a risk on systems and products in order to be innovative and meet these green rating systems may present future, unknown challenges throughout the building life-cycle.

There are also criticisms of the "gimmicky" nature of green rating systems. An article from Forbes magazine claims that LEED certified buildings are often have less energy efficiency than its uncertified counterparts (Swearingen). This article criticizes LEED as nothing but greenwashing. In Washington DC, many LEED-certified buildings, when compared to similar buildings, were the least energy efficient (ibid). As mentioned, LEED operates on a points-based system. Installing a bike rack can gain developers a point and adding only minimum parking space requirements equates two points. Critics claim that this does not do much for the environment and allows buildings the easiest and cheapest path to labeling their product "green" (Swearingen). LEED does not require buildings to prove innovative energy and water efficiency; applicants can acquire LEED status by merely offering projected threshold achievements of the building with computer models. Energy modeling can be inaccurate and has seen its fair share of criticisms as well.

The energy performance of a building is often predicted by energy modeling. A report by EQ Building Performance and Urban Equation for Sidewalk Labs Toronto was recently released for a study on Toronto MURB energy use and performance gap. The performance gap refers to the difference between the energy model prediction and a building's actual usage (7). This report found that current energy modelling practices do not adequately account for energy inputs (5). This report used a dataset containing 95 GTA MURBs, with models completed between 2015-2017 (9). Within this dataset, it was revealed that the performance gap for overall GHG emissions performance is 28%, while the performance gap for energy use is at 13% (4). This is an issue because energy models help developers predict a building's energy use and to reach set performance targets. They are used during the design phase to help developers inform their decisions about investments for energy reductions (7). These results show the need for stronger, more updated energy models. The high discrepancy in the GHG emissions prediction and the actual output shows that despite stringent energy standards, if the tools used to predict emissions are not accurate, the desired result of lowering GHG in the atmosphere will not be achieved.

3.4 Innovations and Potentials

I attended Construct Canada's "The Building Show" at the Metro Toronto Convention Center on November 29, 2018. This is North America's largest exposition and conference for architecture, construction design, engineering, property, and renovations, with over 1,600 exhibits on new products and innovations, 500 speakers and 360 presentations, and technical demonstrations (Buildings Canada). At the show I observed and spoke to many different venders that offered high efficiency building products and was exposed to many new innovative building features and services available. There were many notable examples; one is SemperGreenwall ®, which offers indoor and outdoor vertical garden installations, which can reduce noise pollution and lower ambient temperature. Next Level Stormwater Management ™ offers "soilless" pre-vegetated systems that is a low maintenance solution for stormwater management. Landvac ® offers tempered vacuum insulated glass, which effectively blocks thermal transmission 6-10 times better than single pane glass. Even in academic literature, innovations of specific building proponents, such as fuel cell amplifiers, innovative envelope material, hydrogen in energy retrofitting, just to list a few, can be found.

Figure 3.1: A rendering of Toronto's vertical forest (Kalinowski)

Through my research I also came across Toronto's first potential vertical forest. Inspired by Milan's Bosco Verticale, Brian Brisbin is leading a team of arborists, academics, irrigation specialists and horticulturalists to design this vertical forest (Kalinowski). The Biosco Verticale is the world's first vertical forest – a residential green building consisting of two towers built in 2014. Similarly, Brisbin and his team plans to build a luxury condo with a micro-sustainable climate; a permeable planting system integrated into the building, not just a building decorated with pots and plants. A rendering of what this project will look like upon completion can be

seen on Figure 3.1 (ibid). This prototype building project is a proposed 27-storey building bordering the Yorkville and Annex neighborhoods, at Designers Walk on Davenport Road.

With such heavy urban development, Brisbin states that without innovation like the vertical forest Toronto will likely not achieve Mayor John Tory's goal to increase tree canopy by 40%. While this technology is available in Toronto, it is worth mentioning that this is not a single solution issue – vertical forests can contribute the same way as green roofs, and can duplicate plant biomass, but will not be the whole answer to increasing Toronto's tree canopy (Kalinowski). This project does show that the lack of green building activity in Toronto is not due to the lack of new and innovative building practices. If these technologies and design possibilities exist, and materials and technical construction ability accessible, why are they not more widespread?

3.5 Barriers and Drivers to Green Building Growth

The benefits of green buildings are endless, including lower environmental impact, and major long-term impact on social wellbeing as well as positive financial return. Despite practitioners recognizing these benefits, there is a tendency to focus on minimizing short term costs (Issa et al 1710). The focus on capital costs is the largest barrier to investing in green practices. LEED-certified buildings can cost between $3-5 per square foot extra to build. While that may be the case, it also provides long-term savings of up to $13 in maintenance and operation, energy, emissions, and water (Willard, 2018). Studies have shown that the extra costs associated with building a LEED certified building, as opposed to a conventional building, is negligible (ibid). In some cases, the buildings have cost up to $100,000 less to build and can take up to 45 days less to construct (ibid). The Green Building Economic Impact Study conducted by Booz Allen Hamilton shows that sustainable high-performance buildings have shown that the initial green investment upfront cost of only 2% of construction costs can yield lifecycle savings of over 10 times the amount of initial investment. Long-term financial benefits associated with green buildings are seen particularly in the life cycle perspective (Zuo and Zhao 274). The USGBC's Business Case for Green Building states that green building owners report that their return in investment for sustainable projects improved by on average 19.2% for existing buildings, and 9.9% on new projects. It is proven that LEED-certified buildings, compared to non-certified buildings, use 25% less energy and have a 19% reduction in aggregated operational costs (ibid). These results are immediate and measurable.

In recent years, there have been increasingly more academic articles about barriers to green building adoption. Some of the common barriers include lack of information and education, high cost, lack of interest

and demand, technical difficulties, project complexities, and risks, lack of authority in laws and regulations, lack of government building codes and regulations, resistance to change, lack of green suppliers, lack of financing mechanisms, attitudes and behaviours (Darko and Chan 171). Darko and Chan did a review of the common barriers found in literature and found that the most reported barrier in green building literature is lack of information resulting from insufficient green building education and awareness (175). The result of the findings in this review concluded that overall, the lack of incentives and support is what is affecting widespread adoption of green buildings (175). The authors argue that to overcome this barrier, internal incentives and external incentives are required. Internal incentives refer to the benefits reaped from green buildings, such as lower cost of maintenance and good public relations. The administration of external incentives, both financial and non-financial, are mainly the responsibility of the government (ibid). These academic claims seem to be mirrored by market studies.

In a 2014 study of Canada's green building trends prepared by the McGraw Hill Construction for the CaGBC, respondents to the survey identified their largest barriers to green building growth. Respondents include builders, developers, architects, contractors, consultants and engineers (5). The survey reveals that some of the top barrier is the higher capital expenditures associated with green buildings (29). Another major barrier identified is the lack of market demand, suggesting that more public awareness and education is needed for tenants and owners on green building benefit. Figure 3.2 shows the top barriers from Canadian respondents, as well as global respondents. As displayed, lack of political support and incentives is high on both lists.

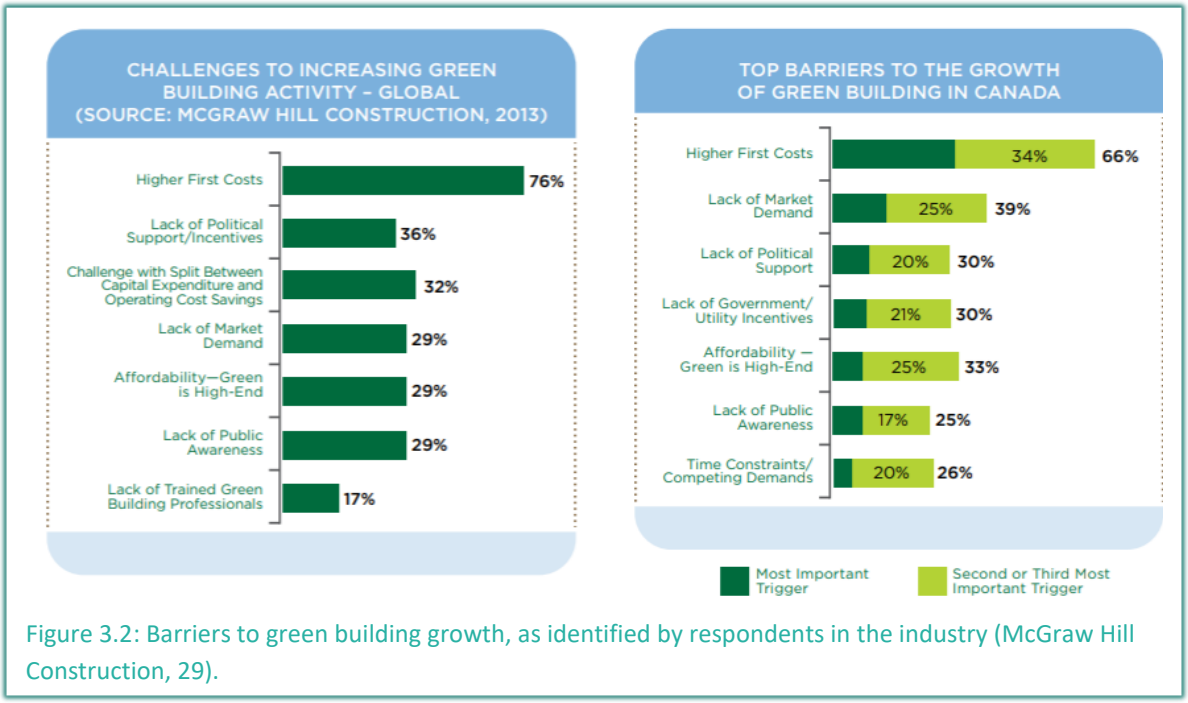


Figure 3.2: Barriers to green building growth, as identified by respondents in the industry (McGraw Hill Construction, 29).

In academic literature, common potential drivers for green building implantation include reduction of lifecycle costs, increased thermal comfort, better indoor environmental quality, reduction of environmental impact, satisfaction of commitment on social responsibility, and etc (Darko et al (388). In a survey done by Darko et al on a group of 104 experts, ranking the importance of 21 common green building drivers, it was found that different stakeholders had different priorities of reasons. Most commonly found, however, is the greater energy efficiency of buildings (391). This comes as no surprise, as there are cost saving benefits to energy saving. This report concluded that governments need to take the lead by instigating polices, programs, and plans that can inform the public of the importance and possibilities of green buildings and help boost the energy and environmental consciousness of industry stakeholders (392).

The importance of the role of government in the dissemination of green building practices is echoed in the McGraw Hill Construction study. A green expert for the report notes that government incentives and mandates may be critical for the encouragement of adopting higher green building standards. As displayed in Figure 3.3, municipal and federal green building policies is top three on the list of drivers for increasing green building involvement, as determined by respondents.

