Analysis of the Intended Implementation Strategies of Municipal Climate Action Plans

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Abstract

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In the United States, many cities have adopted Climate Action Plans (CAPs) to outline strategies to achieve emissions reduction targets. This research focuses on analyzing gaps, strengths, and weaknesses of the actions included in municipal climate action plans to achieve carbon reduction targets for better planning and to inform future research on municipal climate action plans? To answer these questions, I evaluate actions proposed in eight municipal CAPs within five critical areas (land use and the built environment, transportation, energy consumption and management, waste management, and resource management) according to six implementation parameters (conceptualization of the relationship between a given action area and its climate change mitigation goals, identification of policy or planning actions, identification of partners and parties responsible for implementation, identification of financial information, assignment of an implementation timeline, and assignment of a goal or emissions target tied to the planning actions at hand). There continue to be gaps in the actions cities intend to pursue to mitigate their emissions and what they need to do to achieve their ambitious targets. The plans examined demonstrate a good understanding of the role cities are already playing and

can play in the future, but most fall short in establishing accountability for implementation and developing simple pathways to pursue. Future planning efforts should attempt to improve in areas of author accountability, identifying costs and funding, employing consumption-based rather than production-based inventories, and setting implementation timelines and monitoring frameworks. Future research should consider whether municipal budgets consider these actions and plans in their processes and in situations where climate mitigation is included in budgeting processes, whether there are outcomes in line with intended goals.

Table of Contents

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I. Introduction

1. Background

According to the Intergovernmental Panel on Climate Change (IPCC), the global average temperature has risen by 1.0 degrees Celsius above pre-industrial levels, and at its current trajectory, human activity will have caused approximately 1.5 degrees Celsius of global warming relative to pre-industrial levels between 2030 and 2052 (2018). The situation is dire. Risks to the health and wellbeing, food systems, human security, and economic growth are significant and are disproportionately concentrated among the most vulnerable populations on the planet (IPCC 2018). These risks are also disproportionately concentrated in cities, as the majority of people on the planet live in cities (Seto et al. 2014). The trend toward urban living will only continue, and therefore solutions to the climate crisis will need to emphasize the role of cities and urban governance over the Anthropocene. That a robust response is necessary to meet emissions reduction targets and to mitigate the consequences of global warming is beyond debate. The role of municipal climate action planning in this response is the subject of this research.

Cities have a long history of making efforts to mitigate climate change, starting with the adoption of the earliest Climate Action Plans (CAP) in the 1990's. In 1992, Rio de Janeiro hosted the United Nations Conference on Environment and Development, popularly referred to as the Rio Earth Summit, where the landmark United Nations Framework Convention and Climate Change (UNFCCC) was signed. In the treaty, the world's nations agreed to stabilize greenhouse gas emissions to prevent anthropogenic climate change (Bulkeley et al. 2012). Since then, nations, businesses, community organizations, and cities have stepped up to respond to the growing crisis. Cities especially have focused on the issue of mitigation since the 1990's since

many sources of greenhouse gas emissions like transportation, land use, energy consumption, and waste management are wholly or partially within their sphere of influence. As cities the world over started making plans and implementing actions, they formed groups and alliances to facilitate collaboration internationally (Bulkeley et al. 2012). Numerous municipal climate change associations have emerged as a result, including ICLEI – Local Governments for Sustainability (formerly the International Council for Local Environmental Initiatives), the US Mayors Climate Protection Agreement, and the C40 Cities Climate Leadership Group as some of the most prominent examples (Whittington and Lynch 2015). These networks have evolved as evidence supporting the urgency of the climate crisis has grown irrefutable, first to match the goals set out in the Kyoto Protocol and now those set out in the Paris Agreement.

Not all trends follow a linear path. In August 2017, the U.S. Government officially informed the United Nations of its intention to withdraw from the Paris Agreement and that it would not meet its greenhouse gas (GHG) emissions reduction targets (Haley 2017). In response, states, cities, businesses, non-profit organizations (NGOs), community organizations, and individuals launched several initiatives to protest the move and attempt to live up to the United States' international commitments without federal support. Once such initiative was launched in July 2017 by former Governor of California Jerry Brown and former Mayor of New York City Michael Bloomberg, called *America's Pledge*. This organization compiles the data necessary to measure the contribution to the United States' Nationally Determined Contribution (NDC) to greenhouse gas emissions reductions that various states, municipalities, businesses, and other actors promised to continue to strive toward. *America's Pledge* has compiled emissions data on over 3,000 groups and produced reports measuring the extent to which cuts in greenhouse gas emissions meet the commitments of the pledge. A large component of *America's Pledge* is the

We Are Still In network which is made up of thousands of groups with formal declarations of their commitment to Paris, including over 200 cities as of January 2019. As part of their pledges and commitments, cities must put forward actions they plan to take to meet U.S. climate change goals.

These commitments represent an assertion of municipal leadership in the area of climate change governance. What is the role of planning for climate change mitigation in this process of municipal governance over climate change? We know that municipal climate action planning is a productive way of codifying commitments to emissions reductions and setting comprehensive targets (Millard-Ball 2012). We also know that municipal climate action planning can be effective at reducing emissions (Drummond 2010) and that there is immense room for innovation and growth in certain sectors (Van Vuuren et al. 2018).

Evaluating municipal climate action plans reveals the extent to which cities are planning to implement a diverse array of policies that are relevant to the local context and effective at achieving stated targets. It can also reveal the extent to which cities are setting appropriate goals in the most significant areas that a city can influence, and the quality of their implementation strategies (Deejten et al. 2018; Basset and Shandas 2010; Tang et. al. 2010).

2. Research Objective

Cities will attempt to meet Paris-level targets absent U.S. Federal action on climate change, reflecting an attempt by municipalities to assert leadership over national leadership. But questions remain regarding the extent to which the strategies cities are writing into their plans align with the strategies they should be adopting to achieve the Paris goals. Given the urgency of the IPCC (2018) report, the 1.5-degree target is deemed the most appropriate. The first generation of Climate Action Plans has already been reviewed and evaluated by Wheeler (2008).

Using a revised set of criteria drawn from this methodology and those conducted in subsequent plan evaluation studies my project evaluates municipal climate action plans adopted by cities since the signing of the Paris Agreement, asking the following research questions:

1. How can the significant gaps, strengths, and weaknesses of the actions identified in municipal climate action plans reductions targets reveal pathways for better future planning?
2. How can these gaps, strengths, and weaknesses inform future research on evaluating municipal climate action plans?

In Chapter II, I review the relevant literature on planning for climate change at the municipal level, plan evaluation and plan implementation, methodologies for evaluating of climate action plans specifically. In Chapter III, I describe my own research design, synthesizing the methodological tools presented in Chapter II, to evaluate municipal climate action plans according to the two major questions identified above. I present and discuss my results in Chapter IV, evaluating plans according to the research questions. In Chapter V, I comment on future research pathways and make summary comments on the plans and my findings.

1

II. Literature Review

In this chapter, I review the relevant literature on planning for climate change at the municipal level, plan evaluation and plan implementation, and methodologies for evaluating of climate action plans specifically to contextualize my research questions and lay the foundation for the evaluation methodology outlined in chapter three.

1. Planning for Climate Change: Actions Cities Can Take

The Earth's climate system is dynamic in that it is responsive to external change and to itself. The self-reinforcing elements of Earth's climate system vary individually in their magnitude and could result in a runaway effect in which the individual consequences of climate change are exponentially compounded (Steffen et al. 2018). Given the measurable consequences of climate change in 2018, when the observed temperature anomaly was estimated at 1.0°C above pre-industrial levels, there are early indications that some of the planet's climate systems have already reached their tipping point and their individual consequences will begin to build up.

This reflects the pressing nature of the problem of climate change as well as the difficulty of achieving solutions. Gregory Unruh (2000) outlines the principle of a "techno-institutional complex" in which microeconomic factors and decisions at the firm and consumer levels related to technology and markets interact with macro-level institutional and organizational forces that result in path dependency, often contradicting what rational economic models might predict. Unruh argues that the techno-institutional complex has specifically led to a path dependency he terms *"*carbon lock-in" in which high-climate impact technologies and systems of governance (subsidies and other perverse incentives) have embedded carbon emission into the political

economy. Recognizing this embeddedness is critical for developing strategies that will see human society out of it.

Seto et al. (2016) argue that carbon lock-in is characterized by three interrelated types of lock-in: infrastructural/technological, institutional, and behavioural lock-in. Each type of lock-in builds on and reinforces the others. *Infrastructural or technological lock-in* is formed in the process of generating and distributing fossil fuel energy. This process necessitates infrastructure to support carbon emissions, such as pipelines. It also results in the creation of carbon-emitting infrastructure in areas such as transportation and land use. Carbon lock-in in infrastructure and technology is sustained by *institutional* arrangements in which power is exercised to situate carbon emitting and carbon-emissions supporting infrastructure and technology at the center of economic development despite understanding their harm. These arrangements shape consumer demand and the overall *behaviour* of citizens in ways that embed carbon emissions into everyday products and the lifestyles of most people. Breaking out of carbon lock-in overall requires strategies to break each of sub-type of carbon lock-in at once without reinforcing the others—the viability of new technological and infrastructural advancements will be determined by the extent to which institutional arrangements in the economy and political realm can be transformed to allow such developments. And all of this requires shifts in "socially constructed practices… entrenched in culture and other social norms" related to the demand for fossil fuel energy (Seto et al. 2016, 446). Without moving all three levers at once, the "collective inertia" sustaining carbon lock-in will harden in the sections not targeted.

The principle of carbon lock-in is useful for understanding the failures of policy planning that climate action plans at the municipal level attempt to reverse. Governance structures must innovate to escape carbon lock-in, harnessing existing tools and undoing barriers to their

utilization. Cities are uniquely positioned to target technological lock-in and, to a lesser extent, behavioural lock-in through high-density, sustainable development, changes in energy performance standards, and intervening to encourage public transit usage (Grubler et al. 2014, 1390).

Cities contribute substantially to global greenhouse gas emissions and thus global warming, and that they also disproportionately bare the human and financial consequences of global warming (Seto et al. 2014). It follows that cities play an important role in the solution, not only because they are a large part of the cause, but because they stand to gain the most from an effective and equitable set of climate action solutions that will mitigate global climate change. Though it is still difficult to quantify, rough estimates suggest that urban environments contribute to between 56% and 78% of total global greenhouse gas emissions (Seto et al. 2014). Cities also consume more energy than non-urban human settlements. The most progressive cities—those that have made the most headway developing and implementing climate change policy—have undergone a significant transition in their attitudes and approaches to meaningful and effective urban climate policy. Those few cities whose initiatives date to the 1990's have moved on from exclusively intervening in their own municipal operations and have embraced the integration of climate change policy into every sphere of policy they can influence at the community level, including transportation, energy, the built environment, infrastructure, waste management, and even consumer behaviour (Bulkeley et al. 2012). Furthermore, many have adopted the idea of a low-carbon economy, where development and economic growth can be maintained alongside the principle of a low-carbon and even a net-zero economy, where there are no net greenhouse gas emissions relative to what can be captured and sequestered through natural or artificial means (Davis et al. 2018; Jones et al. 2018).

Rebecca Gasper and colleagues (2011) review the literature on the social and economic impacts of climate change on urban environment, revealing the extremely complexity of the problems cities will face as they confront the challenge of climate change governance. The literature reveals that climate change will exacerbate poverty, create resource strain, reduce the food supply in the face of hunger, and reduce the quality of the delivery of government services, in addition to causing diseases to spread more rapidly, displacing vulnerable communities, and reducing the viability of dozens of industries and sectors of the economy that have global impact, from shipping and freight transportation to insurance, real estate, and the retail sector. Additionally, climate change will compound existing distributional inequalities across race, class, and gender. Because cities are dense and diverse and deal with an accumulation of social and economic problems that emerge from their large populations and their need to manage scarce resources, the compounding effects of climate change could lead to an unmitigated financial and social disaster for cities that do not take seemingly drastic steps to prepare.

Cities can influence policy direction in profound ways. Research has shown that cities can lead by example in reducing emissions and meeting climate mitigation targets in response to national and international efforts and shortcomings, especially in emissions from areas like transportation, land use, energy consumption, and waste management, all of which are often under municipal governance (Bulkeley et al. 2012; Davis et al. 2018; Jones et al. 2018). Because of their influence over all of these overlapping and competing areas, cities are able to carve mitigation pathways that are compatible with economic growth and reflect local sovereignty (Bulkeley et al. 2012). Castan Broto and Bulkeley (2013) find that cities involved in transnational municipal networks are more likely to engage in experimental policy interventions. Experimentation can be an important tool for creating climate policy that effectively reduces

greenhouse gas emissions and will be a necessary approach as it creates opportunities and space for new and deeper knowledge. There is room for adjustment of strategies based on what certain cities can do depending on their circumstances, and some strategies such as deep electrification and reducing land-use intensity for food production may be more viable and more effective than once understood at reducing emissions (Van Vuuren et al. 2018). Clearly, a mix of evidence-based strategies are necessary.

The type of influence they wield uniquely positions cities to innovate. Larson et al. (2012) find a strong relationship between land use and transportation policies and differing levels of energy consumption. Other research also shows that cities have a unique responsibility to mitigate the heat effects of climate change, which are compounded in urban areas (Stone et al., 2012). Cities can also develop innovative strategies in the areas of urban and spatial planning, such as incentivizing different transportation and energy consumption choices through land use decisions that support pedestrian activity and discourage personal vehicle usage, or zoning to allow for more density (Creutzig et al. 2016). Gomez Echeverri (2018) reviewed the policy and planning landscape for cities to influence decarbonization in accordance with the levels set out by the Paris Treaty. Echeverri argues that while there are substantial barriers, such as inadequate governance structures and inability to break path dependency and carbon lock-in in critical sectors as well as inadequate criteria for understanding what types of investments are needed and the scopes, cities are uniquely positioned to spur rabid decarbonization by aligning private sector and public sector priorities, criteria, and metrics. This will incentivize investment in new technologies as well as scaling up ongoing trends toward decarbonization.

Some cities have more success than others in achieving urban sustainability principles and reducing greenhouse gas emissions. Some reasons include the pressure on certain high-density

cities, the presence of a strong local culture of democracy, the ability to legally influence regulation, the presence of a healthy "green" economy, and local leaders willing to take on the challenge (Fuhr, Hickmann, and Kern 2018, 1-2). Despite their potential, cities are ultimately able to influence a limited number of sectors with high emissions reduction potential and have limited (financial) capacity to act. Collaboration with other levels of governments will be necessary, especially in areas like food, freight, and air transportation, which are heavily involved in the consumption that occurs in urban areas and drives pollution (Davis et al. 2018; Jones et al. 2018; Williams et al. 2012).

The research reviewed above provides a brief overview of what cities can do to achieve climate change mitigation. Based on this review, my analysis organizes climate action policies within five broad mitigation categories: transportation, energy consumption and production, land use and the built environment, waste management, and resource management (Basset and Shandas 2010; Deejten et al. 2018; Tang et al. 2010).