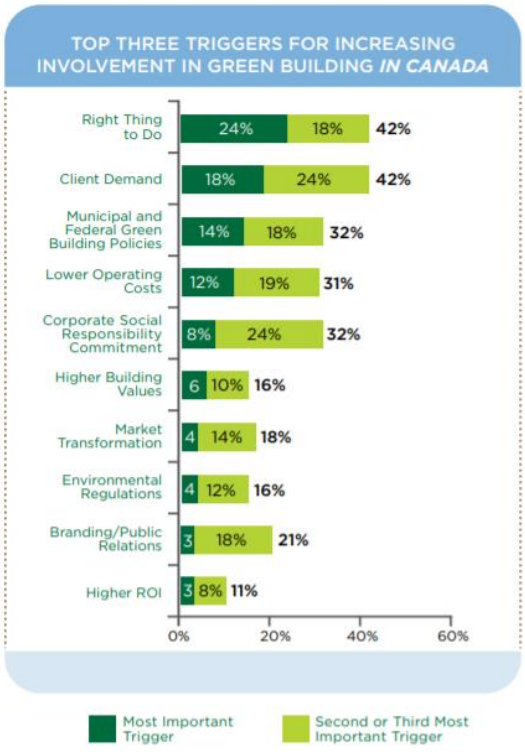


Figure 3.3: drivers identified (McGraw Hill Construction, 23).

In an interview with a private sector planner from a condominium developer in the downtown core, I received some first-hand insight on the drivers of green innovation through the eyes of the private sector. The insight I received seemed to confirm much of the findings both in academic literature, and business reports. In the interview, when asked about the barriers and drivers of more green building development, I was informed that in general, developers only reach the minimum requirements set out by government regulation. He said, "It started out with LEED; everyone wants it, no one is willing to pay for it". He mentions that the Toronto Green Standard, which will be discussed later in this paper, is the *only* driver for green development because it is mandatory. "If everyone were forced to do LEED, all projects would stop because it would not be affordable". He reveals that the green building materials for high-rise are also more expensive; glass is the cheapest option but not good

for energy efficiency, and we cannot go back to brick pre-casting, as that is not a feasible for tall buildings. He concluded on this topic, however, on an optimistic note, "the changing government building standards are good; it is causing a slow shift – there are now more companies producing green building materials. This creates more green competition, so prices will go down."

3.6 High-rise Trends in Toronto

There were two major waves of condo development in Toronto, the first beginning in the 1970s which lasted approximately 10 years, and the second beginning in the late 1990s and continues to this day (Lehrer et al 84). Literature about Toronto's condo boom can be found, but the rapid changes to the industries renders figures and statistics outdated quickly. Much of the literature surrounding the condo boom in Toronto involves gentrification of historically lower income neighbourhoods such as Regent Park.

A personal observation of the current immense high-rise intensification in Toronto can be made, as I work in the industry. The high-rise construction industry is so busy that in the past two months, alone I have been contacted by six different recruiters representing various clients, looking for coordinators for their high-rise projects both commercial and residential. At the time of my research, I work for a high-rise developer on a construction site that stretches an entire block on Yonge Street from Gloucester Street to Dundonald Street. The company I work for is a medium sized company - and within a 500-meter radius of my site, are two other high-rise projects currently under construction and four completed within the past few years. Within the immediate area of my job site, under different development companies, there are several other high-rise projects both currently underway, or just completed, including one directly across the street south of Dundonald Street. These drastic changes have not gone unnoticed by community members. While I cannot provide personal observation of how the landscape of Toronto has changed throughout the decades, I was able to get a first-hand account of how the high-rise development market has evolved over the years. I had the privilege of speaking with members of the board of directors of a community association, the Church Wellesley Neighborhood Association (CWNA), Connie Langille, and Dr. Robert Fabian. Their neighbourhood, nested in downtown Toronto between Yonge Street and Jarvis Street, and Charles Street and College Street (as mapped out in Figure 3.4) has some of the most densely packed high-rise development in the city.

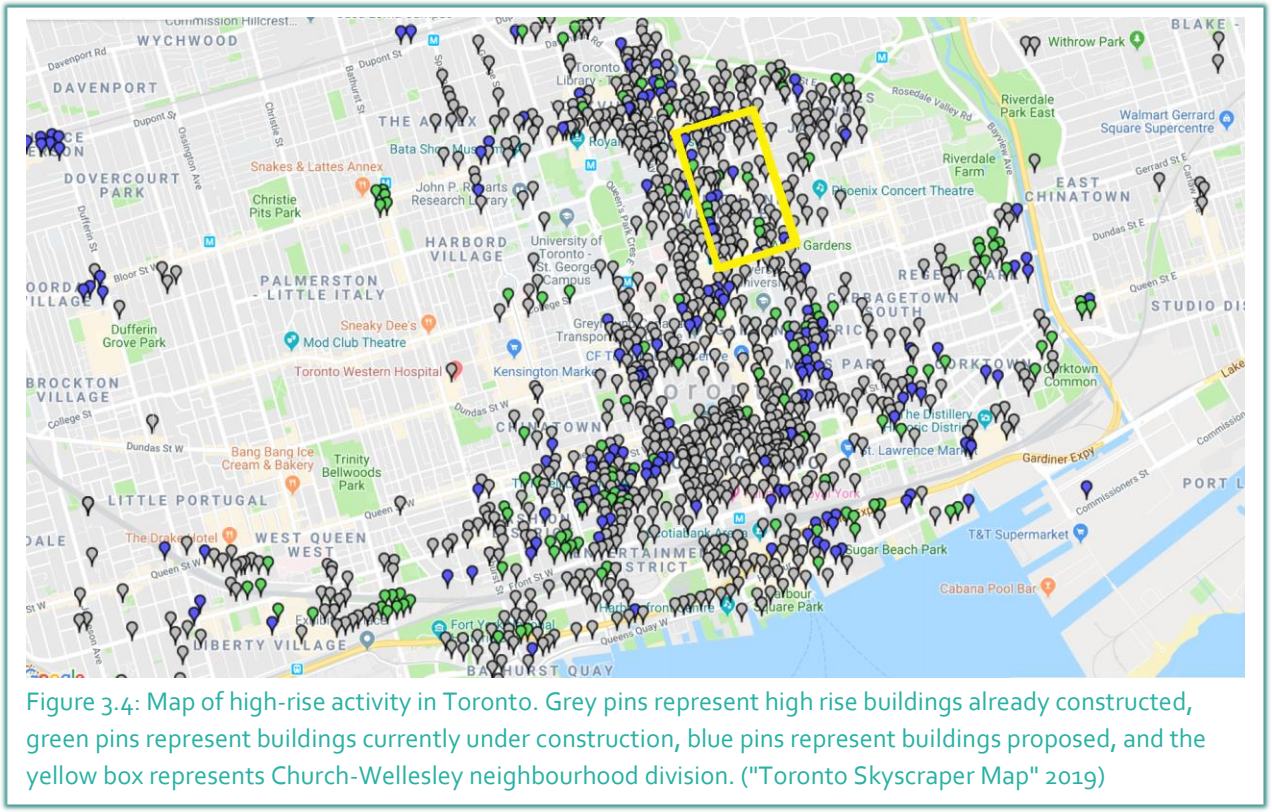


Figure 3.4: Map of high-rise activity in Toronto. Grey pins represent high rise buildings already constructed, green pins represent buildings currently under construction, blue pins represent buildings proposed, and the yellow box represents Church-Wellesley neighbourhood division. ("Toronto Skyscraper Map" 2019)

Robert was the first Chair of Computer Science at York University, and was a management and systems consultant for many years. He spends much of his time addressing urban planning and design issues and led the charge that resulted in the publication of the Yonge Street neighborhood vision, which is being included in the North Downtown Yonge Street Planning Framework. He has articles on urban design and will be leading the Ryerson LIFE course on urban planning. Robert first got into community meetings when a development 20 meters from his study window was proposed, that would have subject him to a view of a blank wall. Robert revealed that twenty years ago in his community, there was an absence of major projects. Major projects were the exception and welcomed by the community, as it gave neighbours the sense of progress and economic activity. More recently, however, this positive mindset of the neighbourhood response to development has shifted. The spurt of construction in the past decade has made community members feel a sense of construction overload, causing a much higher level of reaction. The additional load of densely packed construction chaos is being acutely noticed by neighbours. Connie is the Chair of the Placemaking Committee and Treasurer of CWNA and has lived, and raised her family, in the neighborhood for almost 30 years. She works assisting youth for a local non-profit and is a strong community advocate on the preservation of historic buildings in the area. Connie has been one of the core nine members of CWNA since its founding. She noticed the condo boom begin around 15 years ago. Though my interviews with Connie and Robert, I was able gain insight on how the landscape of condominium development has evolved over the

years with respect to community outreach, engagement, and involvement. These insights will be discussed in later sections of this paper.

Toronto is one of the fastest growing cities in North America. *The Zero Emissions Buildings Framework* released by the City of Toronto in 2017 reveals that the city added 85,166 residential units and 2,690,000 m² of non-residential floor area between 2011 to 2015 alone (6). Presently, there are more than 400 proposed high-rise projects in the city (Brussow and Sewell). SkyscraperPage is an online database of high-rise buildings from around the world- Figure 3.5 shows all the high-rise buildings currently being constructed in Toronto, while Figure 3.6 maps out the proposed high-rise buildings in Toronto. Toronto is expected to continue to lead in development throughout the next few years, as it as for some time (Hauen). The Financial Post reported that condominium construction launches hit a new record in Toronto (Powell).

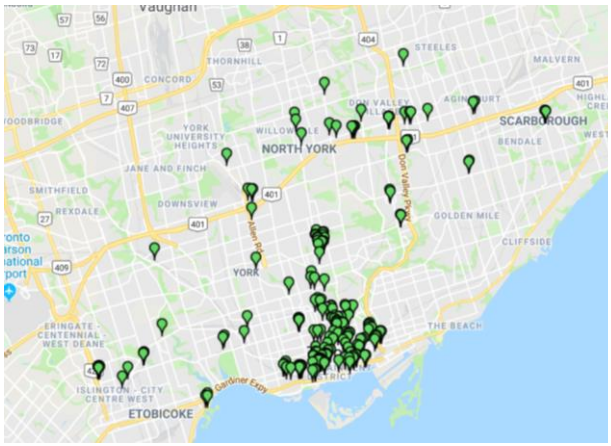


Figure 3.5: map of all 195 high-rise buildings currently being constructed in Toronto ("Toronto Skyscraper Map")

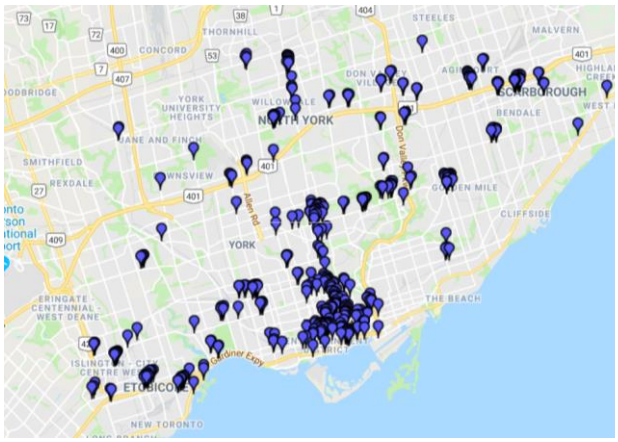


Figure 3.6: map of all 402 high-rise buildings currently being proposed in Toronto ("Toronto Skyscraper Map")

A count of the number cranes in 13 major cities across Canada and the USA by international real estate consultancy Rider Levett Bucknall (RLB) in the July 2018 shows Toronto dominating the count, as displayed in Figure 3.7 (Hauen). RLB suggests that the increase in net crane count is indicative of the prosperity of the construction industry. The RLB crane index reveals that the for crane-use, the residential sector is the most active, with total crane count at 44%, as displayed on Figure 3.8 (Brussow and Sewell). This study also reveals that for the third consecutive reporting period, Toronto is leading this market. The report exposes that over 86% of Toronto's cranes are currently used in the construction of new living spaces. This means that a majority of the high-rise development activity happening is for condominiums.