2. Plan Implementation and Plan Evaluation

Plans can be evaluated in various ways, depending on the research question and the purpose of the evaluation. Talen (1996) distinguishes between evaluation of a plan prior to implementation, evaluation of the planning practices, analysis of the policy implementation, and general implementation of plans. My research is a form of analysis of planning documents, a sub-type of Talen's form of evaluation within planning practice. By examining the presence and relative strengths of the parameters of implementation, my research will identify areas within climate action plans that require improvement for those plans to be useful. My research also considers to a limited degree policy implementation analysis because I relate the local context and its likelihood to facilitate climate mitigation action by including information about local

political context, existence of prior plans, and state-level requirements. One important aspect to acknowledge is that these types of analysis, as do all evaluations done prior to implementation, assume the plan will be implemented. Unlike the evaluation of the implementation of plans, which examines gaps between expectations and outcomes, this form of evaluation assumes implementation will occur as described by the base level of information formed by the goals and actions of the plan in question. William Baer's (1997) foundational text on planning evaluation also explores the various stages in the design and implementation process during which plan evaluation can occur, and the divergent analyses that can proceed from each stage. The most important trend Baer identifies is that evaluation at any stage should identify *what aspect of the plan is under evaluation*, and then *proceed from a set of criteria* developed prior to the analysis. Further methodological insights can be found in research by Philip Berke and David Godschalk (2009): the purpose of plan evaluation is to assess the integration of the key elements of plans—*quality, goals, policies, and actions.*

Bardach (1977) describes policy implementation (and does not distinguish policies with programs for the purposes of his analysis) as a series of games negotiated among players who do not wish to cede their power to assembly all the required pieces to achieve a desired outcome. His research attempts to describe each of these games in an effort to assist policymakers in designing policies capable of withstanding them. For Bardach, identification of actors, funding, and actions and goals are the elements most important for effective plan evaluation. Most policies and actions involve different and competing levels of government and of power, where a multi-level framework is useful for evaluating the comprehensiveness of who is considered. In addition to this, various actors have competing motivations and act rather defensively regarding their power. Sources of money, and the assumptions that power the belief in their availability,

can make or break policy implementation. Budgets and the need to scrutinize uses and flows of money can significantly delay projects or cause further division when there's a lack of transparency. Moreover, poorly defined objectives and poorly defined policies to achieve them confused, delay, and ultimately cost implementation credibility and efficiency.

Following Bardach (1977), my evaluation focuses on these categories of analysis, with updates for climate action planning specifically. Pressman and Wildavsky (1984) extend this framework. It is important to identify the lead partners who will implement policy, because there must be some measure of accountability and their absence would stunt the implementation process. However, for the most part, individual decisions are made by individuals, and the multiplicity of decisions are not always made at the direction of the lead agent. As the numbers for both increase, especially as unexpected situations arise, the implementation process can quickly grow beyond the original scope or the effective control of the authority responsible for implementation, resulting in delays or overruns. Plans cannot just identify actors; they must organize and coordinate their roles. Each additional decision maker in the implementation process is an additional potential chokepoint that could delay or derail a policy. Carefully examining these relationships during design can allow policymakers to craft actions around agents who may otherwise harm implementation and define the structure that will enable successful outcomes. Pressman and Wildavsky also argue that implementation is slowed and harmed by complexity. The more elaborate an idea or policy, the more its implementation will feature situations whose decisions and outcomes could alter the implementation process. One solution to the problem is to develop actions that are simple and aim directly at their intended goal; vague or overly broad ideas are to be avoided.

3. Evaluating Climate Action Plans

Wheeler (2008) was among the first to provide insights into the status of local climate action plans. Wheeler's evaluation of the first generation of state and local climate action plans assesses the basics of climate action plans: the goals they set, the measures they use, the implementation issues they consider, and the strengths and weaknesses of the plans Wheeler assesses the plans based on their primary characteristics, such as the status of their emissions inventory, whether they had estimates for greenhouse gas emissions reductions for each measure, whether they had estimates for the cost of implementation for each measure and identified funding sources, and whether the plan described a progress reporting mechanism. He also evaluates the plans based on their content: emissions reductions targets, requirements for renewable energy, measures aimed at curbing vehicle emissions, energy efficiency in buildings, whether the plan promoted "green" economic activities, and whether the plans include adaptation measures. Wheeler recommends that future plan evaluation exercises determine whether they have established more rigorous short-term reduction targets and stronger timelines for long-term reduction goals.

Picking up where Wheeler (2008) left off, Basset and Shandas (2010) examine 20 municipal climate action plans to understand their processes and products. Specifically, they study the *reasons for creating a climate action plan*, the *structure of the planning processes used* to develop the plans, and *how the cities chose the types of actions* that were included in the plans. To achieve this, they apply an evaluation matrix to assess the breadth of policies included and the depth of their development. Breadth involves looking at the number and diversity of the climate change mitigation policies. Depth examines five sub-parameters: assignment of a target, provision of an implementation timeline, identification of the party responsible for

implementation, funding sources, and whether the municipality has the power to implement the policy on its own. These parameters help to structure my own evaluative framework. Basset and Shandas' (2010) research is also useful because it reveals the importance of local control over the planning process in order to achieve the optimal breadth and depth of planning.

The emergence of the international networks, which are made up of a small core of cities active in the discussion and implementation of policy and a periphery of passive actors, benefiting from their more innovative associates, represent a new level of governance (Bulkeley and Betsill 2013). The networks not only cross the vertical barriers but their influence and actions across the world represent changes traditional governance processes. This research incorporates further levels of governance into a framework called *multi-level governance,* which Betsill and Bulkeley (2016) employ to theorize the competing and interlocking levels of governance implicated in response to global climate change: the new level constructed through international networks, the business and non-profit sectors, in addition to state, national, international, and local dimensions. Bulkeley and Betsill (2013) identified two phases to in the development of urban climate change agendas. The first consisted of actions they termed "municipal voluntarism". This phase is characterized by small and medium sized cities forming international alliances to support and share evidence-based policy solutions to reduce greenhouse gas emissions. The scope of influence of these actions was often limited to a city's own municipal operations and actions were specific to only a few sectors. The second phase, "strategic urbanism," infuses climate change governance into every aspect of urban policy and the community. The municipal alliances that appeared in the first phase continued to grow and evolved into more profound engagements where city leaders committed their cities to achieving significant greenhouse gas emissions reductions targets. This phase is characterized by an

increase in number of climate change experiments as policy tests and the spread of successful policies across cities (Castán Broto and Bulkeley 2013). Cities in this phase also begin to develop the tools and technologies they would need to account for their emissions and the impacts of their interventions (Bulkeley and Betsill 2013).

The multi-level governance framework helps to better describe the interactions necessary to achieve climate change governance, particularly at the local level. It also provides a useful framework for understanding the plans I evaluate in this study as products of a competitive and collaborative governance process. While it is beyond the scope of my study to operationalize multilevel governance, it is nonetheless a useful framework that allows us to contextualize municipal climate action plans so that we can be practical and realistic about their limitations and possibilities.

In another assessment of early municipal climate action plans, Tang et. al. (2010) examine the level of awareness of cities regarding climate change, how well they analyze the local context and climate change-related impacts, and the actions the cities have taken and will take to mitigate and adapt to climate change. The authors identify several categories of actions including communication and collaboration with other levels of government and the broader public, financial fees and incentives, land use policies, transportation policies, energy policies, waste strategies, resource management strategies, and implementation and monitoring strategies. In their work, Deetjen et al. (2018) identify the best-practice strategies for municipal governments to pursue in order to achieve GHG reductions in line with the 1.5-degree goal through a rigorous literature review. They use the relative ambition level of the policies to grade best-practice spheres of action. This work recognizes the mutual, sometimes reinforcing influences some policies have on others. These policies are grouped into five categories: transportation, energy

consumption, energy production, utilities and green spaces, and regional impacts. The purpose of categorizing them is to simplify reporting on the broad sectors cities can influence and must influence to achieve Paris Agreement goals.

A notable outcome of Wheeler's (2008) work has been the recognition of the importance of greenhouse gas inventories. Most of the plans Wheeler analyzed did not conduct useful inventories for measuring reductions in any effective way. Boswell et al. (2010) examined the greenhouse gas emissions inventories that informed the climate action plans of 30 cities. They conducted a content analysis considering 70 variables to examine the links between descriptive statistics, demographics, and other metrics with GHG emissions inventory assumptions, results, and the actions contained in climate action plans. While GHG emissions inventories typically follow standardized methodologies and are forthright with the assumptions and data they use, they also only consider part of the whole picture. One component of the inventory is the business-as-usual projection, which entails forecasting future emissions based on current patterns of activity and growth. This forecast often however ignores exogenous change, or change due to technological, political, or economic factors outside the control of cities. These types of changes would affect the usual course of business, and therefore emissions, regardless of whether the city acts directly to reduce emissions. The result is an over-estimation of emissions and a miscalibration between actions and emissions. Another component often missing from inventories is an GHG emissions reduction estimate for actions within plans themselves (Whittington and Lynch 2015). Research on the coordinated climate action of cities has shown that there is no systematic accounting or benchmarking system for measuring reductions, and therefore performance can only be measured on an individual basis for cities (Zimmerman and Faris 2011). The research is mixed regarding whether climate action plans have a causal impact

on policy or are effective at reducing CO_2 emissions in ways that would not have occurred absent the plan (Millard-Ball 2012).

Drummond (2010) conducted a post-hoc analysis to determine the effectiveness of state-level climate action plans at reducing greenhouse gas emissions. The study has major limitations, such as not including industrial emissions in the analysis as well as only evaluating changes in CO_2 emissions. His analysis operates within a framework focused on consumption rather than on production of energy, the latter method being able to tell only a partial story. Nevertheless, he finds that climate action planners at the state level have been moderately effective at reducing CO_2 emissions. The implications of his study are that though the current strategies may not have enough of an impact, there is potential at the state level for much broader achievement and likely at the local level too. More importantly, Drummond's research suggests that climate action plans are in fact a useful planning exercise.

Millard-Ball (2012) conducted case studies and statistical analysis of municipal climate action planning and argues that these plans likely do not have a causal impact on the implementation of policy. Millard-Ball argues instead that climate action plans most likely reflect the pre-held policy preferences of planners, policymakers, and citizens, thus codifying policy decisions what would take place in absence of the plan. Although it may be the case that one cannot say that planning has a causal impact on policy, Millard-Ball (2012) admits that the same is true in reverse—though he concludes that planning is likely not as significant of a causal indicator as previously held preferences are, he admits that it is impossible to truly determine the counterfactual he presents. Thus, we are left with a chicken and egg problem. This may indicate that determining causality in relation to planning and policymaking is not the most productive empirical goal. If it can be determined that plans and the planning process have some impact on

policymaking, even by simply codifying existing preferences and charting a path forward, Millard-Ball admits that their low cost would make them worthwhile. Studying the processes through which they come to be and evaluating their implementation are worthy empirical goals, even if they don't show causal attribution between policy and planning.

III. Methodology

My thesis uses a qualitative analysis of climate action plan documents to evaluate the relative quality of key planned implementation parameters. The purposes of this thesis are to provide potential pathways for continued improvement to climate action plans and to generate ideas for future research. As mentioned in section one of this literature review, this study is a planning practice evaluation through the analysis of municipal climate action plans. Talen (1996) has several critiques directed at the types of plan evaluation occurring before implementation. Among them are that they all share the assumption that implementation will occur, which is not so valuable when trying to measure gaps between intended and actual outcomes. She also argues these analyses do not allow to evaluate causality between plans and outcomes since they don't consider outcomes. Ultimately, she favours evaluation occurring after implementation despite its own limitations surrounding the definition of success and choosing timing because it is tangible, that is there are measurable results not born out of pure assumptions. I disagree. Pressman and Wildavsky (1984) write that evaluation and implementation are opposite sides of the same coin, and continuous evaluation drives continued implementation which creates further need for evaluation in a virtuous cycle. Evaluation occurring even before the implementation stage, I believe, contributes to this process and allows improvement to future planning efforts and to implementation as it occurs, if only to accentuate the gaps implementors must consider so as not to be unexpectedly blindsided by them. To quote the authors, "Learning is the key to both implementation and evaluation." (Pressman and Wildavsky 1984, xviii).

Talen (1996) also concedes it is difficult to define success in the planning process, which creates problems for evaluating outcomes of implementation. Part of the problem lies in the fact that many plans do not define a precise goal, so achieving a certain threshold is difficult to

gauge. Another problem lies in the different perspectives on the purpose of a plan—is it intended as guide or as directive? In the former, simply citing or consulting the plan is enough for it to be deemed a success while in the later the carrying out of the plan's actions would be the marker of success, and even then the definition of the degree and scope of implementation remains debatable (pilot? partial? full?). In studies that have defined implementation parameters to measure the gaps between intended outcomes and actual ones, the analyses and findings have centered on the general underachievement of plans and the significant delay and rise in costs of their implementation. The research has focused on identifying the problems, economic, political, social, regulatory in nature, that affect the actions that carry out policies once they are adopted and generally lead to their failure (Bardach 1983; Talen 1996).

My research looks at the source, the plans, and scrutinizes the implementation strategies as they are conceived and described. I argue that it is worthy to continue to improve plans to make them as robust as possible in the face of systemic problems that by nature act against the very purpose of plans. Robust plans, I believe, allow actors to, at the very least, have defensive measures and ammunition with which to defend their goals against the detractors, political whimsies, and economic fluctuations that would affect prioritization of the policies they are charged with implementing. My goal is to identify gaps in the plans themselves to alert practitioners and researchers of potential improvements as well as further research so that plans are designed to best assist and serve those tasked with bringing their actions to fruition. Further research could be conducted to identify the reasons for which these gaps exist, and how they impact implementation actions, and possibly even outcomes. One potential pathway linking all of these areas is the role of planners themselves. Other research has identified a significant gap in the involvement of planners in the design of climate action plans and my own research continues

that trend and further finds that planners are often ignored in the anticipated implementation as well.

1. Case Study Selection

Cases were selected from among the 239 cities and consolidated city-counties who signed the *We Are Still In* pledge as of January 30, 2019. I sorted cities based on whether they had a climate action plan, which were systematically catalogued by searching each local government's website for the presence of a plan using the search keywords "climate action plan", "climate action", "sustainability action plan", and "sustainability plan" to catch as many action plans directed at reducing GHG emissions. When no results were obtained for those keywords, I searched "climate", "sustainability", and "environment" to identify departments, agencies, offices, committees, groups, and pages on those websites where climate action plan documents might be located. I excluded cities only when all options were exhausted. Plans in either adopted or draft form were included. Of the 239 cities, 139 have a plan (58.2%) and 100 (41.8%) do not as of May 1, 2019. (See Appendix A for full list of cities and their characteristics). The sample was further reduced by excluding all plans adopted prior to the signing of the Paris Agreement in December 2015; to simplify sorting, January 1, 2016 was used as the cut-off date. Of the 139 cities with a plan, only 61 (43.9%) have been adopted since the Paris Agreement, or just over one quarter of all cities who signed the pledge (25.5%).

To select the eight case study plans, the 61 cities were sorted according to their home state's U.S. Census Region. The regional groups were further divided in two based on population; the median population was calculated in each region to sort cities into two equal groups. Finally, cities were chosen at random in each group to obtain eight in total. Table 1 below outlines some of demographic characteristics of the cities and Table 2 lists the cities in

each region and population group. Other authors sort their case study cities based on population and geographic characteristics to create diversity in the cities they evaluate (Wheeler 2008; and Basset and Shandas 2010; Boswell et al. 2010). Smaller cities can often be overlooked in studies like mine despite their instrumental role at the beginning of climate action planning. Regional diversity is also of interest because of the local nature of the causes and consequences of climate change; the U.S. Census regions are a somewhat general but acceptable division of broad climate zones and predictable climate change impacts.

The eight case study cities are:

A. Midwest:
    a. Large city: Saint Paul, Minnesota
    b. Small city: Evanston, Illinois
B. Northeast:
    a. Large city: Pittsburgh, Pennsylvania
    b. Small city: Hoboken, New Jersey
C. South:
    a. Large city: Charlotte, North Carolina
    b. Small city: Alexandria, Virginia
D. West:
    a. Large city: Denver, Colorado
    b. Small city: Emeryville, California

Table 1: Demographic Characteristics of Cities by Census Region

Measure	Midwest	Northeast	South	West
Count of cities	13	13	9	26
Total pop.	4,209,378	11,154,613	2,868,091	8,646,453
Mean pop.	323,798	858,047	318,677	332,556
Median pop.	298,957	88,479	256,031	84,184
Minimum pop.	14,250	30,722	81,889	4,833
Maximum pop.	853,431	8,560,072	826,060	3,949,776

Table 2: Cities by Census Region and Population Group

Large cities	(above median)		
Midwest	Northeast	South	West
Cincinnati, OH	Hartford, CT	Charlotte, NC	Anchorage, AK
Cleveland, OH	New Haven, CT	Nashville, TN	Bellingham, WA
Columbus, OH	New York City, NY	New Orleans, LA	Boulder, CO
Detroit, MI	Newton, MA	Orlando, FL	Chula Vista, CA
Indianapolis, IN	Philadelphia, PA	St. Petersburg, FL	Denver, CO
St. Paul, MN	Pittsburgh, PA		Los Angeles, CA
St. Louis, MO	Rochester, NY		Oakland, CA
			Richmond, CA
			Salt Lake City, UT
			San Francisco, CA
			San Jose, CA
			Santa Monica, CA
			Sunnyvale, CA
Small cities	**(below median)**		
Bloomington, IN	Fairfield, CT	Alexandria, VA	Ashland, CA
Columbia, MO	Hoboken, NJ	Columbia, SC	Aspen, CO
Evanston, IL	Lancaster, PA	Fayetteville, AR	Belmont, CA
Grand Rapids, MI	Lexington, MA	Little Rock, AR	Breckenridge, O
Highland Park, IL	Princeton, NJ		Corvallis, OR
Iowa City, IA	Somerville, MA		Emeryville, CA
			Encinitas, CA
			Healdsburg, CA
			Menlo Park, CA
			Milwaukie, OR
			Palo Alto, CA

Small cities Midwest	(below median) Northeast	South	West
			San Rafael, CA
			Santa Fe, CA

2. Limitations

My case study sample is limited to eight cities and their most recent climate action plans; therefore, my findings and conclusions are not statistically significant nor are they intended to be. My findings for individual cities will not be generalizable to the other cities in their census region or to the larger sample of cities. However, the gaps I identify and recommendations I make can be considered by all cities working towards updating their climate action plans or creating their first. My goal is to help improve the plan creation process so that climate action plans can be useful tools in implementing mitigation actions.

A further limitation of my study is the scope of the evaluation. My thesis focuses on planning documents to evaluate their quality relating to key parameters that facilitate implementation actions. My thesis is not a post-adoption evaluation of the implementation of adopted climate action plans. It does not intend to assess the outcomes of the implementation of actions, their success, or to determine whether a strategy can or will be successful. My thesis identifies the gaps in the implementation considered against evaluation parameters I will define below. I argue that plans should include specific information when considering how to implement their strategies in order to be successful and complete, but these are not absolute requirements nor are they strictly necessary for a plan to generate outcomes in line with its goals. By identifying these gaps, my thesis attempts to draw practitioners' attention to areas that might be neglected but necessary to a plan's success, and to point to further research directions.

The method of selection I used also introduces some bias into the cities ultimately selected for study. Cities in regions where few cities overall having signed on to the pledge, and furthermore those regions with fewer cities having adopted plans (Midwest, Northeast, South), were overrepresented in the final list for selection. Each of the cities was more likely to be chosen than any of the cities in the West region. However, this reality reflects the fact that more cities in the West have adopted climate action plans since the 2015 Paris Agreement, which is ultimately a positive outcome.

3. Evaluation Criteria

The multi-level governance framework theorizes the competing and interacting dimensions of governance—local, state, national, international, transnational network, and private sector—at play in climate change mitigation policy (Bulkeley and Betsill 2013). This project is concerned with the local dimensions, and specifically with municipal climate action plans. These plans are tailored to their local environments, and as such represent a diversity in thinking, local conditions, and abilities to respond to the challenges presented by climate change (Basset and Shandas 2010). Nonetheless, whatever the scope and level of ambition of local climate action plans, these documents require implementation strategies in order to successfully translate their goals into action (Wheeler 2008). Central to the ability of cities to assert leadership in the area of climate change governance is their capacity to affect policy by working with, or around, competing levels of governance. Cities can assert leadership more robustly in certain areas than others—do the plans account for this discrepancy, and how do they identify the areas in which partnerships will need to be formed or political power will need to be restructured? Whatever the type of action envisaged—a new program, an infrastructure project, the creation of a grant, a new set of regulations—most will require money to make happen and a good plan will consider

sources of funding and amounts required. Ideally, the plans also describe timelines for achieving overall GHG emissions reductions targets in the medium- and long-term as well as timetables for implementation their intended strategies. Finally, the best plans should tally the contribution each strategy, or each policy area, contributes to the city's overall target, which ought to be based on GHG inventories using best practice methodologies (Basset and Shandas 2010; Wheeler 2008).

This project evaluates the climate action plans of eight U.S. cities adopted or in draft form following the signing of the Paris Agreement. Two overarching questions, informed by the literature reviewed above, structure my evaluation framework.

1. How can the significant gaps, strengths, and weaknesses of the actions identified in municipal climate action plans reductions targets reveal pathways for better future planning?
2. How can these gaps, strengths, and weaknesses inform future research on evaluating municipal climate action plans?

I answer these questions by constructing an evaluation framework that examines the general plan characteristics and conducts a content analysis to examine the specific policy areas at work in the plan. The evaluation serves to identify and describe plan characteristics to generate discussion on the current state of climate action planning.

A) Climate Action Plan General Characteristics

For each plan, I identify basic information such as the year the plan was adopted, the authors, and the length of the plan. Wheeler's (2008) conclusions and recommendations inform the other general characteristics in my analysis. They are a reasonable starting point because they were intended to influence future planning efforts in subsequent climate action plans and direct future research. Given the time that has passed since this initial study, I argue that his basic

recommendations surrounding the need for a GHG inventory, to set medium- and long-term GHG emissions reductions targets, and for a post-adoption monitoring framework should be standard features of plans.

Furthermore, in terms of plan authors, Basset and Shandas (2010) found in their interviews with those who crafted plans that traditional planners and planning departments played a small if any role in the development of most plans. Their absence, despite how many policies and proposed actions, especially in transportation and land use, are relevant to the everyday work of planners, is especially notable in the lack of feasibility of certain plan strategies. Therefore, their role in the crafting each city's climate action plan is described in my evaluation.

Finally, the science of accounting greenhouse gas emissions—a GHG inventory—has evolved much since Wheeler's study, especially as a response to the signing of the Paris Agreement, which called for standard measures to assess national progress towards reduction targets. The typical approach to creating a GHG inventory involves measuring emissions production for a given jurisdiction. This method generally punishes industrial cities reliant on polluting industries and undercounts the contributions of larger service and consumption-driven cities (Jones et al. 2018). Because economic activity is driven by consumption of goods and services by residents, a GHG inventory based on consumption better captures individual cities' behaviour and activity patterns and provide a better representation of their resulting emissions. In an increasingly globalized economy, virtually no one can escape the intensive energy and emissions demands of the transport and manufacturing sectors embodied in the production and delivery of goods and services, but these are ignored in a standard production-based inventory (Davis et al. 2018). For cities to be truly successful in mitigating the emissions they generate, the embodied emissions of urban consumers should drive emissions accounting. I identify the

methodology used by each city to develop its GHG inventory to understand whether cities use this approach and how it might influence the actions they prioritize.

B) Climate Action Plan Content

Deetjen et al. (2018) conducted an extensive review of the literature on climate change mitigation strategies that would be required to achieve the timeline established by the October 2018 IPCC report on 1.5-degree Celsius of warming by 2100. From this review, the authors developed a set of best practices and policies for achieving climate change mitigation in line with this more aggressive IPCC target. These policies are grouped into five categories: transportation, energy consumption, energy production, utilities and green spaces, and regional impacts (723). While the five categories of analysis are useful, my project revises them to include policies related to waste and resource management as explored by Basset and Shandas (2010) and Tang et. al. (2010). I have also condensed policies related to energy consumption and production as well as land use and the build environment to incorporate incites from my review of the literature into the analytical framework.

Ambitious, best-practice policies are so termed because they represent more than just the most innovative tools cities can use to directly influence practices that generate greenhouse gas emissions. Because actors at all levels of governance have not previously devoted the time and resources necessary to achieving significant reductions in greenhouse gas, the types of policies scholars argue are now necessary are somewhat more expansive and challenging to implement (Jones et al. 2018). There is a growing consensus surrounding the need to address the energy and transportation sectors and managing demand for both for they contribute the majority of local emissions (Larson et al. 2012; Van Vuuren et al. 2018; Williams et al. 2012). In the fields of planning and local governance, land use policy is an important tool for regulating both, because

so much of travel and energy delivery, consumption, and efficiency is tied to the built environment and its spatial form (Deetjen et al. 2018; Glaeser and Kahn 2010). Waste and resource management are both tied to the consumption patterns and resulting emissions of city residents, workers, and visitors as well as being a tool in and of themselves to reduce GHG in the atmosphere. These types of strategies can be useful in reducing existing GHG in the atmosphere because they can, through strategies like reforestation and afforestation, capture and sequester atmospheric CO_2 (Deetjen et al. 2018).

One of Wheeler's (2008) major findings was that, while acknowledging that plans reflect their local context, action areas related to implementing a plan's policies were nebulous at best, and this was the case for most first-generation plans he evaluated. Basset and Shandas (2010) outline strategic parameters for the implementation of climate change policies at the municipal level, emphasizing the assignment of a target, provision of an implementation timeline, identification of the party responsible for implementation, funding, and whether the municipality had the power to implement the policy on its own. Similarly, Gallivan et al. (2011) evaluate climate action plans by identifying the requirements for enacting certain strategies and the external factors that play a role in their implementation. These parameters help to structure my own evaluative framework. Based on the literature reviewed in Chapter II and referenced herein, we know that the major areas cities can impact in terms of climate change mitigation are land use, transportation, energy, and resource management (Deetjen et al. 2018; Tang et al. 2010; Basset and Shandas 2010). We also know that plan evaluation requires evaluating the identification of actors, funding, and actions and goals, in addition to the complexity of the policy goals (Bardach 1977; Pressman and Widalsky 1984). I identify whether partners and parties responsible from other levels of governance and their roles are identified in the plan

(Basset and Shandas 2010). Lastly, we know that evaluations of early climate action plans and more recent evaluations have attempted to conceptualize plan quality in various ways, the most salient being evaluating the strengths and weaknesses of the specific goals and actions, measures, and implementation strategies (Wheeler 2008; Basset and Shandas 2010). The numerous policies described in the literature as key to achieving the 1.5°C warming threshold are synthesized and gathered into five categories—land use and the built environment, transportation, energy consumption and management, waste management, and resource management—to facilitate the evaluation and description of each climate action plan's implementation strategies.

My evaluation analyzes these policy areas focusing on the following implementation parameters, structured by underlying questions I detail below:

1. How does the plan conceptualize the relationship between this action area and its climate change mitigation goals?
    a. Does the plan conceive of the action area (land use, transportation, energy, waste management, and resource management) as a response to the impact(s) climate change will have on the community?
2. Identification of policy or planning actions,
    a. Are the actions identified within each area simple and specific?
    b. Are the actions representative of what cities need to pursue to be successful?
3. Identification of partners and parties responsible for implementation (including competing levels of governance and actors outside the traditional federalist governing structure),
    a. Are lead partners identified?
    b. Is their role within the implementation process identified?

4. Identification of financial information,
    a. Is a cost estimate provided for each action?
    b. Is there a budget established to break down the costs?
    c. Is a source of funding identified?
5. Assignment of an implementation timeline,
    a. Does the plan define a timeline for implementation?
    b. Does the plan identify a deadline for implementation?
6. Assignment of a goal or emissions target tied to the policy or planning actions at hand.
    a. Does the plan tie individual actions to emissions reductions?
    b. Does the plan identify other benefits or goals not related to emissions?

These six characteristics form what I call implementation strategy quality. A high-quality plan not only includes these elements, and possibly more, but also provides rich detail about each. A "yes" answer can be assigned to a given policy area for any of the above questions even if all actions concerned do not quite answer the question satisfactorily, however most must meet the threshold. In an ideal plan the answers to each of the questions should be "yes", while a high-quality plan would answer "yes" to most questions and to at least one question in each of the six parameters. Only addressing one action out of many others in a given policy area in a way that satisfies all of the above questions does not mean the plan is of high-quality; it only means the plan dedicated the appropriate effort to a single action. Quality is used as a relative and somewhat subjective term and my study does not score plans based on their performance in the area of implementation, but on the rigor and practicality of the implementation strategies outlined in the respective plans. Quality is also subjective because the importance of each policy area may vary depending on geographical and climate considerations, as well as political and

social ones. For example, cities that do not own or manage their own utilities or energy supply will not have as much room to act in that area as cities which do. Similarly, cities with cooler climates may have differing levels and patterns of energy demand and therefore will need to apply different strategies than those in hotter climates. However, the questions I have outlined above are specifically designed to evaluate the quality of plans within the context that they are developed, because they are taking the stated targets within the plan as a baseline.

Through a deep reading of the plans, my analysis identifies the defining characteristics of each plan's implementation strategies and comments on their quality against best practice. By conducting content analysis, I answer the yes or no questions devised above, and compare the eight cities selected to reveal patterns of gaps, strengths, and weaknesses that appear. Though the findings will not be generalizable to all climate action plans or cities, they lead to important pathways to improve the likelihood of success that will result from the plans and to suggest further research related to processes, strategic planning, and outcomes of urban climate mitigation planning.

IV. Results and Analysis

Each plan dedicates some attention to explaining the motivation behind the plan's creation, from the role cities play in housing most of humanity and originating most emissions to the challenging consequences climate change will bring to the local environment. Half of the climate action plans were updates or new versions of earlier plans and built-on their achievements and the challenges from which they learned. Emeryville, California and Pittsburgh, Pennsylvania, for example, tied together how their plans related to each other and described and justified the changes and improvements they made. In Pittsburgh's case, this third version of their climate action plan emphasized more emissions sectors directly and incorporated its first monitoring framework. Charlotte, North Carolina recognizes the role it plays in enabling decisions that maintain carbon lock-in and its plan is a step toward dismantling. The CAP for Evanston is a direct response to the IPCC Report on 1.5°C of warming and acknowledges that while many of the changes will have minor or possibly even beneficial effects to the community, those consequences will make Evanston a more attractive city to those who must escape areas facing more threatening changes like sea-level rise.

Cities use a variety of strategies to tie-in the actions they take with the climate actions goals they've set. Many rely on relating the characteristics of their local context and environment to the impacts climate change is expected to cause. Almost all clearly identify at least some links between the different areas of policy cities can affect, such as between land use and transportation, to demonstrate how efforts require collaboration across all levels of government and areas of influence as well as to somewhat reduce the level of innovation they must pursue in each distinct area to address its specific emissions and traits. No plan addresses all of the policy areas deemed essential for action to achieve the 1.5-degree Celsius target.

The sections on each city include a table showing the answers to each of the yes or no questions I describe in Chapter III. These questions are drawn from the literature reviewed in Chapter II and reflect the best practices for climate action planning and implementation parameters for evaluation (Bardach 1977; Bassset and Shandas 2010; Deetjen et al. 2018; Gallivan et al. 2011; Pressman and Widalsky 1984; Tang et al. 2010; Wheeler 2008).