While construction seems to be booming, many economic theorists and even developers predict that the demand side of the condo boom will come to a halt soon. Many financial news articles can be found stating that Toronto's condo market likely to settle down in 2019. Many executives from large developers in Toronto, such as Menkes Developments Ltd, Centre Court Inc., and Diamond Kilmer Developments, that all echo this sentiment (Wong). Developers state that this is the first time in the past couple years that the market has shown resistance, and that certain projects may not be able to break barriers on pricing (ibid). While developers are cautious of short-term prices staying flat, prices long term are still expected to increase due to supply constraints when compared with Toronto's growth prospects (ibid).

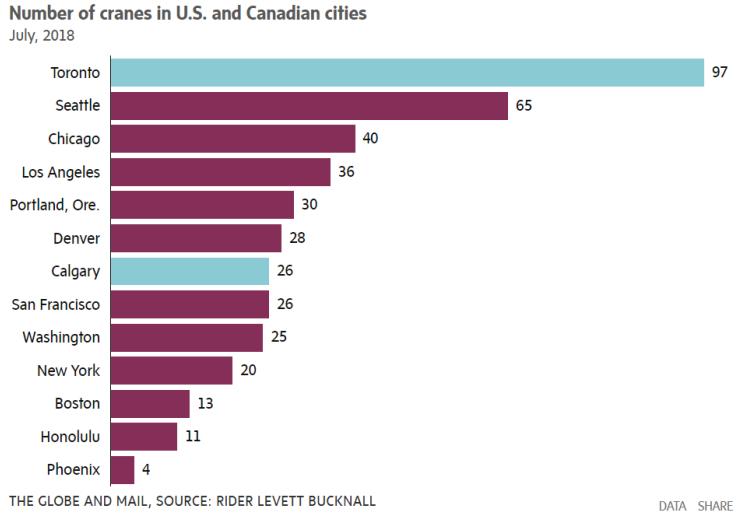


Figure 3.7: RLB crane index; count of cranes in major USA and Canadian cities (Hauen)

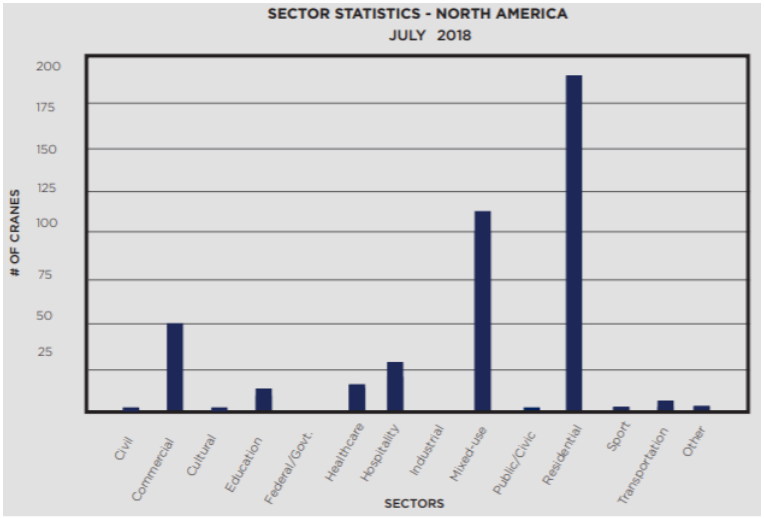


Figure 3.8: Overall status of crane-use statistics in North America (Brussow and Sewell 2018)

In terms of the trend of sustainability efforts for MURB in Toronto, there has been no clearly identified improvement in energy efficiency since 1998 (EQ Building Performance and Urban Equation 4). In 2018, the International Green Building Adoption Index (IGBA1) study done by CBRE in partnership with Maastricht University reported that Canadian cities set the pace for holding the highest percentage of "green" certificates in 10 markets across Australia, Canada, and Europe (2018). Notably, 51% of the space in Vancouver and 51% in Toronto holds some form of green certification (ibid). These trends drive the new and redevelopment of office buildings. While Toronto is known for highest number of green office buildings, the same cannot be said about high-rise condominium development. Statistics of green certified condominiums in Toronto is not as easy to come by.

While 86% of Toronto's cranes are currently used in the residential high-rise construction, little information can be found the percentage of buildings currently under construction have any form of green certified. The CaGBC website houses the "CaGBC LEED Project Profiles", an online database of all registered and certified LEED projects in Canada. An advanced search filtering out only high-rise MURB in Toronto shows that only 47 profiles can be found. The following Figure 3.9 shows all the MURB with LEED certification in Toronto, along with the registration date. All of the projects fall under the LEED Canada for New Construction and Major Renovations rating system. The gap between registration dates and certification dates suggest that the certifications are for major renovations rather than for new buildings.

Figure 3.9: All high-rise MURB in Toronto with LEED certification (CaGBC).

Project No.	Project Name	Project Address	Registration Date	Certification Date	Certification Level
13578	30 Roe	30 Roehampton	6/21/2010	8/28/2018	Gold
15326	Alto at Atria	2205 Sheppard Ave E	1/26/2012	4/17/2018	Gold
13689	Confidential Project	---	6/17/2010	4/9/2018	Silver
17112	Alexandra Park Condominium	38 Cameron St.	7/28/2014	3/1/2018	Gold
12107	U Condominiums	1080 Bay St & 65 St Marys St	4/14/2009	6/12/2017	Certified
12966	Residences at RCMI	426 University Avenue	12/9/2009	3/27/2017	Certified
12542	World Condos on Yonge	7161 & 7171 Yonge Street	11/29/2009	2/13/2017	Gold
10601	L Tower	8 The Esplanade	2/27/2007	2/3/2017	Certified
12649	River City Phases 1 & 2	River Street & King Street	10/8/2009	8/12/2016	Gold
11741	Hullmark Centre Inc.	5 Sheppard Avenue East	11/14/2008	4/28/2016	Gold
13474	Confidential Project	---	6/15/2010	2/19/2016	Certified
12406	Gooderham Condominium	390 Cherry Street	12/18/2009	2/10/2016	Silver
11399	300 Front Street	300 Front St.	6/16/2008	2/5/2016	Gold
11997	Residences at One Old Mill	1 Old Mill Drive	3/10/2009	12/11/2015	Gold
14133	Residences of Avonshire Inc.	120 Harrison Garden Blvd.	4/11/2011	10/16/2015	Gold
12145	Cinema Tower	21 Widmer St.	5/12/2009	7/30/2015	Certified
12392	Clear Spirit Condominium	390 Cherry Street	12/18/2009	6/23/2015	Silver
10703	775 King West	775 King St. West	6/19/2007	6/5/2015	Gold
10742	SIX50 King West	650 King Street West	6/4/2007	5/20/2015	Silver
13703	Fuzion	20 Joe Shuster Way	7/7/2010	5/12/2015	Gold
13223	Railway Lands	150 Dan Leckie Way	3/4/2010	4/21/2015	Gold
11985	One Park West Boutique	260 Sackville Street	4/29/2009	4/21/2015	Gold
12519	The Berczy	55 Front Street East	8/28/2009	4/13/2015	Gold
12453	West Village Building B	2 Eva Road	9/2/2009	3/18/2015	Gold
12451	West Village Tower A	6 Eva Road	9/2/2009	12/22/2014	Gold
11920	Reflections Condo	85 The Donway West	1/20/2009	11/10/2014	Gold
12160	Motion	570 Bay Street	6/16/2009	10/29/2014	Gold
13579	Richgrove Seniors Housing	620 Martin Grove	6/21/2010	9/16/2013	Gold
11398	Nuvo at Essex Inc.- Phase III	45 Viking Lane	6/26/2008	8/7/2013	Gold
13255	One Oak Street, Toronto	One Oak St	4/12/2010	5/8/2013	Gold
10638	246/252 Sackville Street	246 - 252 Sackville Street	3/26/2007	4/5/2013	Gold
11119	Residences of Maple Leaf Sq	55 Bremner	2/15/2008	2/26/2013	Silver
10860	James Cooper Mansion Inc.	28 Linden St.	9/18/2007	2/21/2013	Silver
11105	Residences of Avonshire Inc	100 Harrison Garden Blvd	4/7/2008	1/31/2013	Silver
11322	Sierra and Palomar	7 & 3 Summerland Terrace	4/14/2009	12/12/2012	Gold
10420	mintoSkyy	1042 Broadview Ave.	10/11/2006	11/5/2012	Gold
12813	Rêve Condos	560 Front Street West	2/10/2010	11/5/2012	Gold
10353	M5V Condominium	375 King Street West	7/13/2006	10/29/2012	Gold
10904	Republic of Yonge & Eglinton	25 Broadway Ave	1/11/2008	9/18/2012	Gold
10905	Republic of Yonge & Eglinton	70 Roehampton Ave	1/11/2008	9/18/2012	Gold
10934	SPRING@MINTOGARDENS	23-33 Sheppard Ave East	12/20/2007	8/8/2012	Gold
10355	Residences at Accolade Inc.	Eglinton Ave E & Wynford Dr	8/8/2006	2/29/2012	Gold
10155	The Residences at Verve Inc.	120 Holmwood Avenue	4/27/2005	11/26/2010	Gold
10237	Nuvo at Essex Phase 2	25 Viking Lane	12/13/2005	10/5/2009	Silver
10219	MintoMidtown	2195 Yonge Street	9/28/2005	5/8/2009	Gold
10188	Minto Roehampton	150 Roehampton	6/15/2005	1/30/2008	Gold
10113	Radiance @ MintoGardens	33 Sheppard Avenue East	2/10/2005	4/20/2006	Silver

Chapter 4: Energy Planning

4.1 Goals and Benefits of Community Energy Planning

Many scholars have studied and written about the importance and benefits of CEP for sustainability and the health and wellbeing of community members. Huang, Yu, Peng, and Zhao defines community as a "social group of any size whose members reside in a specific locality" (1337). Huang et al claims that taking action, such as formation of a CEP, on different spatial and temporal scales is necessary for the reduction of fossil fuel consumption (1336). The importance of having a highly sustainable CEP in energy transformation is because municipalities can have substantial impact on conquering climate change by changing their own operations. Local governments own and control thousands of buildings and institutions (Sussman, 3). Municipalities own and control thousands of buildings and energy intensive infrastructure facilities, and are in the best position for inspiring and educating Service providers that impact GHG emissions (ibid).