The plans are generally strong in conducting and incorporating GHG emissions inventories, specifying concrete actions that are comprehensible and realistic, and identifying partners for implementation of the action. The most significant weaknesses in implementation parameters are accountability, funding, and implementation timelines. Below, I discuss each plan in detail, with attention to its major strengths and weaknesses. Then I present my observations about the gaps, strengths, and weaknesses identified to outline areas for future improvement and future research.

Hoboken, New Jersey

Table 3: Evaluation of Plan Implementation Parameters for Hoboken, New Jersey

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
How does the plan conceptualize the relationship between this action are and its climate change mitigation goals?	a. Does the plan conceive of the action area (land use, transportation, energy, waste management, and resource management) as a response to the impact(s) climate change will have on the community?	No	No	Yes	Absent	Yes
Identified policy or planning actions	a. Are the actions identified within each area simple and specific?	No	No	Yes	Absent	Yes
	b. Are the actions representative of what cities need to pursue to be successful?	No	No	No	Absent	No
Identification of partners & parties responsible for implementation	a. Are lead partners identified?	Yes	Yes	Yes	Absent	Yes
	b. Is their role within the implementation process identified?	No	No	No	Absent	No
Identification of funding required and sources	a. Is a cost estimate provided for each action?	Yes	Yes	Yes	Absent	No
	b. Is there a budget established to break down the costs?	Yes	Yes	Yes	Absent	No
	c. Is a source of funding identified?	No	No	No	Absent	No
Assignment of implementation timeline	a. Does the plan define a timeline for implementation?	Yes	Yes	Yes	Absent	Yes
	b. Does the plan identify a deadline for implementation?	No	No	No	Absent	No

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
Assignment of other goals or specific emissions target	a. Does the plan tie individual actions to emissions reductions?	Yes	Yes	Yes	Absent	No
	b. Does the plan identify other benefits or goals not related to emissions?	No	No	No	Absent	Yes

Hoboken, New Jersey's Climate Action Plan (2018) distinguishes between community action and municipal action. The plan relies on two GHG emissions inventories—one for community-wide emissions, and one specifically for emissions from municipal operations. The inventories were conducted in 2013 and are production-based by sector. The community-wide inventory is inclusive of the municipal operations inventory. Hoboken also sets separate emissions reductions targets for community-wide emissions and emissions from municipal operations. The goals are: Gold Star Energy Certification by 2022 (1% average annual reductions over three years community wide, and 3.6% average annual reductions over three years in municipal operations); a greater than 16% reduction from the 2017 baseline by 2027 for the entire city (community and municipal operations); Net Zero electricity by 2030 community wide and by 2025 in municipal operations; Carbon Neutrality by 2050 community wide and by 2035 in municipal operations). The goal of carbon neutrality by 2050 is in line with the consensus range to limit global warming to 1.5 degrees (IPCC 2018). Hoboken does not include any plans to reduce emissions from waste management, even though waste represents at least 9% of community-based emissions.

The distinction sustained throughout the plan between emissions from municipal operations emissions and community-wide emissions sets Hoboken's plan apart from the other

cities reviewed. Hoboken also identifies costs and costs savings associated with each action area, which is further than most of the plans reviewed go in assessing costs and funding. For each action item, Hoboken identifies implementation partners, usually just referenced as the city itself, but sometimes in conjunction with developers, utility corporations, contractors, or other relevant partners. For each action, Hoboken also lists an implementation timeline of short-, medium-, or long-term implementation. Interestingly, for each action, Hoboken lists the goal as a percentage of emissions reduction achieved through the action. It is a useful product of their granular GHG inventory and distinguishes it in its level of detail from many of the other plans. The plan did not identify a monitoring framework.

In the area of land use and the build environment, Hoboken focuses on residential auditing and educating citizens on renewable energy in residential buildings and performing outreach to businesses to help transition to renewable energy. They also commit to reducing emissions from municipal operations and the implementation of electric vehicle infrastructure and solar power. Integrating infrastructure that supports renewable energy into the built environment, including LED streetlights and traffic lights, infrastructure changes to accommodate electric vehicles and solar power, and advocacy for green building codes are major components of the plan.

Because tourism from motorists is a major part of its economy, Hoboken emphasizes vehicle electrification in the transportation elements of his plans through expanding charging station infrastructure, electrification of city-owned transportation resources, regulatory standardization, and various outreach and education. Beyond this, they also propose some incremental actions related to expanding access to active transportation and public transportation, though these goals are less concrete.

Hoboken plans to be net zero by 2030 and completely carbon free by 2050. The only way to do this is to shift from fossil fuels to renewable energy. They emphasize the transition to solar power in their plans despite acknowledging its limitations, and don't suggest implementing other renewable energy programs, besides upgrading efficiency standards in municipally operated buildings to reach 100% renewable energy.

Hoboken is situated in a vast wetland, with parts at or below sea level, making it especially vulnerable to water damage from storm surge and flooding. In the area of resource management, water and flood management under a multifaceted framework is an important part of the city's climate mitigation strategy, including designating conservation areas for floodwater resiliency and green space as well as energy micro-gridding for more dynamic systems to protect from flood damage.

Given the specificity with which Hoboken identifies costs and cost savings for each policy, as well as the emissions reduction targets, the extent to which some policies may not have funding constraints or targets identified may indicate the level of priority for implementation of that action. Hoboken should be commending for striving toward carbon neutrality by 2050 and by 2035 for municipal operations. While it is clear that the plan is incomplete in terms of implementation strategies and ensuring that the targets are met through an effective monitoring framework, they go further than other plans to specify funding and costs and implementation timelines.

Charlotte, North Carolina

Table 4: Evaluation of Implementation Parameters for Charlotte, North Carolina

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
How does the plan conceptualize the relationship between this action are and its climate change mitigation goals?	a. Does the plan conceive of the action area (land use, transportation, energy, waste management, and resource management) as a response to the impact(s) climate change will have on the community?	Yes	Yes	Yes	Absent	Absent
Identified policy or planning actions	a. Are the actions identified within each area simple and specific?	No	No	No	Absent	Absent
	b. Are the actions representative of what cities need to pursue to be successful?	No	No	No	Absent	Absent
Identification of partners & parties responsible for implementation	a. Are lead partners identified?	Yes	No	No	Absent	Absent
	b. Is their role within the implementation process identified?	No	No	No	Absent	Absent
Identification of funding required and sources	a. Is a cost estimate provided for each action?	No	No	No	Absent	Absent
	b. Is there a budget established to break down the costs?	No	No	No	Absent	Absent
	c. Is a source of funding identified?	Yes	No	No	Absent	Absent
Assignment of implementation timeline	a. Does the plan define a timeline for implementation?	Yes	No	No	Absent	Absent
	b. Does the plan identify a deadline for implementation?	No	Yes	Yes	Absent	Absent

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
Assignment of other goals or specific emissions target	a. Does the plan tie individual actions to emissions reductions?	No	No	No	Absent	Absent
	b. Does the plan identify other benefits or goals not related to emissions?	Yes	Yes	No	Absent	Absent

Charlotte's plan, Toward Resilience: Charlotte Strategic Energy Action Plan (2018) was a joint project of a public-private partnership called Envision Charlotte and a research group from the UK called Carbon Captured Ltd. A production-based GHG inventory using 2015 baseline data was developed in 2017. Charlotte does not embrace net carbon neutrality by 2050, instead opting for slightly better than the 80x50 goal. Charlotte's goal is less than 2 tons of CO2e emitted per capita across the City by 2050—an 83.3 reduction. The 2015 baseline is 12t per capita. This goal is not in line with the goal of preventing 1.5 degrees of warming. The plan is weak in the area of funding. They propose the creation of a "Revolving Funding Mechanism" by which the city can take savings from existing projects and reinvest in other energy efficiency work. They also envision the expansion of public-private partnerships and the creation of energy service companies to be funding mechanisms. The explanation regarding the preferred financial model is vague, and no actual funds or costs are identified for the proposed actions. No funding model at all is specified for how educational programs and retrofitting incentives would be accomplished. The plan is stronger on implementation timelines for some actions related to land use and the built environment, but that parameter is weak for most other action areas. Each of the policies is assumed to contribute to the goal of reducing emissions to 2tCO2e per capita by 2050.

The plan is weak in its identification of partners and lead actors for the actions it proposes. A partner is not identified for most actions. One exception, though still vague, is the plan for the retrofitting agenda. The plan describes the creation of Resilient Innovation Districts (RIDs) which are to be initiated through stakeholder dialogue. The goal is to create mixed use neighborhoods in which stakeholders and government work to create new business models that can lead to a low carbon economy. The concept is vague, but the plan relies upon it as omits primary implementation strategy. It includes stakeholder engagement and the identification of partners such as Universities and research institutions, and city government-owned sites, business, residences, transportation systems. The plan does not explain a specific structure or numerosity for the RIDs. Charlotte does not include any actions to reduce emissions from waste management, an area under its direct control for solid waste, or resource management.

Buildings are the single largest source of green house gas emissions in Charlotte, around 48%. Reducing them is critical to meeting the city's targets. The sets forth an ambitious retrofitting agenda for low carbon buildings and a retrofitting agenda, and plans to create robust educational programming to accompany these retrofitting efforts, but lacks rigor in its explanation of the funding for these programs.

Transportation accounts for roughly 40% of Charlotte's GHG emissions. The plan recognizes the need for rapid increased uptake in public transportation but lacks specifics regarding strategies to expand existing public transportation networks. It is worth nothing that the city has a separate Transportation master plan. Analyzing its emissions effects is beyond the scope of this project. The plan's transportation section emphasizes the expansion of personal electric vehicle usage rather than the expansion of public transportation and is stronger on specifics in this area. The plan recognizes that shifting to electric vehicle usage as quickly as

possible can result in deep cuts in GHG emissions, but it does not focus enough on reducing emissions in this area.

Charlotte's plan is most robust in its analysis and priorities for emissions from energy usage. They have adopted a five-stage framework to get to zero carbon energy. On the supply side, the relevant stage is generating on-site energy and purchasing the remainder. These stages are reflected in the plan by the adoption of Resilience Innovation Zones and locally formed Energy Services Companies that sell services rather than energy directly. The plan also states clearly that the trajectory of natural gas development would lock in the extractive and emissions-heavy resource until 2070, far beyond when it would be sustainable, and so sets forth an agenda to shift away from natural gas.

Charlotte's five stage framework also includes shifting energy demand and reducing energy consumption. This entails changing the times and intensity with which demand for energy is placed upon the grid. As part of its management of energy emissions, Charlotte proposes incentivizing batteries and other technology for storage and spaced out usage of energy. However, the specifics are lacking. The remaining two stages of the five-stage framework are to reduce energy consumption and change the energy consumed. These stages are reflected most in the buildings portion of the plan, as the buildings and energy sections are integrated in this plan. Given that buildings are the bulk of emissions and provide the most present opportunity for reductions, this is sensible. Innovations that allow reuse of heat waste and other types of energy efficiency will allow a larger store of zero carbon energy to be maintained. Charlotte’s rejection of carbon neutrality in favour of an 80x50 goal, as well as its lack of specifics with regard to funding and implementation timelines, make it a relatively weak plan.

Denver, Colorado

Table 5: Evaluation of Plan Implementation Parameters for Denver, Colorado

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
How does the plan conceptualize the relationship between this action are and its climate change mitigation goals?	a. Does the plan conceive of the action area (land use, transportation, energy, waste management, and resource management) as a response to the impact(s) climate change will have on the community?	Yes	Yes	Yes	Absent	Absent
Identified policy or planning actions	a. Are the actions identified within each area simple and specific?	Yes	No	Yes	Absent	Absent
	b. Are the actions representative of what cities need to pursue to be successful?	Yes	No	No	Absent	Absent
Identification of partners & parties responsible for implementation	a. Are lead partners identified?	Yes	No	No	Absent	Absent
	b. Is their role within the implementation process identified?	No	No	No	Absent	Absent
Identification of funding required and sources	a. Is a cost estimate provided for each action?	No	No	No	Absent	Absent
	b. Is there a budget established to break down the costs?	No	No	No	Absent	Absent
	c. Is a source of funding identified?	No	No	No	Absent	Absent
Assignment of implementation timeline	a. Does the plan define a timeline for implementation?	No	No	No	Absent	Absent
	b. Does the plan identify a deadline for implementation?	No	No	No	Absent	Absent

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
Assignment of other goals or specific emissions target	a. Does the plan tie individual actions to emissions reductions?	No	Yes	No	Absent	Absent
	b. Does the plan identify other benefits or goals not related to emissions?	Yes	Yes	Yes	Absent	Absent

Denver's 80x50 Action Plan (2018) is the shortest of the plans examined, at 28 pages. While plan length does not necessarily indicate anything about plan quality, in this case it does. Of the eight plans examined, Denver's was the only city to exclude the greenhouse gas emissions inventory from the plan document. The inventory is an important tool in establishing the legitimacy of the plan's goals and actions. The city, however, conducts its inventory on an annual basis and is available on a dedicated website[1] with data from 2017 informing the plan. It was a hybrid inventory primarily focused on production and it included consumption-based emissions estimates for shipping and aviation, construction materials, and food-related activities driven by local consumption. Both the inventory and the plan were the responsibility of the Denver Department of Public Health & Environment with planners only playing a supporting role in creating the plan.

Denver did not set the ambitious goal to fully decarbonize by 2050. As the title of the plan suggests, the city plans to pursue the popular 80X50 goal of reducing emissions 80% by 2050 using its 2005 emissions as a baseline. The plan, like others, does not feature a monitoring framework but does set several intermediate GHG emissions reduction targets. The rate of

[1] https://ghgfootprint.com/denver/index.html#gpc

decrease is not consistent, but targets are set every 5 years until 2050. The next target is 15% by 2020. The plan also sets several sector-based non-emissions targets.

The length of the plan reflects the few policy areas within which Denver plans to act. In fact, the plan explicitly states it addresses three specific sectors: energy efficiency, energy generation, and transportation. The plan ties together these areas and others not directly mentioned, such as the built environment, as a set of interrelated actions that work together. Sustainable building practices are a critical part of the city's goal of energy efficiency—using less energy and finding lower cost ways to use similar amounts of renewable energy. To that effect, Denver plans to adopt the 2018 International Energy Conservation Code and develop an energy performance program requiring low-performing buildings to make incremental energy improvements. These actions would lead to a requirement that all new buildings be net-zero by 2035 and would support reducing energy use in commercial buildings by 50% by 2050. The plan’s other major focus area related to energy in the built environment aimed to change consumer behaviour by incorporating energy efficiency into how buyers and renters view the costs and benefits of their housing decisions. Denver would establish an energy rating system for residential units that would describe the energy consumption and efficiency of different building characteristics so consumers can make an informed choice.

Denver focuses on energy sources in two ways. The first is increasing its local supply of renewable energy as one of its paramount goals in order to reach the target of supplying 100% renewable energy to buildings by 2030. The city intends to advocate the Colorado Public Utilities Commission to continue investing in large-scale renewable energy projects and to partner with Xcel Energy, the investor-owned utility in Denver, as it works to supply 55% of Denver’s energy needs with renewable energy by 2026, up from 29% in 2018. This is the only

instance in the plan where a partner is named and the actions themselves don't describe the form of the relationship. It is also, due to the passage of time, an example of the speed with which change occurs. This plan was adopted in July 2018, and by December 2018, Xcel became the first major electric utility to announce it would become 100% net-zero by 2050. By April 2019, this commitment was reflected in the climate action plan of another city in this study, Saint Paul, Minnesota. The second area is vehicle electrification. Denver seeks to incentivize the replacement of GHG emitting cars with electric vehicles because EVs are the only available automobile product for consumers that is environmentally sustainable. One potential policy Denver considers worth considering is changing the building code to require charging stations in new development, including all public & municipal buildings. The plan mostly suggests exploring different strategies to increase access to charging infrastructure so that electric vehicles become an attractive option.