Research pertaining to the methods and tools for a bottom-up model of CEP at different stages of community development can also be found. One good example is the Huang et al article, which reviews the framework of CEP and traditional primary energy planning (PEP) and summarizes ways to optimize community energy systems. Figure4.1 shows some of the comparative points of benefit of CEP over PEP. Huang et al defines the geographic means of a community as being preferably, but not limited to, less than 10 km^2 (1337). The article includes mention of both the top-down method and bottom-up method, and at which temporal stages of CEP these methods come into play. For instance, during the community master plan and the community regulatory plan phases, a top-down model uses the upper policy to promote implementation

of measures to save energy (1338). At the community site plan and architectural design stages is when the bottom-up approach is utilized.

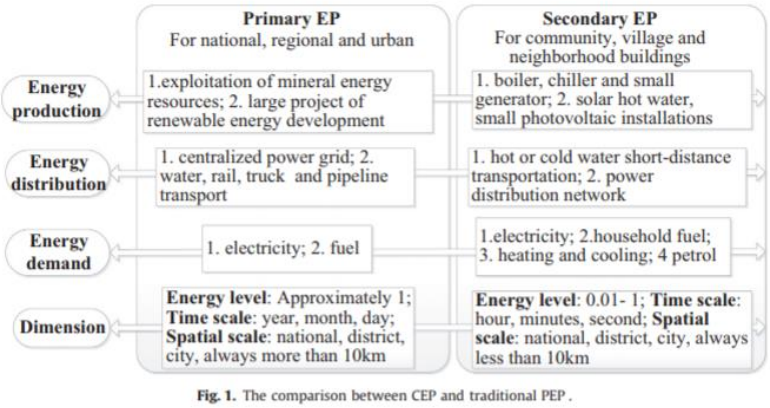


Figure 4.1: Huang et al.'s comparison between CEP and PEP, to show benefits of having a smaller more localized regional plan (1337).

Another great database for CEP implementation tools and policies to accelerate CEPs is QUEST Canada. QUEST, which stands for Quality Urban Energy Systems of Tomorrow, is a Canadian national NGO that pushes the acceleration of adopting integrated, efficient, community-scale energy systems (QUEST). The organization informs, inspires, and connects decision-makers. Some of the roles of QUEST include commissioning research, communicating best practices, convening government, utility and private-sector leaders, and working directly with local authorities for on-the-ground implementation solutions (ibid). The objective of QUEST is to engage provincial ministries for the advancement of CEP and associated project implementation through supportive provincial programs and policies. QUEST addresses CEP implementation barriers and works to find collaborative solutions. Through advice, peer learning, and implementation tools, QUEST provides support is given to municipalities and utilities in the community energy planning process.

In Toronto and surrounding areas, there are many resources through which the public can access collected data about GHG emissions from urban spaces, as well as regional plans and implementation strategies. One such agency is the Atmospheric Fund (TAF). TAF was established by the City of Toronto in 1991 to finance local initiatives for climate change efforts. Operating as a non-profit organization, TAF works closely with the City to test and advance programs that reduce GHG emissions. The City of Toronto website has a page of resources for CEP. According to the webpage, CEP is defined as the process which considers energy early in the infrastructure and land-use process[1]. This process also includes identify opportunities for integration of local energy solutions at building or neighborhood-scale. Some of the key benefits of Toronto's CEP includes less strain on energy infrastructure, fewer GHG emissions, improved resilience to power

[1] City of Toronto. City Planning Division. *Community Energy Planning* [Toronto]: 2019. City of Toronto. https://www.toronto.ca/services-payments/water-environment/environmentally-friendly-city-initiatives/community-energy-planning/

outages, and job creation. The overall goal of Toronto's CEP is to reduce energy use and increase the use of renewable low carbon energy sources and the development and use of District Energy Systems.

District Energy Systems are low-carbon thermal energy networks. For the City of Toronto, much of the energy resilience focus is in the reduction of energy demand and use, however, there are also renewable energy efforts. In 2013, a new requirement was adopted by City Council which mandates that all City-owned buildings must generate at least 5% of energy-use from renewable technologies (City of Toronto "Renewable Energy"). The technologies employed include solar photovoltaic, geothermal, biomass, and solar thermal. In partnership with Toronto Hydro in 2012, the City launched phase one the Feed-in Tariff (FIT) program, outfitting solar photovoltaic (PV) panel for city-owned buildings. The second phase was completed in 2016; the result of the two phases was 20 solar PV rooftop systems, totaling 2.5 MW of installed capacity (ibid). This translates to GHG emissions reductions by approximately 147 tonnes per year, and generates over 3,300 MWh of electricity, which can power 280 households. The third phase began in October of 2016 and includes the installation of over 40 Solar PV systems on rooftops of City facilities, double the number in phase two. These installations will have a 6.0 MW capacity, which will generate 7800 MWh of electricity annually, which equates to the consumption of 350 households and will result in 353 tonnes of GHG emission reduction each year. This is significant because it shows the potential capacity and impact of renewable energy. The technology exists and is suitable for implemented in Toronto, yet a vast majority of our GHG emissions from buildings comes from natural gas (as will be discussed in section 4.4). If the same percentage requirement for energy-use from renewable technologies was imposed on private building development as it is for city-owned buildings, the impacts on GHG emissions reduction would be spectacular.

The production of renewable energy offers opportunities for local governance of the production of energy, rather than the conventional centralized energy production (Van Der Schoor et al. 667). Many regions and communities have expressed aims to transform to a self-sufficient renewable energy system (ibid). Bottom-up solutions for sustainable development lead by innovative networks of activists and organizations respond to location situations, and to the values and interests of the communities involved (Seyfang and Haxeltine, 384). There can be no community energy planning emerging from grassroots if there is not enough interest at the community level. In the topic of transitioning a society for sustainability, research for innovation has traditionally focused on competitive market-based innovations rather than on "grassroots" innovations. Grassroots innovations refer to social-technical alternatives that attempt to replace existing unsustainable systems (Hargreaves et al 859). Literature on these sociotechnical transformations and social change shows how historic transformations have developed through a buildup of projects in "niche" space (Seyfang and Haxeltine, 382). Strategic niche management is a concept that developed as a practical

approach to governing sociotechnical niches to promote desired systemic outcomes. The concept of grassroots innovation is an emphasis on community-led social innovation that is developed at the community level and outlines how strategic niche management can be applied (ibid). For successful niche growth and emergence, the three key processes identified are as follows: managing expectations, building social networks, and learning (384). Expectations need to be widely shared, realistic, specific, and achievable; niches need to present themselves to external audiences that they live up to their promised performance (ibid). Networking activities can embrace stakeholders with resources from their organizations that can support the growth of a niche. Learning can contribute to everyday knowledge and expertise, as well as "second order learning", which refers to people questioning the assumptions and constraints of regime systems (ibid). These are amongst some of the many techniques scholars have observed for successful social innovation.

4.2 Toronto's Energy Plans and Policies

The social contract theory refers to a real or ideal agreement or pact between the state and a civil community (O'Brien et al). This is the idea that legitimate, collective governance arrangements should be informed by the people's consent. This agreement defines the responsibilities and rights of these groups to one another. The changing climate is creating new challenges for governments and citizens, inevitably forcing existing and evolving social contracts to be rethought (O'Brien et al). Particularly, social arrangements that strive to enhance the security and well-being of present and future generations will have to undergo dramatic transformations in response to the consequences for the changes in the ecosystem and increasing extreme weather events (O'Brien et al). The potential dangers posed by climate change has led to urgent calls for action. Such actions include the development of new types of social and political arrangements for enhancing local and global human wellbeing and enable all levels of societies to more effectively contend complex problems (ibid). Efforts such as these are present in Toronto, as in recent years, there has been more effort in plans and policy for climate change and GHG emissions reductions.

City of Toronto is fairly informative and transparent about their energy planning and sustainability efforts. Information is easily accessible online, with email contact information at the bottom of each page (which, from my experience, has always been responsive within 48 hours). According to the City of Toronto website, the Environment and Energy division continues to develop and implement innovative polities and programs to address the adaptation and mitigation of climate change. On the Environment and Energy division's "Climate, Energy & Resilience" page, the information and resources are available for the public:

- TransformTO – This is Toronto's ambitious climate strategy.

- Green City Operations –The City's current efforts for the reduction of operating cost and environmental footprint.
- Environmental Plans and Reports – Reports, plans, policies and research for a greener, cleaner, more sustainable Toronto. Reports in this section include the Environmental Progress Report, Carbon Credit Policy Report, Environment & Energy Division Annual Report, and more.
- ResilientTO – Toronto's Resilience Strategy, for preparation of climate-related challenges, shocks, chronic stresses, and sharp events that threaten the city's wellbeing.
- District Energy – how the City is utilizing thermal energy distribution systems for numerous buildings at the neighborhood scale.
- Community Energy Planning – at a city-block scale, an infrastructure planning process which identifies opportunities to integrate low-carbon, local, and resilient energy solutions

CEP is defined by TOCore, the Downtown Energy Strategy released in April 2018, as "how energy is used in communities, and how its use affects the community including energy cost, energy security, and environmental impacts. Community Energy Plans show how designing for sustainable energy supports community objectives of GHG emissions reduction, local job creation and funds retained in community" (15). [2] As stated on the City of Toronto website, community energy planning is a key component of TransformTO. Because this paper is looking into how policy, codes and standards influence the climate change sustainability efforts of high-rise, in this section, the three main documents to be discussed that exemplify Toronto's climate change adaptation and mitigation efforts are the following:

- ✓ TransformTO
- ✓ Toronto Green Standards Version 3
- ✓ Zero Emissions Building Framework Study

TransformTO [3]

This is Toronto's climate action strategy. It was approved by City Council in July of 2017 and sets long-term, low carbon strategies and goals to for GHG reduction and improvement of heath, social equity, and economy. The GHG emissions reduction targets, with 1990 levels as baseline, are as follows:

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[2] City of Toronto. City Planning Division. *TOCore - Downtown Energy Strategy* [Toronto]: April 2017. City of Toronto. https://www.toronto.ca/wp-content/uploads/2018/04/9585-city-planning-tocore-energy-strategy.pdf

[3] City of Toronto. City Planning Division. *TransformTO* [Toronto]: n.d., City of Toronto. https://www.toronto.ca/services-payments/water-environment/environmentally-friendly-city-initiatives/transformto/

- 30% by 2020
- 65% by 2030
- 80% by 2050

The energy portion of the TransformTO goals include 75% renewable or low-carbon energy by 2050. This strategy includes the pathway set out to achieve a low carbon future, short term strategies (including business cases for efficiency in buildings), community and equity engagement reports, and modelling advisory reports.