Most of the plan's actions are simple; they relate to only one idea or policy, except for the partnership with Xcel which could feature many different projects and programs. They are mostly suggestive with few framed as requirements. The plan's major failures lie in three of the six implementation parameters: partners, funding, and implementation timelines. Virtually none of the actions feature these elements, with target dates only being present for goals. The plan, without these elements, is essentially a wish list of things to do and would likely offer little support to anyone trying to implement it. It might serve as a reference for leaders as a rallying point.

Saint Paul, Minnesota

Table 6: Evaluation of Plan Implementation Parameters for Saint Paul, Minnesota

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
How does the plan conceptualize the relationship between this action are and its climate change mitigation goals?	a. Does the plan conceive of the action area (land use, transportation, energy, waste management, and resource management) as a response to the impact(s) climate change will have on the community?	Yes	Yes	Yes	Yes	Yes
Identified policy or planning actions	a. Are the actions identified within each area simple and specific?	Yes	Yes	Yes	Yes	No
	b. Are the actions representative of what cities need to pursue to be successful?	No	No	No	Yes	No
Identification of partners & parties responsible for implementation	a. Are lead partners identified?	Yes	Yes	Yes	Yes	Yes
	b. Is their role within the implementation process identified?	Yes	Yes	No	No	No
Identification of funding required and sources	a. Is a cost estimate provided for each action?	No	No	No	No	No
	b. Is there a budget established to break down the costs?	No	No	No	No	No
	c. Is a source of funding identified?	No	No	No	No	No
Assignment of implementation timeline	a. Does the plan define a timeline for implementation?	Yes	Yes	Yes	Yes	Yes
	b. Does the plan identify a deadline for implementation?	No	No	No	No	No

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
Assignment of other goals or specific emissions target	a. Does the plan tie individual actions to emissions reductions?	No	No	No	No	No
	b. Does the plan identify other benefits or goals not related to emissions?	Yes	Yes	Yes	Yes	Yes

Saint Paul, Minnesota's Climate Action and Resilience Plan was in draft form in April 2019. Its authors work for The Great Plains Institute, a non-profit organization that works with cities to develop strategies for sustainable development, with support from local and state planners. In addition to mitigation strategies, the plan considers adaptation as well.

The most salient information from the GHG inventory is described but the methodology and the full results aren't included in the plan. It is production-based and concedes this approach can't account for emissions embodied in the consumption patterns of residents and visitors. Saint Paul sets the ambitious goal of carbon neutrality by 2050, which is necessary to limit warming to 1.5°C. It also sets an intermediate target, however, its 50% reduction target by 2030 is calculated relative to the business as usual scenario projected from 2015, which is far less ambitious than a baseline year set in the past since the reduction is based on anticipated growth. This type of target-setting was unique among the plans and is comparatively less burdensome.

The plan's actions are intended for implementation during the 2019-2025 period. It is designed to be updated every 5 years to report on accomplishments and describe the next set of policies as part of regular monitoring. The plan touches on all five policy areas examined and describes how some of the actions interact or would have a mutually beneficial impact on one another. For instance, most trips in Saint Paul occur in single-occupancy vehicles and are often

less than a mile long. Many can be accomplished using transit or active modes of transportation. Many transit options exist in Saint Paul, but they don't serve all neighbourhoods and residents equally. Increasing ridership is key to reducing fuel emissions and the primary ways to increase ridership relate to coverage, service level, costs of fares. Saint Paul proposes infrastructure investments to build new transit lines but doesn't suggest where and who they would serve. The plan also vaguely suggests working with private-sector actors to develop first- and last-mile solutions. The plan recognizes the need to make it safer and easier to ride the bus or walk by proposing to accelerate the construction of planned bike and pedestrian infrastructure and expand the availability of bike share. The plan also recognizes the link between abundant parking and the use of single-occupancy vehicles to complete most trips. It correctly identifies that parking must be managed from a land-use perspective and proposes to reduce or eliminate minimum parking requirements and, more ambitiously, set parking maximums.

In terms of renewable energy, Saint Paul has done preliminary studies on the solar potential in the city and sees opportunities for installations on rooftops, especially on larger and taller buildings and institutions. Their long-term visions recognize the potential of solar as a source of reliable power; 40% of the city's current electricity needs could be supplied from rooftops alone. They also recognize that these actions could accelerate the pace of change ahead of plans for carbon neutrality the city's electric utility, Xcel Energy, is pursuing. The main strategy envisioned would be to create a 1-year financial incentive to install rooftop solar, but the plan shares no details as to its form (subsidy, tax break, grant) or its source of funding. Treatment of sewage is tied to significant electricity use, which will rely on GHG-emitting sources until Xcel Energy completes its transition to carbon neutral electricity. Saint Paul sees Xcel's energy transition as the firm's responsibility and beyond solar, proposes no other measures for

decarbonizing energy sources. Instead, it wants to reduce the demand for water to directly influence how much electricity is needed for treatment. It also mostly offloads the responsibility to reduce water consumption to consumers by proposing to work with the private sector to use less water-intensive landscaping when it could have modified its building or landscaping code, and to work with institutions with high hot water needs to develop alternative heating solutions, such as solar thermal. Again, the plan doesn't consider costs although they would mostly be borne by non-city actors.

Like most of the other seven plans, building energy efficiency is another major focus. The plan identifies relatively specific actions in education, advocacy with higher levels of government, incentives, and new policies to improve energy efficiency in buildings. Develop energy disclosure requirements for residences, similar to the one described for Denver, and conduct a feasibility study for an energy benchmarking requirement for commercial buildings. On a less ambitious level, the city also intends to expand the existing Sustainable Building Policy and to allow charging stations to be installed on residential streets. In addition, Saint Paul wants to create an energy retrofit program for existing building envelopes in order to increase efficiency in electric and gas-dependent heating, and to shift away from gas-dependent appliances and heating when possible.

Saint Paul doesn't link its waste generation to emissions but does recognize the importance in altering consumer habits overall. All of the actions the plan proposes represent innovations for the city: adopt a plastic bag ban ordinance; develop and implement a compost collection service; adopt an ordinance to require food packaging to be compostable; create a waste prevention plan. As new actions, there are more unknowns for Saint Paul than if it had prior experience in these

policy areas, which only serves to highlight the gap in financial and scoping information in the plan.

Like most other plans, Saint Paul's CAP does not outline who would be responsible for leading the implementation of the actions. It doesn't estimate costs and only occasionally recognizes that some actions will require funding but never suggests how to pay for it. As stated above, the actions are planned for 2019 to 2025, but none of the actions has a specific implementation timeline of estimate of how long it might take to implement. On a more positive note, Saint Paul does describe several secondary goals to be achieve that are intended to support the overall emissions reduction targets. Some of the most specific include how much new bike infrastructure should be built (300 miles), deploying 600 "level 2" electric vehicle chargers to support having all vehicles on the road be 100% electric, generating 50 MW from residential rooftop solar, all by 2050.

Emeryville, California

Table 7: Evaluation of Plan Implementation Parameters for Emeryville, California

		Land use and the built environment	Transportation	Energy Consumption and Management	Waste Management	Resource Management
How does the plan conceptualize the relationship between this action are and its climate change mitigation goals?	a. Does the plan conceive of the action area (land use, transportation, energy, waste management, and resource management) as a response to the impact(s) climate change will have on the community?	Yes	Yes	Yes	No	Yes
Identified policy or planning actions	a. Are the actions identified within each area simple and specific?	Yes	Yes	Yes	No	No
	b. Are the actions representative of what cities need to pursue to be successful?	No	Yes	No	No	No
Identification of partners & parties responsible for implementation	a. Are lead partners identified?	Yes	Yes	Yes	Yes	Yes
	b. Is their role within the implementation process identified?	No	No	No	No	No
Identification of funding required and sources	a. Is a cost estimate provided for each action?	No	No	No	No	No
	b. Is there a budget established to break down the costs?	No	No	No	No	No
	c. Is a source of funding identified?	No	No	No	No	No
Assignment of implementation timeline	a. Does the plan define a timeline for implementation?	Yes	Yes	Yes	Yes	Yes
	b. Does the plan identify a deadline for implementation?	Yes	No	Yes	No	No

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
Assignment of other goals or specific emissions target	a. Does the plan tie individual actions to emissions reductions?	Yes	Yes	Yes	Yes	Yes
	b. Does the plan identify other benefits or goals not related to emissions?	Yes	Yes	Yes	Yes	Yes

Emeryville, California's Climate Action Plan (2016) is the city's second version and builds on the original adopted in 2008. The authors are not named, and planners are not cited as contributors. The plan recognizes the need for planners to increasingly incorporate aspects of climate change into their everyday planning activities.

Emeryville used two GHG inventories to inform its goals and planned actions. The first was completed in 2014 and used the standard production-based approach. In 2015, the city used a new methodology and completed a consumption-based inventory based on 2013 data that accounted for the life cycle of energy, water, goods, and services consumed by households. Like half the plans I examined, the plan sets its GHG emissions reduction target at 40% below baseline level by 2030 and 80% below baseline by 2050. The baseline was set based on the 2004 emissions inventory. Among the climate action plans examined, Emeryville's has the most well-defined monitoring plan. City staff will provide an action report on the implementation progress of each mitigation and adaptation action every 2 years. Every 4 years, it will produce a full monitoring report that will include an update to the GHG inventory.

The actions contained in the mitigation plan address the 2030 target—40% below the 2004 baseline—and all five policy areas. Comparatively to some of the other plans, the actions represent a much wider range of ideas, but they remain only possible actions because they are

mostly exploratory in nature or are weak suggestions. In some ways, the simplicity of the language used to describe the policies suggest the authors, whoever they may be, were naïve or perhaps uninformed about the complexity and effort required to integrate local transit service with regional agencies, or perhaps to implement a measure to ban the sale of fossil fuel-powered vehicles at car dealerships. There are several mentions of incentives, without defining their type, to promote passive energy systems in buildings, to encourage commuters to ride transit, to build EV charging stations on private property, and many others, but none are associated with a cost estimate which is likely a key component to the implementation of incentives.

There are some notable exceptions to the generally poorly defined and overly broad actions. The CAP recognizes the need to reduce parking because it encourages driving, and to manage the existing parking supply. It then suggests simple actions defined in understandable terms: to decrease the maximum number parking spaces in new development and to start charging for street parking by installing parking meters in certain neighbourhoods. The plan doesn't consider this issue, but such a reversal in policy is likely to produce some change. Another area where the plan defines an action clearly is renewable energy. While PG&E is Emeryville's electric utility, the plan recognizes the need to develop local renewable generation capacity through public and private initiatives and without the need to rely on its investor-owned utility. Emeryville plans to join the East Bay Community Choice Energy (CCE) program, run by a new not-for-profit public electric utility, East Bay Community Energy, that offers renewable energy to costumers Alameda County.

The plan uses a relatively repetitive matrix to define both partners and timelines, but the fact those implementation parameters are included at all is evidence that some thought went into the process of implementation, if not the actions that should be implemented. The plan identifies

city departments relevant for each action or policy as lead partners and categorizes actions as either ongoing or expected completions timelines, given in 5-year leaps up to 15 years. Virtually all outreach actions are ongoing while the exploratory actions, which inform the planning process for later actions, all fall in the 1-to-5-year range. Infrastructure improvements and actions that the plan expected would require significant community buy-in, like building a new regional transit hub or banning fossil fuel car sales, would take up to 15 years, potentially stretching into the next climate action planning window given that the actions are supposed to support the goal to reduce GHG emissions to 40% below 2004 levels by 2030.

Like five other plans, Emeryville's plan does not provide any cost estimates. This could be due to many of the actions being, essentially, studies which would reveal the cost of the actions being considered. Unlike other plans, this CAP does attempt to suggest in general terms the impact each action would have on emissions reductions, but ultimately falls short by not defining what "low", "moderate", and "high" impact represent. Each goal is also tied to co-benefits, but again the matrix format makes it quite repetitive and there are only four options (economy, environment, equity, health) which are not defined, similarly to the emissions impact levels.

Table 8: Evaluation of Plan Implementation Parameters for Evanston, Illinois

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
How does the plan conceptualize the relationship between this action are and its climate change mitigation goals?	a. Does the plan conceive of the action area (land use, transportation, energy, waste management, and resource management) as a response to the impact(s) climate change will have on the community?	Yes	Yes	Yes	Yes	Yes
Identified policy or planning actions	a. Are the actions identified within each area simple and specific?	No	No	No	Yes	No
	b. Are the actions representative of what cities need to pursue to be successful?	No	No	No	No	No
Identification of partners & parties responsible for implementation	a. Are lead partners identified?	No	Yes	No	No	No
	b. Is their role within the implementation process identified?	No	No	No	No	Yes
Identification of funding required and sources	a. Is a cost estimate provided for each action?	No	No	No	No	No
	b. Is there a budget established to break down the costs?	No	No	No	No	No
	c. Is a source of funding identified?	No	No	No	No	No
Assignment of implementation timeline	a. Does the plan define a timeline for implementation?	No	No	No	No	No
	b. Does the plan identify a deadline for implementation?	No	No	No	Yes	Yes

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
Assignment of other goals or specific emissions target	a. Does the plan tie individual actions to emissions reductions?	No	No	No	No	No
	b. Does the plan identify other benefits or goals not related to emissions?	Yes	Yes	Yes	Yes	Yes

Evanston, Illinois's Climate Action and Resilience Plan (2018) was created by a 17-resident working grouped convened by the Mayor. The stakeholder-driven effort does not describe what role planners played but acknowledge them as contributors. The plan does not include a formal monitoring plan. It suggests performance metrics for annual reporting and performance evaluation for each policy area it addresses but does not go so far as to require such reporting, placing it somewhat in the middle of the pack for monitoring strategies.

The full GHG emissions inventory, included in full as an appendix, was conducted in 2017 and uses a production-based approach. The inventory shows that Evanston has reduced its emissions 24% since its 2005 baseline. It aims for an aggressive 50% reduction by 2025 and 80% by 2035 on the way to carbon neutrality by 2050. By front-loading its emissions reductions, Evanston gives itself more time to focus on those harder-to-eliminate emissions that might take longer to eliminate due to technological availability or non-local systemic issues.

Most of the actions described offer few details. Evanston plans to develop, adopt, and monitor a host of new initiatives, but almost never describes what those changes might actually entail. What's worse, Evanston fails to identify any partners for implementation despite many of its actions requiring community buy-in or support from other levels of government. Financial information for either the actions or the plan overall is also absent. With a few notable

exceptions, the plan also does not address timing for any of the actions. The two actions that have timelines are fully electrifying all buses and vehicle fleets operating in the city by 2035 and adopting an energy transition strategy for new construction into the building code by 2020 that would become a requirement by 2030. In terms of land use and built environment initiatives, Evanston's plan is one of only a few plans examined that consider land use issues. Increasing density and the amount of mixed-use development is seen as a key area to reduce the number, type, and distance of trips required by residents to conduct their daily lives. The plan focuses on actions to encourage the private market to take the lead, such as creating incentives like density bonuses and expediting review for mixed-use developments.

Many of Evanston's planned actions exhibit off-loading of actual responsibility to effect change to others even though they are unnamed. This is possibly best exemplified in their actions intended to address renewable energy supply. Evanston's past efforts to move toward using renewable energy were achieved by purchasing renewable energy credits which offset emissions at a fixed exchange rate. The plan recognizes that more must be done, especially to generate renewable energy locally. It does not take the lead in acting, however. Some of the actions simply exploratory, like evaluating expanding the Community Choice Electricity Aggregation program, which allows the city to purchase power for residents from sources other than the primary supplier, and creating a municipal alternative retail electric supplier, while others place the burden on individuals and the community.

The plan's other focuses are to educate residents and businesses about investing in their own sources of renewable energy and to support community solar projects. These actions are, somehow, supposed to lead to 100% of electricity consumed in Evanston coming from renewable sources by 2050. The plan does, however, consider all five policy areas examined and

is one of the rare plans that addresses the urban canopy, but does so modestly. The urban canopy provides important benefits to the natural environment by improving air and water quality, increasing absorption in soils, and providing a habitat for animals. Furthermore, trees help cut heating costs by creating shade and cooling local areas while also capturing and storing carbon emitted in the atmosphere. Maintaining its health and expanding it are expected to contribute to important emissions reductions and this must be done with the knowledge that trees planted today will need to be adapted to the environmental conditions of the future. Tree replacement in the right of way, new trees on public property, and developing an ordinance that would require permits for tree removal of private property are intended to add only 2,000 net new trees by 2050. The plan does not mention what this represents in terms of percentage growth nor quantify the emissions the trees might mitigate. On the transportation front, Evanston's plan again suggests the city should incentivize private actors to build charging stations, like other plans. Actions in the area of active transportation mostly focus on awareness of walking and bicycling as travel options and are supposed to support the plan's goal of reducing vehicle miles travelled (VMT) by 50% by 2050 based on 2005 levels as the main approach to emissions reductions in transportation.

With the absence of so many implementation parameters, it is difficult to imagine how exploring weak policies that would mostly place the emissions reduction burden on individuals themselves might successfully achieve the ambitious goal of reaching carbon neutrality by 2050. Furthermore, because most of the actions off-load responsibility, even if more details were on the absent implementation parameters (partners, financials, timelines), the actions are too imprecise and show evidence of a lack of consideration for what needs to happen and how it should be done to be an effective plan. Had the actions been described more clearly, such as the kind of

requirements relating to energy efficiency and what supporting building preservation might entail, then the plan could have served as at least a list. Without this level of specificity, Evanston's Climate Action and Resilience Plan lacks vision.

Alexandria, Virginia

Table 9: Evaluation of Plan Implementation Parameters for Alexandria, Virginia

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
How does the plan conceptualize the relationship between this action are and its climate change mitigation goals?	a. Does the plan conceive of the action area (land use, transportation, energy, waste management, and resource management) as a response to the impact(s) climate change will have on the community?	Yes	Yes	No	No	Yes
Identified policy or planning actions	a. Are the actions identified within each area simple and specific?	No	No	No	No	No
	b. Are the actions representative of what cities need to pursue to be successful?	No	No	Yes	No	No
Identification of partners & parties responsible for implementation	a. Are lead partners identified?	Yes	Yes	Yes	Yes	Yes
	b. Is their role within the implementation process identified?	No	No	No	No	No
Identification of funding required and sources	a. Is a cost estimate provided for each action?	Yes	Yes	Yes	Yes	Yes
	b. Is there a budget established to break down the costs?	No	No	No	No	No
	c. Is a source of funding identified?	No	No	Yes	No	No

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
Assignment of implementation timeline	a. Does the plan define a timeline for implementation?	Yes	No	Yes	Yes	Yes
	b. Does the plan identify a deadline for implementation?	Yes	Yes	Yes	Yes	No
Assignment of other goals or specific emissions target	a. Does the plan tie individual actions to emissions reductions?	No	No	No	No	No
	b. Does the plan identify other benefits or goals not related to emissions?	Yes	Yes	Yes	Yes	Yes

The city of Alexandria's Energy and Climate Change Action Plan was updated from its 2009 version in 2018. This plan consists entirely of short-term actions to be implemented by FY2023. The goal is to reduce emissions to 10 metric tons per capita per year, which would place Alexandria on track to achieve an 80% reduction from 2005 emissions levels by 2050. This is a straightforward 80x50 goal and represents a rejection of the more ambitious goal of complete carbon neutrality by 2050, which would be the minimum necessary to limit warming to 1.5 degrees by 2100. Unlike many of the other plans studied, Alexandria plans to establish a monitoring task force to produce an update to the plan within two years, and they provide a cost estimate for the monitoring program (around $305,000) per year. Alexandria provides some cost estimates for action, but mostly does not identify costs or funding sources. The city also identifies partners for implementation for each policy it describes; these include the lead actors and secondary actors, mostly internal departments from the city.

A production- based inventory was conducted using a 2015 baseline. The inventory is included as an appendix to the plan. Unlike other plans that do not identify a role for urban

planners at all, planners are references as implementation partners and stakeholders in the plan. However, planers are still absent from the actual development of the plan, and no authors or developers of the plan are listed for accountability. While the plan carries more depth than the other plans studied because it details actions in each policy area, it still pursues relatively low hanging fruit, has weak emissions reduction targets, and does not specify costs or funding to the extent that would be necessary for actual implementation. Unlike many of the other plans, Alexandria has robust implementation timelines. Being that it is a short-term plan, that is sensible and should be a minimum expectation.

Alexandria's land use plans reflect the idea that open space carries social benefits as well as enhancing the quality of the environment and creating low carbon recreational opportunities. The city plans to increase the amount of open space throughout the city while also encouraging development density around mass transit centers. Alexandria does recognize that optimizing the economic, environmental, and social performance of existing buildings and new buildings is an important part of climate change mitigation strategy. Building requirements are one of the few areas of energy supply that the city has direct power to shift. Through rebates, outreach and implementation assistance, and increasing the stringency of building codes that it controls, the city hopes to optimize its green building policy and reduce emissions substantially. However, a major hurdle is that localities in Virginia are not authorized to establish mandatory benchmarking programs or disclosure requirements to assist them in regulating emissions on their own.

Emissions from transportation account for around 36% of total emissions for the city of Alexandria. Transportation is not a key focus of this plan but is supposed to be a key focus of Phase 2 of the plan, which is currently under review. Given that this study only evaluates phase

1, it cannot be determined whether the transportation elements of the plan will be more robust in the future. However, in the current plan, they only relate to electrification of city owned vehicles and some electric vehicle charging infrastructure. These actions do have specified costs identified and are proposed to be completed by FY2021, but they are mostly actions for the city government to take internally through its own employment benefits for workers, as well as developing more electric vehicle charging infrastructure. These are achievable goals but won't substantially reduce transportation emissions in the ways needed.

Emissions from residential and commercial energy usage account for around 56% of the city of Alexandria's emissions. The city lacks significant power to reduce emissions from community energy usage, which is why it has focused its action items on municipally owned property. Currently, a whole host of energy and transportation initiatives that Alexandria could undertake are prohibited under state law, because localities are not empowered to act on their own in these areas and need explicit authorization from the state government. The problem is that municipal operations account for only 4% of the city's emissions, so community action is necessary to achieve any significant reductions. Energy efficiency is conceptualized as important in tandem with emissions reductions, and actions are framed as achieving both at once in municipally operated areas through retrofits. For community-wide emissions reductions and efficiency efforts, the city focuses on outreach and education as well as limited financial and zoning incentives.

Compared to the other plans studied, waste and resource management have outsized importance in Alexandria. Some plans neglected these areas altogether. The city argues that optimizing efficiency and safety in the collection and processing of solid waste as well as reducing the amount of waste collected will reduce GHG emissions and preserve city resources.

They set forth a large number of robust actions that have costs identified and straightforward implementation timelines. The policies include incentivizing better recycling sorting practices through better infrastructure and education, optimizing garbage pickup routes, increase composting, developing innovative pricing schemes, and advocating legislation to further empower the city government to take emissions-reducing actions. Alexandria also argues that a stronger forest canopy would reduce GHG emissions and improved air quality, increases property values, mitigates storm runoff and other flooding, and creates public spaces for recreation. However, the goals they set for expanding the forest canopy are minuscule, and the actions specified are vague and signify that this is a low priority (outreach programs and updating the urban forest master plan).

While Alexandria's plan is the most robust in terms of simplicity and specificity of actions as well as the broadest because it attempts to plan within each important action area, the overall reduction targets are too weak for the city's capacity and for what is necessary.

Pittsburgh, Pennsylvania

Table 10: Evaluation of Plan Implementation Parameters for Pittsburgh, Pennsylvania

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
How does the plan conceptualize the relationship between this action are and its climate change mitigation goals?	a. Does the plan conceive of the action area (land use, transportation, energy, waste management, and resource management) as a response to the impact(s) climate change will have on the community?	Yes	Yes	Yes	Yes	Yes
Identified policy or planning actions	a. Are the actions identified within each area simple and specific?	Yes	Yes	Yes	No	Yes
	b. Are the actions representative of what cities need to pursue to be successful?	Yes	No	No	No	Yes
Identification of partners & parties responsible for implementation	a. Are lead partners identified?	Yes	Yes	Yes	Yes	Yes
	b. Is their role within the implementation process identified?	No	No	No	Yes	No
Identification of funding required and sources	a. Is a cost estimate provided for each action?	No	No	Yes	No	No
	b. Is there a budget established to break down the costs?	No	No	No	No	No
	c. Is a source of funding identified?	No	No	No	No	No
Assignment of implementation timeline	a. Does the plan define a timeline for implementation?	No	No	Yes	No	No
	b. Does the plan identify a deadline for implementation?	No	No	No	No	Yes

		Land use and the built environment	Transporta-tion	Energy Consumption and Management	Waste Management	Resource Management
Assignment of other goals or specific emissions target	a. Does the plan tie individual actions to emissions reductions?	No	No	No	Yes	Yes
	b. Does the plan identify other benefits or goals not related to emissions?	Yes	Yes	Yes	Yes	Yes

Pittsburgh's Climate Action Plan (2018) is a third update of a planning process that began in 2008. Though the lead authors are unspecified, the acknowledgements page reflects a large collaborative effort between private and public stakeholders and contributors. While it is helpful to see who all had a say in the plan's development, listing so many with no lead contributor identified has the same effect in terms of accountability as naming no one. Uniquely, compared to the other plans, urban planners are acknowledged as contributors. The plan is weak in the area of funding. Costs and potential funds are identified for only two of the actions proposed. The plan is also weak on implementation timelines. It does not set a deadline or a timeline for any of the policies except for deploying electric vehicle charging stations. Partners including different levels of government are identified for each action, suggesting that deeper thought was given to that parameter than the others.

Pittsburgh is one of two cities studied that employ a consumption-based inventory, using a 2013 baseline. While consumption-based, it does not account for all sectors of emissions. In some areas, like emissions due to waste management, use a production methodology because of the unavailability of consumption data. Despite the relatively robust inventory, Pittsburgh has opted for an 80x50 goal rather than complete carbon neutrality. They include intermediate goals

of a 20% reduction by 2023 and a 50% reduction by 2030. No monitoring framework for ensuring the plan is on track is identified.

The plan recognizes the ties between transportation planning and land use. It focuses on densifying the city around transit and active transportation infrastructure so that energy efficiency can increase and reliance on cars for commutes and other trips can decrease, significantly reducing the emissions associated with energy use. The plan also focuses on forging a path for Pittsburgh to have the ability in the future to exert local control over building regulations that would require increased energy efficiency and reduced energy consumption through legislative advocacy and benchmarking ordinances and energy codes. Alongside land use changes and an emphasis on encouraging taking alternate modes of transportation in lieu of a car, there is a need to make changes to the supply of parking. The plan does not elaborate what it envisions in terms of changes in supply but recognizes the need to set a maximum limit and to eventually eliminate minimums as well.

Pittsburgh also emphasizes expanded public transportation to encourage citizens to shift away from personal vehicle usage. The vision for increased and improved transit service involves infrastructure investments and changes to how service is delivered. It involves specifically identifying equity disparities in terms of who needs transit and who has it. Beyond this, though, most actions are not targeted at behaviour or cultural change in this area. While transportation-related emissions account for a significant proportion of Pittsburgh's total emissions, the CAP's actions are mostly targeted at municipal operations and public agencies with only some benefits and access to the public.

The plan recognizes the importance of moving to renewable and non-polluting sources of energy in order to achieve the desired reductions from electrifying vehicles and other sources of

direct emissions, especially in the transportation sector. The plan also identifies possible synergies in renewable energy production and waste reduction by utilizing anaerobic digestion to process organic waste and create biogas for fuel.

Efficiency doesn't just come from reducing the energy consumption caused by end-user's appliances or reducing energy lost and wasted because of poor-quality buildings. The plan recognizes that losses occur in the production and transmission of energy as well (10%-50% lost as heat depending on load) and proposes infrastructure investments to upgrade the electrical grid and gas distribution grid.

Pittsburgh is somewhat stronger in resource and waste management than other plans. The plan outlines ambitious goals to improve the city's tree canopy and actions that will directly contribute to that effort. However, it relies significantly on outside help, whether property owners or the natural world's ability to regenerate itself independently. Reducing the amount of sewage that needs to be treated and water that needs to be provided or is lost due to leakage helps somewhat reduce the energy consumed by Pittsburgh. For water treatment activities that cannot be avoided, the plan proposes to upgrade equipment to be more energy efficient and to improve green infrastructure to reduce the water that infiltrates into the water management system.

Because it rejected the goal of neutrality and is weak on funding and implementation timelines, Pittsburgh's plan leaves a lot to be desired. However, the inclusion of a consumption-based inventory is a major step in the right direction and will allow the city to rely on more robust data for future planning.

1. Gaps between Action Areas and Goals/Targets

A) Energy, Land Use, and the Built Environment

Most plans recognize, either implicitly or explicitly as in the case of Denver, that the most important areas in which cities can act and that have a high level of impact on emissions are energy, land use and the built environment, and transportation. While they may recognize the importance of addressing these issues, the specific actions they propose still represent, for the most part, "low-hanging fruit" in terms of what can be completed quickly, frugally, and successfully. Plans often use vague and suggestive language that does not spell out exactly what must be accomplished. When more descriptive terms are used, such as to describe regulatory actions or capital projects, they still are not stipulated as actions that must or even will be taken. Many of the actions, whether intentionally or not, "off-load" much of the responsibility to act on to other actors. Some of the plans recognize that behaviours and lifestyles will have to change to achieve the goals they set, but only offer small incentives for individuals, firms, and institutions to make some or all of the effort rather than develop nudging strategies or more forceful influence campaigns to affect general opinion, let alone requirements to do so. Most of the plans do recognize that such requirements will eventually be needed and briefly describe plans to investigate or test such measures on a limited basis.

Every plan examined addresses energy efficiency in buildings by proposing policies like creating and improving energy efficiency standards in the building code or lobbying the state for enabling legislation to allow it, as in Pittsburgh. Virtually all justify this because the majority or the plurality of the emissions in their inventories come from energy use tied to building operations. However, these changes focus on new buildings and not the substantial proportion of the building stock that was built prior to energy efficiency standards developed in the late 20th

century. Evanston, Illinois and Charlotte, North Carolina both intend to develop retrofit programs for older, inefficient buildings, but only Evanston is considering making theirs a requirement.

Renewable energy generation is another popular idea to reduce building-based emissions, but cities at this stage are either proposing to evaluate the feasibility of incentives for their installation or collaborating with their electric utility to shift generation to greener sources. This last effort is usually described in less transparent terms and makes unclear to what degree the local government can negotiate with its electricity provider(s)—Emeryville, California appears to be able to negotiate on behalf of its residents and was negotiating joining the East Bay Community Choice Energy (CCE) program, run by a new not-for-profit public electric utility offering renewable energy in Alameda County; Alexandria, Virginia, on the other hand, intends to purchase Renewable Energy Certificates (REC) to offset 100% of electrical energy usage by City facilities by 2020, a small portion of the community's energy consumption overall.