Toronto Green Standard[4]

The Toronto Green Standard (TGS) is the sustainable design requirements for new developments, both private and city-owned. The TGS addresses a few of the City's environmental priorities, including improving air quality, reducing heat island effect, reducing energy use and GHG emissions from new buildings while making buildings more resilient to power disruptions, reducing storm water runoff, protecting and enhancing ecological functions, and more. For the purpose of this project, I will be focusing on the energy aspect of the TGS. This set of standards raise energy efficiency requirements to a certain percentage standard above the OBC, rather than a set of absolute performance targets. The predecessor of the current TGS V3 is the TGS V2, which applied to all new planning applications which were received by April 30, 2018. Compliance with the new TGS V3 is mandatory for all applications made after May 1, 2018. TGS v3 Tier 1 was updated to 15% improvement above the 2017 OBC, in which energy efficacy requirements also went up, or to meet absolute performance targets by building type.

Unlike the previous versions of TGS, which only had a two-tier systems, with Tier 1 being mandatory and Tier 2 being voluntary, TGS V3 was restructured to present a four-tiered outline of performance levels for the goals of achieving near zero GHG building emissions by 2030 (6). [5] The energy standards in TGS V3 is so stringent that it is comparable to LEED standards. Tier 4 compliance is such a high level of performance, it is roughly aligned with a Net Zero Ready level (EQ Building Performance & Urban Equation, 12). LEED certification, which was once a higher standard for green buildings in North America, can now be used to supplement the TGS V3. A copy of the LEED Supplement can be acquired through contacting the city. This LEED supplement document was created in 2019 and includes a summary comparison of TGS V3 for mid to

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[4] City of Toronto. City Planning Division. *Toronto Green Standard* [Toronto]: 2019., City of Toronto. https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/

[5] City of Toronto. City Planning Division. *Report for Action: Toronto Green Standard Version 3 - Review of Potential Incentives and Results of Additional Consultation,* ser. PG.30.9, [Toronto]: May 2, 2018. City of Toronto. https://www.toronto.ca/legdocs/mmis/2018/pg/bgrd/backgroundfile-115478.pdf

high-rise residential and non-residential developments and LEED Version 4. The document includes three summary comparison tables. The first is Tier 1 mandatory performance measure requirements of TGS V3 and the corresponding LEED BD+C V4 credits and prerequisites. The second summary table compares Tier 2 to Tier 4 of the voluntary performance measure requirements with the corresponding LEED BD+C V4 credits and prerequisites. Lastly, the third table compares the highest TGS voluntary levels, Tier 3 and 4, and CaGBC's ZCB. The conclusions of overall similarities and differences from these comparisons is that while a number of the TGS development features overlap with LEED credits and prerequisites in design intent, the TGS recognizes and illustrates Toronto's regional environmental priorities, policies, by-laws, and standards, while LEED Canada is a national voluntary standard. In a phone interview with Lisa King, the Senior Policy Planner of the City of Toronto who co-designed, updates, and monitors the TGS, when asked about whether the stringency of the direction TGS is evolving will make LEED obsolete, Lisa informed me that the most recent TGS is very comparable to LEED because the city worked with LEED as a joint effort to produce V3. The zero carbon targets are simultaneous, and the same energy modelling was used. While the two systems are related, Lisa states that they work differently.

Zero Emissions Building Framework Study [6]

This report is a study to identify an effective way to update the TGS GHG and energy efficiency measures so that it addresses the city's climate while still being feasible for the construction industry (6). Incremental targets for energy use, thermal demand, and GHG intensity were developed for zero emissions by 2030; this is critical to meeting Toronto's 80% GHG reduction target by 2050 (from 1990 levels, which is set as the benchmark), as shown in Figure 4.2 (7).

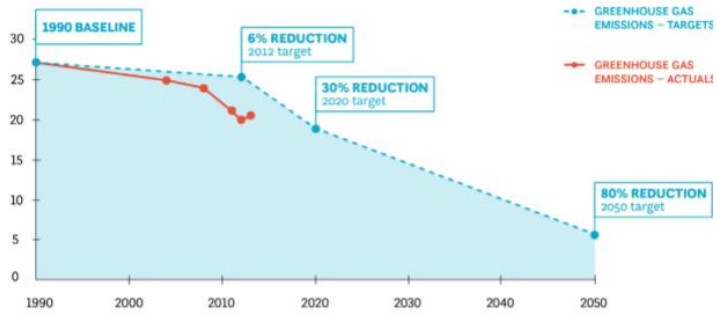

Figure 4.2: Toronto's GHG Emissions and Targets from the Zero Emissions Building Framework Study Report(12)

By 2050, it is estimated that following this proposed framework, GHG emissions can be reduced by 30.6 megatonnes (9). The framework for this report sets targets for five of the most common building architypes; four tiers of performance were developed for the transformation of the building industry from what it is now, to the near-zero emissions level by 2030. Under

[6] City of Toronto. City Planning Division. *Zero Emissions Buildings Framework* [Toronto]: March 2017. City of Toronto. https://www.toronto.ca/wp-content/uploads/2017/11/9875-Zero-Emissions-Buildings-Framework-Report.pdf

this new framework, new developments are required to reach performance levels in total energy use intensity, thermal energy demand intensity, and GHG intensity (7). These performance targets are supplemented with new and updated prescriptive requirements such as renewable energy generation, district energy connection, air tightness testing requirements, submetering, etc. An updated set of "Energy Modelling Guidelines" are also included in this framework to clarify methods of calculating energy performance to improve consistency and support compliance. Figure 4.3 shows the future plans for how the TGS can move toward achieving the goal of near zero emissions level of building performance by 2030. Figure 4.4 shows the comparison of TGS V2 and V3 targets for high-rise MURB. The two charts in Figures 4.3 and 4.4 show how the higher voluntary tiers of standards of the TGS will slowly become the mandatory requirements.

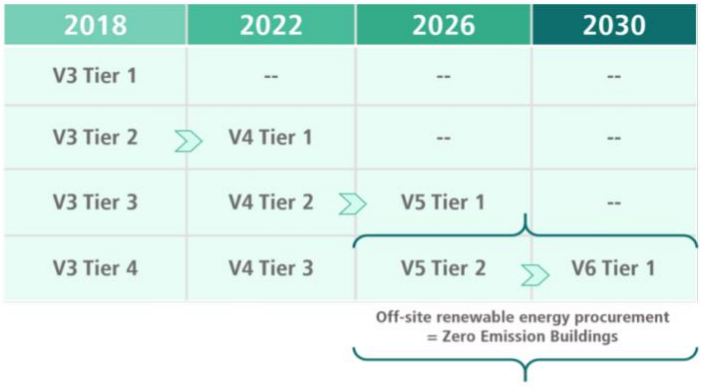

Figure 4.3: Zero Emissions Buildings Pathway (36)

Tier	New TGS Targets			Overall % Change in Construction Costs*
	EUI (kWh/m²)	TEDI (kWh/m²)	GHGI (kgCO2e/m²)	
TGS v2 T1 (SB 10 2017)	190	77	26	N/A
TGS v2 T2	170	70	20	1.5%
TGS v3 T1	170	70	20	1.5%
TGS v3 T2	135	50	15	3.5%
TGS v3 T3	100	30	10	6%
TGS v3 T4	75	15	5	3.6%

Figure 4.4: How TGS V2 targets for high-rise MURB compare to TGS V3 targets. (38)

This report also indicates measuring energy performance from Toronto's current "percent above" the OBC, to an absolute performance target approach, would help bridge the gap between construction building performance and design (6). This is because there is little correlation between TGS compliance with performance requirement of energy standard, and the amount of energy the building was designed to consume (24). This shift to a targets-based approach is necessary, as while conventional energy standards for commercial and multi-family buildings in North America have become more stringent over time, it has not correlated to new building lower absolute energy use (ibid). In Europe, targets-based approach has shown positive outcome in building energy use reduction. This shift will establish a measurable performance pathway from the conventional buildings, to high-performance buildings, to eventually near zero, and zero-emissions buildings.

4.3 Developer Incentives for Meeting Higher Standards

There are several financial incentives available for high performance buildings. Under the TGS V3, there is the **Development Charge (DC) Refund Program** available for projects meeting the voluntary Tier 2 to 4 standards, or near zero emissions levels in accordance with the Development Charge Bylaw[7]. A list of the program requirements, eligibility, registered project evaluators, and DC refund procedures can all be found on the City of Toronto website. In my conversation with Lisa, she clarified that the DC refund as per bylaw is the same, there is no additional higher refund for higher voluntary tiers achieved; regardless of which tier is reached, the DC refund will be the same. When asked about other financial incentives beyond the DC refunds, Lisa indicated that there was a percentage of the proceeds from the cap and trade system that was invested into green development projects, but the provincial cap and trade system has since been cancelled under the Ford government. The **High-Performance New Construction (HPNC) Program** offers financial incentives for buildings constructed with performance above OBC requirements[8]. Under this program, new buildings and major renovations can get up to $10,000 for modeling costs, as well as $800 for every kW saved, depending which track of the program is chosen. Embridge Gas Distribution offers a green building initiative program called **Savings By Design**. According to the *Zero Emissions Building Framework Study,* this program offers support for green building design and construction through access to expertise, and financial incentives of up to $30,000 for buildings achieving 25% energy use reduction over the 2012 OBC standards. City of Toronto offers the **Imagination, Manufacturing, Innovation Technology (IMIT) Incentive program**, which offers a grant of 60% of the municipal tax increases over a 10-year period (ibid).

According to the McGraw Hill's Canada Green Building Trend Report for the CaGBC, mandates and incentives from the government of all types are considered by industry survey respondents to have a high impact on the decision to build more sustainably, as displayed on Figure 4.5 (26). The best tool for those seeking to increase green building levels in Canada is the creation of stricter mandates (ibid). When asked about non-financial incentives, Lisa King mentions that quality of green buildings is a major incentive for developers. Green buildings are more comfortable, and more durable during its life cycle, and creates high benefits to society.

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[7] City of Toronto. City Planning Division. *Development Charges and By-laws & Rates* [Toronto]: 2019. City of Toronto. https://www.toronto.ca/city-government/budget-finances/city-finance/development-charges/development-charges-bylaws-rates/

[8] City of Toronto. Water and Environment. *High Performance New Construction Program* [Toronto]: 2019. City of Toronto. https://www.toronto.ca/services-payments/water-environment/environmental-grants-incentives-2/energy-efficiency-incentives/

In my interview with the private sector planner for a condo development company, when asked about meeting green standards, he revealed that the majority of condo developers will only reach the minimum requirements. When asked about incentives for reaching higher tiers, he revealed that while faster permitting is a potential incentive many in the industry hears and talks about, it does not happen; no one gets faster permits. As for DC refunds, it is a difficult process to prove that the standards are met. It is very paper work intensive and often not worth the risk of spending the money for higher standards, completing the rigorous paperwork, then not getting the approval for whatever reason. He states that the same goes for other voluntary green standards like LEED; very paperwork heavy, and not worth the time or effort due to the difficult process of proving that standards are met.

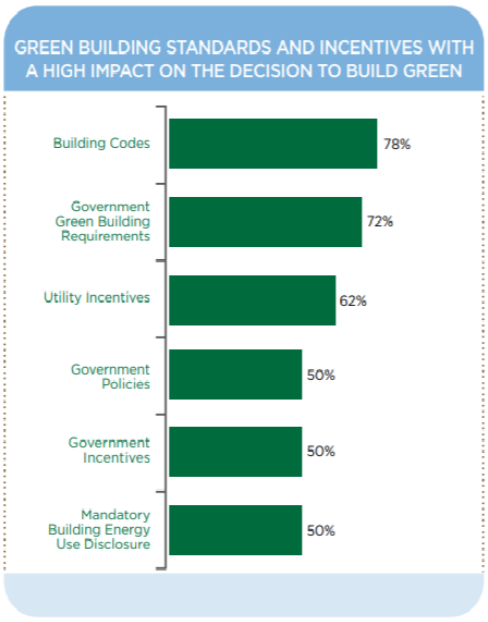

Figure 4.5: Industry survey results of causes of green building decisions (McGraw Hill Construction, 26).

4.4 Effects on Toronto's Development Industry

The 2016 GHG Emissions Inventory by TransformTO found that approximately 45% of GHG Emissions in Toronto is caused by homes and buildings, as shown on Figure 4.6. The *Zero Emissions Building Framework Study* states that The Climate Change and Clean Air Action Plan was adopted in 2007, outlining various actions for the reduction GHG emissions for improved air quality in the city (12). Since then, the high-rise industry has been trending toward overall increase in heights, which can create challenges for efforts in GHG emission and energy-use reduction (13). This is because commercial and residential high-rise buildings often use cladding materials and envelope systems that grant high heat transfer rates between building interior and exterior. As a result, in 2010, the City of Toronto began to address

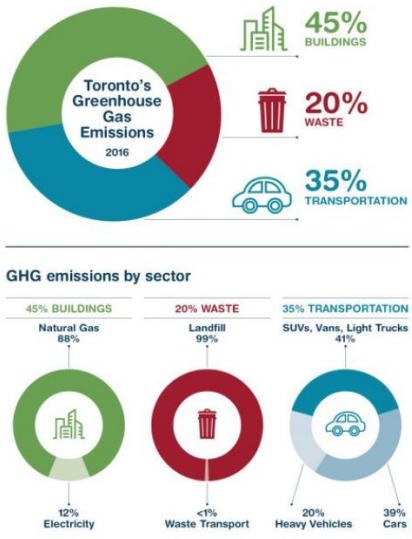

Figure 4.6: Breakdown of Toronto's GHG Emissions in for 2016 by sectors (TransformTO)

the challenges of reducing building emissions in Toronto with releasing the original TGS. Since then, each updated TGS released has been increasingly more and more rigorous with green standards. Toronto's 2016 Greenhouse Gas Emissions Inventory also found that community-wide GHG emissions were 33% lower in 2016 than in 1990; putting the city half way towards the TransformTO 2030 target of 65% reduction. While it is not expressly determined that this GHG emission decrease resulted directly from the increased green standards, there is a correlation in timeline.

While all new buildings proposed after May 1, 2018 must abide by the standards set up Tier 1 of TGS v3, how prevalent are the voluntary standards of Tier 2 and higher? The TGS page in the City of Toronto website has a list of certified Tier 2 project. Tier 3 and 4 are new introductions to TGS V3, so results are not yet measurable as they have yet to be built. In my conversation with Lisa, I was informed that they are already seeing applications for Tier 3 and 4 coming in. Buildings that strive for the highest tiers of standards are mostly public institution buildings, rental buildings, and commercial buildings. This is because in these circumstances, the developer is also the owner of the building, and therefore directly benefit from the lower operational and maintenance costs associated with higher efficiency buildings. In condo development, the owners that reap these benefits are homeowners rather than the developer, therefore developers are less inclined to want to incur the higher initial building costs unless it is a demand form the purchaser market. Lisa also mentioned that the TGS and OBC feed off each other; the TGS has historically influenced the standards in the OBC to improve. When reviewing the TGS, the direction for where the OBC is going can be predicted; at the 5 year reviews of the OBC, it catches up to TGS standards. The TGS shifts the target, showcases taller and denser buildings and proves that higher standards can be achieved, which paves the way for higher standards in the OBC. This sentiment is echoed by the private developer planner interviewed; he mentioned that the OBC is starting to come up slowly to par with the TGS. He mentions that for the industry shift to green buildings, a shift in the building code is most key.

TGS V3 is very comparable to environmental standards of LEED certification. Only 47 profiles for all high-rise residential buildings in Toronto were found to be LEED certified. The new high-rise MURBs in Toronto that must meet the standards of TGS V3 Tier 1, would theoretically function at LEED standard levels, making a drastic difference in energy-use performance and GHG emission levels. The EQ Building Performance and Urban Equation report for Sidewalk Labs Toronto found that of the MURBs currently either in the design or construction phase analyzed, only 5% would meet TGS V3 standards for Tier 1 (4). This shows the stringency of the new TGS v3 standards, and the drastic impact that would be made if all buildings moving forward were forced to meet Tier 1 of TGS. While these changes are positive, there is still a lot that can be done. The city is hesitant to embrace true revolution in building practice. Sam Crignano, who works for

Cityzen Developments, the developer interested in bringing Brisbin's vertical forest to life, states that there will be challenges in the approval process for this groundbreaking project (Kalinowski 2018). Crignano expresses that the city tends to be rigid; things slightly out of the norm is never well received.

While the improved green standards is good news for sustainability in the city, one factor that must be addressed is cost. Figure 4.7 shows the cost premiums associated with achieving the different target tiers in mid to high rise buildings. As displayed, for residential and commercial office buildings, this could raise construction costs by up to 6%.

Table 1. Construction cost premiums for proposed Tier 1-Tier 4 energy targets

Performance level	Overall % change in Construction costs over OBC (SB-10 2017	
	Residential and commercial office	Commercial retail
Tier 1	0.5- 2.3%	0.7%
Tier 2	2.1-3.5%*	6.5%
Tier 3	3.0-6.0%	8.2%
Tier 4	3.6-4.9%	16.9%.

Figure 4.7: from the Report for Action- Toronto Green Standard Review and Update released by the Toronto City Planning Division (9)

4.5 Role of Community

Gilmour et al in a QUEST report for Canada's Energy Transformation talks about the "role of local" as being the opportunity for local, community-based solutions to meeting energy needs, and for communities and local interests to have impacts on energy development projects. There is a considerable account of community participation accepted and encouraged by the city in these subjects for community members that want to take part and have a voice in Toronto's strategic plans. TransformTO has conducted extensive community engagement for setting this ambitious long-term climate strategy. According to the Community Engagement page of the TransformTO website, nearly 2000 community members took part in online surveys and TransformTO events to share their visions for Toronto in 2050.[9] Events on various topics took place throughout 2015 and 2016, called "TalkTransformation!" events, and residents were encouraged to share their ideas on each topic by completing an online workbook. The Community Engagement page has accessible, well documented, easy to navigate report summaries of community ideas, and presentation slides from events. There is even an Engagement & Equity Report, created through the Urban Sustainability Directors Network (USDN) Building Diversity Fellowship, which offers advice for how TransformTO can best

[9] City of Toronto. City Planning Division. *TransformTO Community Engagement* [Toronto]: n.d., City of Toronto. https://www.toronto.ca/services-payments/water-environment/environmentally-friendly-city-initiatives/transformto/transformto-climate-action-strategy/community-engagement/

engage marginalized and equity-seeking groups in the development of climate action plans, and designing and implementation the solutions. This is significant, as TransformTO 's primary function is the supplementation of the City's Climate Change Action Plan and Sustainable Energy Strategy and to accelerate Toronto's transformation towards a more sustainable city, and it shows that Toronto does have a strong commitment to input from community members in development of these plans.

In terms of what community members can do to influence the high-rise development market, a common sentiment I picked up on in my interviews with Robert and Connie is that responsiveness to community needs by developers largely relate to the community support of the local council member. For the neighbourhood of CWNA, Robert spoke about how since Councillor Kristyn Wong-Tam was elected in 2010, developers are now more responsive to local communities than they once were. Connie shed light on the experienced history of community involvement in the planning process throughout the years. She revealed that Councillor Kyle Ray, retired city councillor for Ward 13, formerly Ward 27, and Kristyn Wong Tam's predecessor, was not as encouraging of community participation in planning and development. There was little-to-no civic engagement- if you reached out through email, you would receive a phone call back so that there was no paper trail, and community participation was often limited to photo opportunities. Due to this lack of outreach, most community members were not aware of the possibility to take part in decision making process of planning and development. Councillor Wong-Tam, on the other hand, is very involved in this topic, engaging community members, bringing together groups of people, and encouraging them to participate. This has resulted in community members feeling more empowered to take part in the proposal and planning process of developments. Prior to this, and still persistent amongst many now, were perceptions of feeling powerless, as though in a David vs Goliath style fight against the large developers with abundant monetary resources and political pull. Connie claims these misconceptions have since slowly begun to change, with more and more people realizing the potential and possibility of their voices. Connie gave me many accounts of times her neighbourhood association was able to change entire development plans and save numerous heritage buildings. One of CWNA's major win was the Lanterra project at 11 Wellesley West. It was initially proposed to be two high-rise towers, but due to the diligence of the CWNA, community organization, rallies, and marches, it is now a single 60 storey tower, with a 1.6 acre park at the base. These anecdotes show the incredible power dedicated members of the community can make in the development landscape. The CWNA began with just nine members, and this core group of nine throughout the years have been able to make profound impact on Toronto's built environment.

Specifically pertaining to the topic of this paper of energy planning and high-rise development, what role can the community play? The community feedback provided in the TransformTO events, community

reports, and other submissions, helped TransformTO identify the common ideas and themes prioritized by citizens. This means that the city is taking a very collaborative approach to its climate plan, including the concerns and voices of Torontonians. Lower GHG emissions, climate change resilience, and green building standards were not amongst the commonly mentioned topics by citizens. The most mentioned ideas overall, across all categories, include better, more reliable, accessible transit, more complete, dense, and walkable communities, urban agriculture, cycling infrastructure, and presence of greenspace. Green buildings and energy standards not being a priority, and not being on the horizon of main concerns for community members, was also related during my interviews with Connie and Robert. Connie revealed that the some of the common priorities of the neighbours include the desire for green space, preservation of heritage, development that brings value to a neighbourhood, and is aesthetically fitting for the neighbourhood (ie. presence of an angular plane). Robert revealed that it is rare that people participate for a positive outcome, rather than trying to avoid a negative one. This means that there is a lack of overall public attention to the importance of climate change adaptation and mitigation, and the urgency of the need to address climate change issues. While the City needs to lead by example with its plans and policies, as it has with the ambitious goals set out through TransformTO, the public needs to support and participate in the behaviour change.