B) Transportation

All plans emphasize vehicle electrification but do so by supporting the expansion of charging infrastructure and private ownership. Cities have come up with different approaches to achieve vehicle electrification through electric charging stations, whether it was requiring their installation as part of building codes or investing in the technology directly to be made available for public use. Focusing solely on vehicle electrification also carries risks because without further actions in the areas of affordability of vehicles, such as in the form of subsidies, few people have the financial ability to purchase electric vehicles which are often higher-priced than petroleum-fueled vehicles, despite cities like Denver and Evanston explicitly listing equity as a priority in carrying out the actions and distributing their benefits. One issue no plan addresses but

is very important according to Davis et al. (2018) is how to manage the electrification of vehicles while the energy supply undergoes a transition toward renewable and non-polluting sources. Without ensuring that the energy grid is both clean and able to handle the added demand from electric vehicle charging, the required added capacity would likely not result in significant reductions in emissions overall, though this would require further study to quantify accurately.

Few cities pursue policies that create new requirements governing their own actions or those of other actors. One notable exception is the construction of new parking, and the effect abundant parking has of inciting drivers to use their cars, is an example of this reality. A little more than half (five out of eight) of cities recognize the relationship between parking, car use, and land use costs, but usually only plan to revise minimum amounts associated with new development, rather than eliminating them and letting the market decide what amount of parking is needed based on demand for use. Three of the five even plan to set maximums amounts. However, for the most part, cities simply acknowledge that in the long run, to make the most significant reductions in emissions, some or all the actions they consider will need to become standard or minimum practice, not just suggested best practice.

C) Waste and Resource Management

Some important policy areas receive little to no attention in the plans. Managing emissions management from waste and sewage treatment and conservation of land and biodiversity are totally absent, although one could argue that conservation of land and biodiversity is tangentially addressed through reforestation, which some cities mention as providing better habitats for local wildlife. However, their absence can probably be explained by the fact that emissions from waste generally make up a small proportion of all emissions (under 2% in all cases). Cities may also have a limited ability to protect land and wildlife outside of their traditional role in managing

parks, so a more multi-level approach with agencies responsible for natural areas like states and the federal government might be necessary. Surprisingly, and perhaps disappointingly, only half of cities address reforestation and expanding their tree canopy, despite many opportunities to do so through the exercise of power in the various spheres they can influence. Trees, like other plants, fix nitrates into the soil, capture carbon dioxide (CO2), produce oxygen, sequester and fix carbon, and stabilize soils. Because trees sequester carbon from the atmosphere and store it in their body mass, trees are carbon sinks that greatly reduce the impact of CO2 emissions (Nowak et al. 2013, 229). This effect also purifies the atmosphere and benefits local environments (Hutyra et al. 2011, 784). Importantly, trees can be processed in ways that maintain the built-up carbon storage of deceased trees, making them a potential source for sustainable development, magnifying their impact on CO2 reduction. It would seem evident that increasing the tree canopy would be an essential tool in making direct reductions in CO2 emissions, yet even the cities that plan to plant more set low planting goals and even rely on nature to take care of itself, as in Pittsburgh.

2. Strengths and Weaknesses

To discuss the strengths and weaknesses of the plans examined, it is necessary to first acknowledge that no plan represents an ideal in terms of any of the implementation criteria examined—conceptualization of the relationship between the policy areas and their climate change mitigation goals, identification of policy or planning actions, identification of partners and parties responsible for implementation, identification of funding sources, assignment of an implementation timeline, and assignment of a goal or emissions target tied to the policy or planning actions at hand. Each plan has its flaws, and those flaws are unevenly distributed among the policy areas within those plans as well. Energy efficiency in buildings and

improvements to infrastructure are well-understood by cities and are overall well-developed sections in each plan; creating opportunities for local renewable generation are not innovations with which many cities have experience and are vaguely explained.

Trends that Wheeler (2008) and Basset and Shandas (2010) identified as serious gaps in their studies of first-generation plans—the absence of planners in the plan development process and the lack of monitoring and accountability measures—continue in these recent plans. While the findings cannot be assumed to apply to all plans and cities in general, urban planners and traditional planning departments played supporting roles, if any, in the creation of the climate action plans in this study. A few of the plans recognize their role in implementing certain types of actions, especially in the areas of land use and infrastructure planning, but otherwise make little mention of how planners will accomplish these tasks. Monitoring frameworks continue to be poorly defined. By default, the need to update inventories on a regular basis serves to track progress and hold those responsible for implementation accountable based on an expectation of progress. Beyond this requirement, half the plans examined do not include a formal set of performance measures, indicators, or feedback systems to track implementation. Evanston's plan recommends that the city track more than a dozen indicators like the number of buildings retrofitted annually to more energy-efficient standards but doesn't impose a requirement on any actor to follow through with monitoring. The other four plans either require that the authors or supervising department/agency report on the progress made on the plan's actions, usually annually or biannually, or require that the plans be updated to reflect projected achievements and changes in best practices, which evolve quickly. These represent different approaches to ensuring accountability and it is likely that cities will continue to develop their monitoring frameworks

and possibly adopt protocols combining several of the strategies currently being employed separately.

Nevertheless, the plans generally do well in linking the actions they are taking with their expected outcomes and how they are meant to support GHG reduction targets. Furthermore, seven of the eight plans examined show evidence of consideration of accountability for implementation of actions by assigning partners within their own governance structures and outside of them to lead implementation, but many do not name actual plan authors. Likewise, all plans employ GHG emissions inventories, an improvement over early plans, but none attempt a consumption-based inventory that would account for the emissions patterns in the consumption behaviour of citizens rather than the easier production-based inventory.

While some plans are stronger than others, none of the plans are where they need to be in terms of identifying costs and funding for implementing the proposed actions. The plans are also generally weak in setting implementation timelines and deadlines for action, with the exception of Alexandria, which is a short-term plan. Below I discuss the relative strengths and weaknesses of the following characteristics and parameters in more detail: the GHG inventories and targets, the simplicity of targets and actions, plan accountability through naming partners and authors, funding, and implementation timelines.

A) Inventories and Goals

Wheeler (2008) called for cities to rely on robust greenhouse gas emissions inventories for future climate action plans. Producing accurate GHG inventories allows cities to track their progress in their pursuit of long-term reduction goals. A sign that practices have evolved is that all cities studied have greenhouse gas emissions inventories that account for the community's CO2 production. This is a significant improvement, albeit not one that can be generalized to all

cities, over Wheeler's original findings from a decade ago in which some plans did not have inventories or even the intent to complete one in their plan's actions and the few that did were focused on municipal operations. Some of the plans even made use of the consumption-based emissions approach, which is being promoted as recommended best practice. By accounting for the direct and embodied carbon emissions the consumption of local and non-local goods and services create, cities ultimately get a better idea of the effect of their efforts and can tailor their actions to be impactful in the areas that matter. The main gas tracked is CO2 because of its ubiquity in the discussion surrounding climate change, but a few cities, like Charlotte and Pittsburgh, used carbon dioxide equivalents, which provides a conversation rate for other greenhouse gases like methane and nitrous oxide based on how much warming they cause relative to the atmospheric warming caused by CO2. Both gases are significantly more impactful than carbon dioxide and so including them improves the accuracy of a community's total greenhouse gas emissions, but these gases don't always have the same origin as CO2, so attempting to reduce emissions using the same tactics might not actually prove successful. This was, however, beyond the scope of this study.

All cities in my study completed greenhouse gas inventories within 5 years prior to the plan's adoption. Seven out of the eight examined included the inventories either as a chapter in the introduction or as appendices for reference; Denver did not make the inventory available in the plan, but it can be found on the Department of Public Health and Environment's Climate Action webpage. Only two cities (Emeryville, CA and Pittsburgh, PA) use consumption-based inventories to establish their greenhouse gas emissions, which is being pushed as recommended best practice. Denver's GHG emissions inventory uses a hybrid approach relying mainly on a production-based account of emissions supplemented with consumption-based emissions from

food and goods. The other five cities all used production-based approaches to complete their GHG inventories, the current standard.

In addition to regular updates to the inventories, the presence of intermediate goals in most plans supports monitoring by setting goalposts against which progress in emissions reductions can be tracked. However, not all cities go further in establishing formal metrics or requirements for accountability and monitoring the progress of implementation. The plans from Denver, Hoboken, and Pittsburgh make no mention of a monitoring framework. Evanston's plan recommends annual reporting on a number of metrics means but does not require it. The remaining four cities either require status updates on implementation on a regular basis (ever 1+ years) or must update the plan itself at a specific time interval.

The Paris agreement 1.5-degree target requires reaching net zero emissions globally by 2050 (IPCC 2018). For that to happen, cities in the U.S. will need to compensate by achieving that goal faster. While each of the eight cities sets targets for the year 2050, some of the cities are not pursuing carbon neutrality at all. Evanston, IL, Hoboken, NJ, and St. Paul, MN have set targets for net zero emissions by 2050. Charlotte, NC is pursuing a GHG emissions reduction target of 83.3% by 2050 (self-calculated based on its per capita reduction target). All remaining cities are pursuing the often used "80X50" goal, where actions will result in an emissions reductions equivalent to 80% below a given benchmark year's emissions. Charlotte, NC and Alexandria, VA don't set any intermediate targets, which are a way of holding the plan accountable. The six plans that include goals vary greatly in the number (Denver has six; St. Paul and Emeryville each have one) and the goal they set, though the most common is 50% GHG reductions by 2030.

Carbon neutrality by 2050 is the consensus target to limit warming to 1.5°C by 2100. The fact that only half the cities studied are striving to achieve this goal, while not statistically conclusive, does suggest that they are missing part of the urgency of the crisis. None of the plans go so far as to justify in direct terms why one goal was chosen over another beyond saying the goal was necessary to mitigate climate change, but two of those that are pursuing carbon neutrality linked it directly to the 1.5°C threshold. All justify the need for reduction through evocations of the local context, the changes already being felt, or an imperative as demonstrated contributors, and arguably origins, of pollution and climate change, but not all acknowledge the urgency by committing to neutrality by 2050.

Beyond overall greenhouse gas emissions reduction targets, all plans also set other goals intended to contribute to the reduction targets, such as the proportion of energy generated by renewables and vehicle electrification rates. The actions the plans describe are intended to support these policy area-specific goals. They are usually described as part of the overall vision of the city in lofty, sometimes vague language common in planning documents. Some are highly detailed, such as setting a minimum number of electric vehicle charging stations to be installed (St. Paul), and others also identify co-benefits in non-climate change topics like health benefits derived from increase tree coverage. Hoboken goes further: for some, but not all of its actions it provides an estimate of the impact the action will have once completed in the form of a percent reduction of GHG.

B) Simplicity of Targets and Actions

Most plans also used structure that allowed easy comprehension of how discrete actions would lead to defined outcomes, like generating 100% renewable energy or electrifying all vehicles by a certain target year, which supported the overall GHG emissions reductions goals.

This not only helps the public understand how climate mitigation actions are intended to work but also appears to have allowed cities to more clearly organize and connect how actions might have complimentary roles or outcomes. Many plans do well in describing how certain relationships, especially between land use and transportation, can create greater emissions reductions when planning between them is coordinated. Conversely, plans usually glance over the negative feedbacks that might exist, notably in ignoring the need to plan electrification in a way that does not increase demand for energy from polluting sources before they can transition to renewables. Nonetheless, the climate action plans studied use numerous strategies to successfully justify the actions they choose to pursue, though many of those actions are ultimately small in scale or mildly impactful.

C) Accountability

An important aspect of accountability is to define the lead partners, organizations, and actors who will oversee and carry out the commitments outlined in municipal climate action plans. As a strength, almost every plan lists partners for each action area, if not each action; Evanston, Illinois is the lone exception as it lists no partners. Denver lists very few partners and its plan implies that the city government will take the lead role but is arguably not very clear. On the opposite end of the spectrum, Alexandria, Virginia sometimes describes the number of employees needed to manage new projects and initiatives in addition to the agency to which they would report. This level of detail also supports budgeting and prioritization in the planning process because it provides a fuller picture of the resources needed for successful implementation. Emeryville, California also lists every city department and external partner who would be involved for each action, though this produces a high degree of repetition throughout its plan.

Plans could do more to identify the external actors who will either be responsible for carrying out actions or who will bear most of the burden new policies might impose. Sometimes, though not always, they clearly identify other levels of government when actions are outside of their sphere of influence as with Pittsburgh, which plans to recruit Philadelphia to use their combined economic and demographic power to lobby the state for enabling legislation to influence building and zoning codes as they relate to energy. However, most cities, especially cities that rely on changes to regulations to achieve most of their reductions, don't state the who will be affected by the changes they are contemplating. Ignoring these kinds of impacts risks alienating affected stakeholders and reducing buy-in from the community.

A major weakness is that while cities have generally established who is responsible, or accountable, for implementation, many plans don't name their own authors, which makes it difficult to hold the plan itself accountable. Most, five out of eight, have a page or space dedicated to acknowledgments from which the reader can infer who has contributed to the contents, but they do not usually indicate relative influence over the final product. This is an area where cities can immediately improve future planning just in the documentation stage. Interestingly, none of the eight plans examined listed traditional urban planners and urban planning departments as primary authors. When present, they are usually only acknowledgement as contributors and sometimes as implementation partners. Even when actions traditionally undertaken by planners are mentioned, such as changes to land use and zoning or planning infrastructure improvements, the role of planners goes unacknowledged, as it did a decade ago.

D) Funding

Perhaps the most significant weakness in the plans, with some exceptions, is funding. There are two components to funding: costs and sources. Six of the eight plans completely omit

costs from their plans. Two identify grants as a potential source of funding for one to two actions each, but the plan didn't describe the costs so any indication of how much grant money would be necessary was missing. The plans that discuss financial matters mostly identify costs, though when grants from other levels of government exist plans do make an effort to name them and describe their purpose to relate them to their goals and actions. As with timelines, the plans that price their actions do so inconsistently, sometimes giving total costs, sometimes annual, sometimes even budgeting for the staff responsible for the actions, as in the case of Alexandria, VA. Uniquely, Hoboken also provides for some of its identified actions the savings that will be incurred. Not only does this demonstrate a deep level of forethought about the impact of their mitigation policies on other operations, but it is also a useful tool to acquire buy-in from the community since they will be able to directly link the benefits derived from their investments as a community. Funding is one of the two noticeable weaknesses despite its importance in helping cities plan financially for their future needs and inform how to prioritize their resources.

As of 2019, the federal government of the United States continues to retrench its support for local governments by reforming, shrinking, or eliminating programs and grants on which many depend, be they for infrastructure or social services. State governments also off-load financial responsibilities to local jurisdictions because they often face the same budgetary contractions caused by the federal government as cities do.

Now more than ever, municipal governments must carefully plan how to generate revenues to support increased pressure on the services they provide and how to spend their limited resources for urgent or emerging crises. Without accounting for the costs of the actions they intend to accomplish, cities and their climate action plans are walking blindly into situations they may prove unable to handle. New ideas lie at the center of climate mitigation policy and action

and many unknowns still exist, not to mention complications that arise from local conditions. Costs help gauge scope and scale which help cities and public servants prioritize based on what is achievable with existing and future resources. If ideas seem infeasible because of their costs, they might encourage the exploration of other actions that are more achievable while still having a net impact on emissions reductions. By omitting costs, the cities studied are pushing the problem to be discovered and solved later, when the crisis will undoubtedly be more dire. Two cities notably stand out from this criticism: Hoboken, New Jersey and Alexandria, Virginia. Hoboken provides costs and benefits in the form of savings incurred from their mitigation actions. Alexandria describes in detail the cost of an action, sometimes down to the cost of labour of the employees involved in implementation. Nonetheless, neither defines costs and benefits for every action and there is the sources of the funds are still generally absent. It is also unclear whether the reader is meant to infer that city budgets will finance all the actions the plans outline. Generally speaking, plans poorly explained their own structure and how they would be used by the municipal government.