There is always regional variance for the needs of communities. Having a community-based solution to meeting energy service needs means that the energy plan will be tailored around the specific concerns of a community. A key problem with community-led local sustainability initiatives is that while they are essential for solutions in sustainability problems, they are difficult to grow and replicate widely (Hargreaves et al, 879). A study in the Netherlands on community energy initiatives concluded that while this are an emerging phenomenon which provides a useful grassroots approach for citizens to engage in sustainable energy transition for the future, further development of viable visions and organization structures for local energy governance is necessary for achieving lasting results (Van Der Schoor et al. 674).

4.6 Barriers to Community Involvement

Toronto's reports and online access appears collaboration-friendly; why is there such low rates of participation? As mentioned earlier, nearly 2000 Torontonians took part in the TransformTO events and surveys, which is a very small representation of Toronto's population of over 2 million. If Toronto's planning process is so inclusive, why do real estate developers have the reputation of gentrifying forces that do as they please? What are the barriers to community involvement in the development planning process? A common

theme gathered from my interviews, and reviewing the reports and resources available from TransformTO, is that it seems as though many community members are either not aware of how much power they hold or lack the awareness for interest in these topics. Robert observed that mobilization of community members happens when people feel threated; that the vector for action often proceeds threat. For instance, whenever there is threat of shadow over-casting on school yards by proposed high-rise developments, there is lots of engagement seen from community associations, teachers, students, and parents. He reveals that people act on their vested self-interests and own enthusiasms. If action is often initiated as a result of perceived threat, what does that mean for climate change and sustainable urban development?

As demonstrated in the TransformTO community outreach documents, inclusion for community input is not only welcome, but encouraged. There are many steps community members can take to help influence this policy shift, so what is the cause for this low rate of participation? This apparent lack of interest can be due to several reasons. The main factors seem to lack of awareness, time, low expectation of ability to create change, and bureaucratic barriers. Gilmour et al states that is it apparent to government decision-makers and to the energy sector that processes for engaging the public are generally non-existent or not well structured (5). Robert states that it is a question of how knowledgeable local residences are. For effective negotiations to take place, a fair amount of discussions, meetings, etc. are required to gain appreciation of the forces of change, and many community members simply do not have the time, or ability to take off work, to commit. Without the knowledge of the forces of change, and unaware that anger, hostility and resistance are acrimonious and not productive for reaching goals. Connie echoed similar barriers. In order to participate in the Ontario Municipal Board (OMB), now renamed the Local Planning Appeal Tribunal (LPAT), meetings, one needs to have time and resources. The party fighting against development proposals also need money to hire professionals.

The tight timeframes with short deadlines for public consultation may be another barrier to participation. The Government of Canada's public consultation in the development of Environment and Climate Change Canada's strategic assessment of climate change was interested in hearing from indigenous peoples, provinces and territories, industry/companies, academia, NGOs, and other interested Canadians to determining how integrations for climate change considerations can best made in project impact assessment (Environment and Climate Change Canada). The focus for this consultation is for the Government of Canada's commitment in creating better guidelines for projects directed toward environmental protection, respecting Indigenous rights, and strengthening the economy. The consultation period only ran between July 19,2018 to August 31, 2018, as can be seen in Figure 4.8. Rather than constant rolling opportunity for community

members to share their ideas, there are short openings of opportunity (Environment and Climate Change Canada). While this is the average timeframe for provincial and federal government consultations when it comes to regulations and legislation, more can be done to inform and educate community members of these events. With these short periods of consultation, people may not be aware of these short windows of opportunity to have their voices heard.

Figure 4.8: Image extracted from Government of Canada website showing short public consultation timeframes ((Environment and Climate Change Canada).

Opportunities for involvement in the planning and decision-making process may seem restrictive. There are also bureaucratic barriers, as many community members are not aware of where to go to address their concerns. Municipal policies play a large role in determining the level of public participation in the planning process. For instance, the OMB was criticized for favouring developers in zoning decisions (Crawley, 2019). As a part of the Wynne government, the Local Planning Appeal Support Centre (LPASC) was created as a provincial agency that provides legal assistance to residences in the battle against development changes in their local community. The Ford government, more pro-industry and pro-development, and has since made a decision to close this provincial agency (Crawley, 2019). In February 2019, LPASC stopped taking new requests for public services from the public and will have until June 30, 2019 to wind down the business. In terms of goals for climate change, in my interview with Toronto's senior policy advisor Lisa King, it was mentioned that part of the success of TGS and TransformTO was due to the Wynne government setting long term targets for climate change adaptation and mitigation, but the Ford government has since pulled back. Climate change, energy resilience, and low-carbon emissions is not a point of priority for this current provincial government.

Chapter 5: Recommendations

With over 400 new proposed development projects (Brussow and Sewell) and Toronto hitting a multi-year record for new condos under construction (Powell), it is clear that action needs to be taken to limit the social and ecological impacts of this concentrated development activity, both short and long term. With Toronto's growing population, and 86% of Toronto's cranes currently being used in the residential high-rise construction (Brussow and Sewell)., the need for higher green building standards, codes, and policies is essential for creating urban resilience against the effects of climate change. While buildings can be retrofitted to include more sustainable components later in its life cycle, it is better to design and build with efficiency integrated right from the start. In a city as diverse as Toronto, there is no one-size-fits-all approach to solutions.

Through my research, I can surmise that a combination of top-down and grass-roots bottom-up approaches to energy planning is necessary for successful sustainable dense urbanism. It is first necessary for policy makers to set stringent green standards for buildings, both new builds and renovations for existing buildings. As discussed in Chapter 4, section 4.2 on this report, one of the main drivers for developers in meeting higher green standards is government requirement. With a good, established, policy-mandated platform for green standards, the concept of grass-roots, bottom-up approach to sustainable energy planning can then be introduced as the driver of higher voluntary tiers of green building achievement through community demand and pressure.

There must be more environmental education, informing the public on the global severity and urgency of the threat of climate change resulting from GHG emissions. Gilbert et al claims that meaningful public engagement requires a sustained dialog on substantive matters that allow members of the public to develop and share informed opinions (5). This also requires that public input is valued and considered (ibid). To get to this stage, current established processes are required to evolve. This will require the evolution in

regulatory bodies and governments to respond to broadly based public concerns, such as climate change, as well as specific needs of communities and opportunities for them to benefit from energy development projects (ibid). The development of energy literacy by the public will ensure that communities and local interests have constructive and informed impacts on projects. Having a community-based solution in meeting energy service needs means that the CEP will be tailored around the specific concerns of a community. Benefits of doing so go beyond just better accessibility and more equitable distribution of energy; it can also increase citizens' sense of inclusiveness, involvement, connectedness, and collective ownership of space, leading to a more vibrant community.

Education is vital for generating citizen interest in climate change adaptation and mitigation, and for citizens to push for more green policies. How can awareness and interest be generated enough for people to take action? During the 2019 United Nations (UN) Sustainable Development Goals (SDG) Advocacy Training presentation at York University, presenter and UN policy advocate Steven Lee talks about the potentials of the role of social media in establishing policy. He states that social media is extremely effective for widespread repetitive presentation of ideas, reengagement, continuous education, and corporate advocacy. However, for a first-time introduction, it is difficult for people to fully understand or take interest in entirely new wholistic concepts through social media. For a successful and meaningful first-time introduction, Steven suggests that in-person is the most effective. Following the initial in-person introduction of topics, frequent re-engagement and reminders on social media is effective for public opinion shaping and will make people more likely to act. Steven draws these approaches from the commercial and marketing strategies of major corporations and apply them to the UN's SDGs; these same strategies can be applied to spreading the importance of sustainable urban development. Steven states that the most effective way to make change is elections in democratic countries. The first step is to shape the conversation of whatever goal is at hand, vote for the officials that can help toward achieving these goals, then implement. Active citizens are necessary for participation on all levels of government; it is crucial for residents to engage the systems they are members of. When there is a strong coalition of support in establishing a policy, the strength of work that is put into establishing the policy makes it harder to disassemble.

Connie expressed that community members need to embrace development rather than being angry, as anger and resistance will not be effective, and provided me with a few of her tried-and-true pointers for participating and making change in the planning and development realm. Firstly, one can look at a map of neighbourhood associations, and become a member in the association in charge of the geographic region. There is a website called the Toronto Atlas of Neighbourhood Groups and Organizations (TANGO) that

provides this service; an updated map can be seen in Figure 5.1. If a neighbourhood association does not exist in your area, contact your local councillor about wanting to start a one; your local councillor should be ready and willing to help set one up. This also brings up the importance of electing a good councillor. A good councillor will assign a representative for your specific neighbourhood section to manage and address concerns for that specific neighbourhood. Once a meeting is set up with your local councillor or assigned representative, look at the models of other neighbourhood associations. Some associations have lots of resources; meeting with other associations can be extremely helpful in getting mentorship and tips on what to do. Ask a lot of questions; find out how to get involved with local police and heritage preservation. Express to council members the interest in higher green standards; ask councillors for developers to have public consultation meetings beyond just the mandatory city-run meetings. During voting seasons, vote for council members that have stronger platforms for environmental wellbeing and community involvement in the planning process. Demand higher sustainability standards and request higher TGS Tier achievement from developers during community consultation meetings.

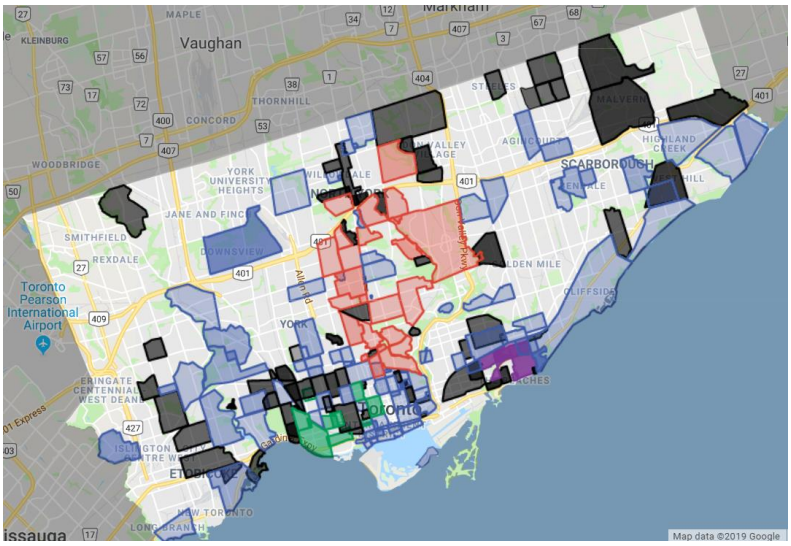

Figure 5.1: Map of Toronto's neighbourhood groups and organizations (Meslin et al.)

How can community members get involved and make meaningful impacts? When asked about what community members can do to help push for higher green building standards, Lisa states that there has to be more activity in the community for bringing sustainability into the political agenda. The topic of TGS needs to be brought into community meetings, and specifically asked for. The importance of electing an official that has a strong platform for climate change adaptation and mitigation is exemplified in Ontario's latest provincial elections. Lisa mentioned in our interview that Kathleen Wynne, the previous premiere of Ontario, set long term climate change targets. However, since then, the Ford government has pulled back, resulting in not as much provincial law for climate change. The same can be said about electing an official that encourages the involvement in community members in the planning decision making process. A great example of this is the LPASC created by the Wynne government to provide legal assistance to residences in the battle against development changes in their local community, which has since been closed by the Ford government.

For community mobilization, there are tactical methods that can be very effective. During the 2019 City Building Expo hosted by Ryerson University and the University of Toronto at the Daniels Building on March 2, 2019, in the panel discussion on growing sustainability in Toronto, councilor Mike Layton relayed his personal experience witnessing the power of today's era of tactical urbanism. He spoke about specific examples of instances where he has seen small groups of community activists that tackle specific issues, being more effective at creating change in governmental policy than large established climate action advocacy groups of people who have been working for decades. He explains that the key to success is having strong, defined, and specific goals, being well organized, and having actions that are well executed.

Delays in scheduling and restrictions on zoning bylaws can be extremely costly to developers. Governing bodies can set non-financial incentives for developers, such as increased allowance in height and density through Section 37 of the Planning Act or a faster permitting process. These can be excellent motives for developers to aim for higher voluntary tiers of the TGS V3. Section 37 can potentially be a great tool for pushing for higher tiers of TGS achievement in condo development. In my interview with the private developer planner, he mentioned that for Section 37, the City usually prioritize public art and parks, but if they want developers to achieve higher tiers of the TGS, that can be done.

The development of city action plans is an important for the reduction of human vulnerability to climate change (Harlan and Ruddell, 130). Many elected local officials and decision-makers are reluctant to take these steps because there are several tradeoffs and challenges apparent in the implementation phase. One major barrier to implementation is the initial finical investment. Many cities in both developing and industrialized counties face the choice between short-term economic development or reduction of environmental degradation (130). In the context of green high-rise building standards in Toronto, since the inception of TGS V3, high-rise development has not slowed down. This shows that raising green standards do not appear to be deterring the development market in this city. Energy modelling practices also need to be updated to provide more accurate energy predictions, to close the performance gap.

It is important to note that while broadly beneficial, the policies, standards, and codes mentioned in my paper does not specifically target the most vulnerable groups to climate change: the marginalized and/or segregated communities. Although having increased green building standards benefits all members of society through increasing co-benefits such as better air quality and less intensive heat island effects, this alone will not solve all urban issues caused by climate change. It is crucial to address one of the most pressing issues of Toronto's housing market, and that is affordability and accessibility. As mentioned, there are higher initial costs associated with higher green standards. These additional costs incurred by developers will likely be pushed onto purchasers, increasing the unaffordability of Toronto's housing market and furthering the

housing crisis in the city. This may also contribute to and perpetuate gentrification. The financial incentive involved in high-performance buildings is lower maintenance and operation costs once the building construction is complete. These lifecycle savings are great incentives for homeowners, but only benefit developers to the degree that they are able to greenwash the marketing of the project to sell higher luxury premium, as they are no longer responsible for ownership and maintenance costs after selling and closing of the units. This is an issue of social inequality, as the financial benefits of lower maintenance and energy costs is only accessible not by those who need it the most, but by those who can afford the high initial property costs. The private sector planner for a high-rise developer that I interviewed revealed to me that about 30% of the cost of development goes toward development charges and permit costs; there is a long list of costs such as fees every time a road needs to be closed, and development charges have increased significantly in the past year. He claims, "the City talks a lot about affordable housing, but where do they think these costs go?", indicating that these ever-raising development costs combined with the increased initial building costs affiliated with higher green standards, gets pushed from developers to purchasers. Lisa, on the other hand, states that there are no studies that show that improved quality of buildings drives up costs of units, and that costs are influenced by the market.

In the 2009 15th Annual Demographia International Housing Affordability Survey of over 90 cities, Toronto is listed among the top 10 least affordable major markets (2). Since the first survey done in 2004, Toronto has more than doubled its middle-income house prices relative to incomes (16). In April 2017, Ontario imposed a foreign buyers tax of 15% for non-Canadian residents (Kalinowski 2018). This has curbed offshore investments and stabilized the hyper-inflation of Toronto's house prices (ibid). Despite this, as depicted in Figure 5.1 , the rate of unaffordability continues to rise. Policy changes that push developers to build more sustainability are crucial for the future wellbeing of the city and its inhabitants, but it has to be done in conjunction with other inclusive legislation promoting affordable housing.

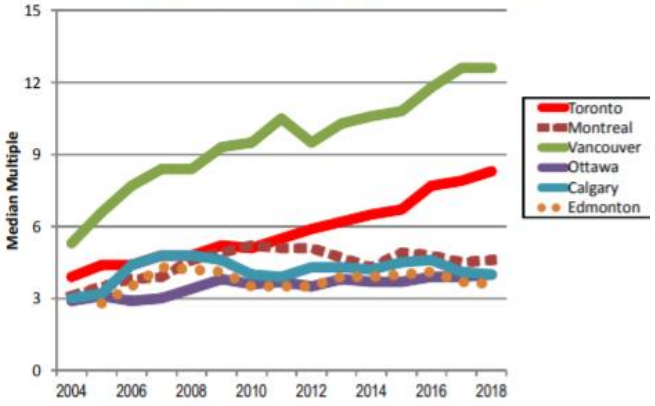

Figure 5.1: Housing affordability graph of Canada from 2004 to 2018 from the Demographia International Housing Affordability Survey (2018). The "Median Multiple" rate used by the International Housing Affordability Survey is the price income ratio; the cost of average house price divided by the average household income. The higher the Median Multiple, the higher the unaffordability.

Chapter 6: Conclusion

Cities are locations for social, economic, political, and technological innovation (Leichenko 166). The development and implementation strategies that promote urban resilience can draw upon the potential for innovation, but new forms of governance are required for fostering these efforts (ibid). Toronto's condo boom demonstrated how urban planning in Toronto has shifted to a neoliberal agenda, wherein planning practice becomes deregulated and public interest becomes a reduced perspective of economic prosperity (Lehrer et al 89). While it may seem like Toronto's current high-rise development market is a building frenzy, a positive shift to more sustainable development is possible. Sustainable development has fascinated much attention as a method of addressing this generation's energy shortage and environmental deterioration problems (Huang et al, 1336). One of the most difficult urban tasks is reducing the fossil fuel consumption in city life (ibid). For lower impact on the environment and a more harmonious urban setting social life, urban planners and scholars recommend that low-carbon cities be the goal for urban development (ibid).

Sustainable, green, high efficiency high rise building development in Toronto will help aid in the climate change adaptation and mitigation efforts, and will contribute Toronto's resilient future. Cities face risks from climate change such as flood and sea level rise, but illnesses related to heat exposure and air pollution are affecting cities across all climate regimes. This is a major global urban health burden and is intensively investigated worldwide. Excessive heat and air pollution resulting from the change in climate has increased mortality and morbidity in cities across six continents (Harlan and Ruddell, 131). It is clear that the construction, operation, and maintenance of buildings contributes greatly to climate change, and more green building practices will drastically lower environmental impact of new developments.

Climate change is caused by the high volume of GHG emissions in the atmosphere caused my human activity (127). In Toronto, almost half of the energy consumption and GHG emissions come from buildings

(TransformTO). Toronto has already experienced many urban vulnerabilities of the effects of climate change, and climate change adaptation and mitigation is necessary for urban resilience. In Toronto, the intensity of high-rise construction activity is unparallel anywhere else on the globe (Hauen). With the absence of planning and building high efficiency, green buildings, the addition of the 195 high rises currently being built (of which 86% involve residential), and 402 currently proposed, will have a profoundly detrimental impact on the GHG emissions in our city.

So, how *can* municipal policies (impacted by community energy planning) influence developers to build in accordance with the adaptation and mitigation of climate change? This can be summarized in the following points from this report:

- Municipal policies are the primary driver of green building development. Most developers responding to the McGraw Hill and CaGBC survey named municipal and federal green policies as one of the top three triggers for increasing involvement in green buildings in Canada (29). When it comes to the question of what impacts the decision to build green, five of the six reasons identified by developers were government related: building codes, government green building requirements, government policies, government incentives, and mandatory building energy use disclosures. Municipal policies and standards in Toronto have demonstrated to be so effective, in fact, that it can even pave the way for provincial policies to change; the TGS has influenced in the past, and is currently influencing, the increasing building performance standards of the OBC, creating higher levels of green standards for all of Ontario. The resilience of local environments to climate change is affected by different types of institutional arrangements. Resilience thinking can help influence the development of improved governance mechanisms which can promote climate change adaptation and mitigation (Leichenko 165).
- Communities can influence the drive for green building projects and overall practices by participating in community associations, as well as communicating and taking a more active roll in all levels of government. Grassroots, community-led innovation for pushing sustainable development and energy planning is possible through methodical spread of information, tactical organization, and strategic niche management.
- More education about the sustainable development is necessary to spread understanding of the threat of climate change, and importance of adaptation and mitigation through policies and green building. The delivery of this education needs to come both from government bodies, as well as person-to-person at the community level.

Cronon argues that the concept of wilderness is a constructed myth, and that the dualisms between city vs nature / human vs non-human is harmful. Cronon describes that seeing the natural world as a separate entity from human activity has extremely detrimental effects, as it diminishes the magnitude of the strong interconnections and interdependencies of all existing things. Having dualisms gives the sense of us vs the "other", that the natural world is an objective resource for humans to take from, leading to exploitation of and environmental degradation. It is crucial to challenge the views of the socially constructed and widely accepted westernized notions of nature and naturalness to break down the misconception that nature and city are separate entities, and that climate change is an "environmental" issue affecting only the natural world. Human activity and the natural ecosystem are extremely inter-related and interdependent. Extreme events caused by climate change are having profound impacts on urban infrastructure, which urban dwellers are heavily reliant on (National Climate Assessment). By lowering environmental impact in the construction and operation process, and integration of greenery into urban space, the dualism between human activity and the notion of "naturalness" can begin to be deconstructed.

Urbanization and environmental sustainability do not have to be mutually exclusive. With higher government regulation on sustainable building practice, and innovations in building design such as Milan's Bosco Verticale, city development and densification can be achieved in conjunction with social and environmental well-being. Government intervention to limit the environmental impact of buildings is a good first step, but more innovative technologies and building designs need to be embrace in Toronto. Policy changes that push developers to build more sustainability, lowering exposure to urban vulnerabilities and increasing climate change resilience, must be done in conjunction with other inclusive legislation to avoid green gentrification and to promote affordable housing. Community members need to recognize that sustainable development is possible, and necessary, to achieve the significant emissions reductions for the adaptation and mitigation of climate change. As Connie Langille imparted to me at the end of our interview, "Everyone can make a difference; anything is possible. You only have no power if you're dumb enough to believe it."

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