E) Implementation Timelines

In addition to funding, another noticeable weakness is implementation timelines. Setting deadlines, timelines, milestones, and other time-based characteristics is one of the two areas in which all of the plans struggle the most, alongside funding. Some plans do not outline specific timelines for each action, instead associating them directly with the goal they support and its timeline. When plans do include implementation timelines, they do so inconsistently with some actions having a detailed implementation schedule and others not, even within the same policy area. Setting deadlines, like identifying cost and funding sources, helps frame actions in a practical view and creates an important measure for accountability.

Defining timelines is important for a few reasons, notably because it creates a goalpost in the public's eye and becomes a way for them to hold their leaders and public servants accountable to the promises they make. It should serve the same function internally for the city's own tracking of its progress and accounting of its decisions and actions. Furthermore, it assists those responsible for implementation with coordinating actions ahead of time and ensuring they are adequately sourced with resources, and time, to be accomplished successfully. Climate action plans are intended to serve as reference documents at their least important, and guides at their best, so providing timelines is useful in tracking when actions should take place, especially if the outcomes of one policy are expected to impact another. It could also serve as a reference measurement for how much time certain types of actions require to be implemented; many climate mitigation policies and ideas emanate from pilot projects in relatively controlled conditions, so adjustments might be necessary to fit different local contexts.

One solution to the problem of the lack of specificity in the implementation strategies, that considers the fast pace of change and innovation in the field of climate change and the need for cities to be flexible in their commitments, is to develop a monitoring framework that requires regularly-timed updates to both the progress made on past and ongoing actions and the scoping and planning of future actions. This would allow cities to adjust their timelines and cost estimates in response to their experiences and the results they are observing. Vague language and the absence of certain elements would be less of an issue because the documents wouldn't be fixed in time. Being able to respond to reality also facilitates prioritization based on the information available in the moment, which is often more complete than the information that was available to inform the original scoping.

V. Conclusions

Through qualitative analysis of eight discrete municipal climate action plans, adopted or in draft form, representing diverse urban geographies and population characteristics, this study evaluates the strategies these cities are planning to employ to achieve their stated greenhouse gas reduction and climate mitigation targets. The purpose of this study is to identify areas for improvement in municipal climate action planning by identifying gaps, strengths, and weaknesses, and to suggest pathways for future research.

This study also develops an evaluation framework rooted in the literature on parameters of implementation quality, the evaluation of planning documents, carbon lock-in, multi-level governance, and the relationship between climate change and urbanization. This evaluation framework is applied to each of the eight cities selected—Alexandria, VA; Charlotte, NC; Denver, CO; Emeryville, CA; Evanston, IL; Hoboken, NJ; Pittsburgh, PA; and St. Paul, MN. It entails a deep reading of the stated intentions and plan actions, accountability, costs, timelines, and goal-setting. While this evaluation is not generalizable to all cities or to the cities in this sample, it does reveal insights regarding the strengths and weaknesses of certain areas of planning in order to suggest a path forward. Most plans recognize, either implicitly or explicitly as in the case of Denver, that the most important areas in which cities can act and that have a high level of impact on emissions are energy, land use and the built environment, and transportation. However, plans often suggest policies that reach for "low-hanging fruit" in these areas, proposing somewhat weak solutions to areas within easy reach of municipal governance rather than seeking deeper solutions through more innovative approaches that will contribute to more robust reductions overall.

The plans examined related their priorities and their intended actions in ways that acquire buy-in from the public as well as tie the science and urgent need for action to the outcomes they set as their goals. They also describe a basic level of accountability by assigning responsibility over most actions to relevant partners and stakeholders. Cities need to take seriously other essential elements of the planning process for implementing climate mitigation actions: establishing timelines for actions, not just goals, to be achieved and developing cost estimates for their actions so they are more easily integrated into the budgeting and capital asset planning processes. Without these key elements, plans ultimately "sit on a shelf" because they do little more than act as a to-do list rather than direct and instruct actions.

Plans themselves were internally inconsistent, with many clearly emphasizing certain areas over others by the apparent level of thought put into developing mitigation policies. While this can hurt the overall quality of the plan and leaves it open to criticism because of inconsistencies or lack of rigour, it can also serve improvements and future planning efforts. Planners, when they eventually become involved in the climate change mitigation planning process, can refer to policy areas or specific actions that have been well developed as models to mimic and combine the various strengths identified here to fill the identified gaps. For instance, cities who do not consider waste management and the vast majority who do not address resource management outside of the tree canopy can look to the few examples highlighted here as a starting point.

1. Future Research

The question of the planning horizon is one I did not consider before this study. The need to act to mitigate the climate crisis is urgent and immediate and our entire way of life requires restructuring of virtually all areas of society and, therefore, plans on a generational timescale seem necessary. Nevertheless, given the constantly evolving state of climate science, of

measurement and reporting of climate change impacts, of emissions reduction progress, it may not be wise or desirable to expend energy on developing strategies that may prove futile in the long run. Setting goals for the long-term is necessary, especially considering scientific evidence pointing to the urgent need for action. However, it may not be sensible to deliberately plan for more distant actions when near-term actions remain less well-defined. Most near-term actions are low-hanging fruit, either by virtue of their relatively inexpensive costs or ease of implementation, and so by the simplicity of their nature should easily be pursued and described in detail.

Areas not examined by this study are the methods for developing the plans, which are usually vaguely described if present at all. Different methods such as interviews with contributors or stakeholders who participated in creating climate action plans in cities might be more appropriate than looking for the information in municipal documents.

Food systems and the production and delivery of our urban food is also only tangentially mentioned in the plans examined. Despite their inclusion in consumption-based inventories for which this study advocates, food and agricultural emissions are not addressed in most municipal climate actions. Agricultural land is sometimes mentioned alongside other "natural" environments for preservation, but the behavioural and economical aspects of food production and consumption are not addressed. It is possible this omission is due that agricultural or rural land is spread out geographically and possibly detached from typical local governments and planning processes. In that regard, a more regional approach could be necessary to truly address the relationship between rural food production and urban food consumption and the emissions they cause together. It's possible the absence or vague mentions of food systems and their components is due to a lack of policy frameworks or existing case studies and pilots on which

cities can base their actions. Research in this area should involve exploration of the link between local government decisions and economic and consumer behaviours surrounding food to determine if and how cities can influence this agricultural land, which generates its own emissions in addition to the embodied emissions from associated activities such as transportation.

A better study would have taken the analysis one step further and investigated capital investment plans or budgets for each city to evaluate whether actions were being incorporated into a city's plan. Other researchers could one day then be able to assemble large enough samples of content analyses and compare them with actions as implemented through the capital investment process and evaluate the causal and other explanatory links between intents and outcomes. This could lead to some of the new methods Talen (1996) described would be necessary to effectively evaluate implementation outcomes.

VI. Bibliography

Baer, William C. "General Plan Evaluation Criteria: An Approach to Making Better Plans." J*ournal of the American Planning Association* 63, no. 3 (1997): 329-44.

Bardach, Eugene. *The Implementation Game: What Happens after a Bill Becomes a Law*. MIT Studies in American Politics and Public Policy; 1. Cambridge, Mass.: MIT Press, 1977.

Bassett, Ellen, and Vivek Shandas. "Innovation and Climate Action Planning." *Journal of the American Planning Association* 76, no. 4 (2010): 435-50.

Berke, Philip, and David Godschalk. "Searching for the Good Plan: A Meta-Analysis of Plan Quality Studies." *Journal of Planning Literature* 23, no. 3 (2009): 227-40.

Betsill, Michele M., and Harriet Bulkeley. "Cities and the Multilevel Governance of Global Climate Change." *Global Governance* 12, no. 2 (2006): 141-59.

Boswell, Michael R., Adrienne I. Greve, and Tammy L. Seale. "An Assessment of the Link Between Greenhouse Gas Emissions Inventories and Climate Action Plans." *Journal of the American Planning Association* 76, no. 4 (2010): 451-62.

Bulkeley, Harriet, and Michelem. Betsill. "Revisiting the Urban Politics of Climate Change." *Environmental Politics* 22, no. 1 (2013): 136-54.

Bulkeley, Harriet, Vanesa Castan Broto, and Gareth Edwards. "Bringing Climate Change to the City: Towards Low Carbon Urbanism?" *Local Environment* 17, no. 5 (2012): 545-51.

Castán Broto, Vanesa and Harriet Bulkeley. "A Survey of Urban Climate Change Experiments in 100 Cities." *Global Environmental Change* 23, no. 1 (2013): 92-102.

Creutzig, Felix, Blanca Fernandez, Helmut Haberl, Radhika Kohsla, Yacob Mulugetta, and Karen Seto. “Beyond Technology: Demand-Side Solutions for Climate Change Mitigation.” *Annual Review of Environment and Resources* 41 (2016): 173-98.

Davis, Steven J., Nathan S. Lewis, Matthew Shaner, Sonia Aggarwal, Doug Arent, Ines L. Azevedo, Sally M. Benson, Thomas Bradley, Jack Brouwer, Yet-Ming Chiang, Christopher T. M. Clack, Armond Cohen, Stephen Doig, Jae Edmonds, Paul Fennell, Christopher B. Field, Bryan Hannegan, Bri-Mathias Hodge, Martin I. Hoffert, Eric Ingersoll, Paulina Jaramillo, Klaus S. Lackner, Katharine J. Mach, Michael Mastrandrea, Joan Ogden, Per F. Peterson, Daniel L. Sanchez, Daniel Sperling, Joseph Stagner, Jessika E. Trancik, Chi-Jen Yang, and Ken Caldeira. "Net-zero Emissions Energy Systems." *Science 360*, no. 6396 (2018): 1419.

Deetjen, Thomas A., Julia P. Conger, Benjamin D. Leibowicz, and Michael E. Webber. "Review of Climate Action Plans in 29 Major U.S. Cities: Comparing Current Policies to Research Recommendations." *Sustainable Cities and Society* 41 (2018): 711-27.

Drummond, William J. "Statehouse Versus Greenhouse." *Journal of the American Planning Association* 76, no. 4 (2010): 413-33.

Fuhr, Harald, Thomas Hickmann, and Kristine Kern. "The Role of Cities in Multi-level Climate Governance: Local Climate Policies and the 1.5 °C Target." *Current Opinion in Environmental Sustainability* 30 (2018): 1-6.

Gallivan, Frank, Jeff Ang-Olson, and Diane Turchetta. "Toward a Better State Climate Action Plan Review and Assessment of Proposed Transportation Strategies." *Transportation Research Record* 1, no. 2244 (2011): 1-8.

Gasper, Blohm, and Ruth. "Social and Economic Impacts of Climate Change on the Urban Environment." *Current Opinion in Environmental Sustainability* 3, no. 3 (2011): 150-57.

Glaeser, Edward L. and Matthew E. Kahn. "The Greenness of Cities: Carbon Dioxide Emissions and Urban Development." *Journal of Urban Economics* 67, no. 3 (2010): 404-18.

Gomez Echeverri, Luis. "Investing for Rapid Decarbonization in Cities." *Current Opinion in Environmental Sustainability* 30 (2018): 42-51.

Grubler, A., X. Bai, T. Buettner, S. Dhakal, D. J. Fisk, T. Ichinose, J. E. Keirstead, G. Sammer, D. Satterthwaite, N. B. Schulz, N. Shah, J. Steinberger and H. Weisz. "Chapter 18: Urban Energy Systems." In *Global Energy Assessment - Toward a Sustainable Future*. Cambridge: Cambridge University Press. 1307-1400.

Haley, Nikki R. “Paris Agreement.” United Nations Communication, New York City, 2017.

Hutyra, Lucy R., Byungman Yoon, and Marina Alberti. "Terrestrial Carbon Stocks across a Gradient of Urbanization: A Study of the Seattle, WA Region." *Global Change Biology* 17, no. 2 (2011): 783-97.

Intergovernmental Panel on Climate Change. *Global Warming of 1.5°C: An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty.* Geneva: IPCC, 2018.

Jones, Christopher, Stephen Wheeler, and Daniel Kammen. "Carbon Footprint Planning: Quantifying Local and State Mitigation Opportunities for 700 California Cities." *Urban Planning* 3, no. 2 (2018): 35-51.

Larson, William, Feng Liu, and Anthony Yezer. "Energy Footprint of the City: Effects of Urban Land Use and Transportation Policies." *Journal of Urban Economics* 72, no. 2-3 (2012): 147-59.

Millard-Ball, Adam. "The Limits to Planning: Causal Impacts of City Climate Action Plans." *Journal of Planning Education and Research* 33, no. 1 (2013): 5-19.

Nowak, D. "Effects of Urban Tree Management and Species Selection on Atmospheric Carbon Dioxide." *Arboriculture & Urban Forestry* 28, no. 3 (2002): 113-22.

Nowak, Greenfield, Hoehn, and Lapoint. "Carbon Storage and Sequestration by Trees in Urban and Community Areas of the United States." *Environmental Pollution* 178, no. C (2013): 229-36.

Pressman, Jeffrey L., and Wildavsky, Aaron B. *Implementation : How Great Expectations in Washington Are Dashed in Oakland : Or, Why It's Amazing That Federal Programs Work at All, This Being a Saga of the Economic Development Administration as Told by Two Sympathetic Observers Who Seek to Build Morals on a Foundation of Ruined Hopes*. 2d ed. Oakland Project Series. Berkeley: University of California Press, 1979.

Seto K. C., S. Dhakal, A. Bigio, H. Blanco, G. C. Delgado, D. Dewar, L. Huang, A. Inaba, A. Kansal, S. Lwasa, J. E. McMahon, D. B. Müller, J. Murakami, H. Nagendra, and A. Ramaswami. "Human Settlements, Infrastructure and Spatial Planning." In *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx. Cambridge: Cambridge University Press, 2014.

Seto, Karen C., Steven J. Davis, Ronald B. Mitchell, Eleanor C. Stokes, Gregory Unruh, and Diana Rge-Vorsatz. "Carbon Lock-In: Types, Causes, and Policy Implications." *Annual Review of Environment and Resources* 41, no. 1 (2016): 425-52.

Steffen, Will, Johan Rockström, Katherine Richardson, Timothy M. Lenton, Carl Folke, Diana Liverman, Colin P. Summerhayes, Anthony D. Barnosky, Sarah E. Cornell, Michel

Crucifix, Jonathan F. Donges, Ingo Fetzer, Steven J. Lade, Marten Scheffer, Ricarda Winkelmann, and Hans Joachim Schellnhuber. "Trajectories of the Earth System in the Anthropocene." *Proceedings of the National Academy of Sciences* 115, no. 33 (2018): 8252-259.

Stone, Vargo, and Habeeb. "Managing Climate Change in Cities: Will Climate Action Plans Work?" *Landscape and Urban* Planning 107, no. 3 (2012): 263-71.

Talen, Emily. "Do Plans Get Implemented? A Review of Evaluation in Planning." *Journal of Planning Literature* 10, no. 3 (1996): 248-59.

Tang, Zhenghong, Samuel D. Brody, Courtney Quinn, Liang Chang, and Ting Wei. "Moving from Agenda to Action: Evaluating Local Climate Change Action Plans." *Journal of Environmental Planning and Management* 53, no. 1 (2010): 41-62.

Unruh, Gregory C. "Understanding Carbon Lock-in." *Energy Policy* 28, no. 12 (2000): 817-30.

Wheeler, Stephen M. "State and Municipal Climate Change Plans: The First Generation." *Journal of the American Planning Association* 74, no. 4 (2008): 481-96.

Whittington, Jan, and Lynch, Catherine. “Climate-Informed Decisions: The Capital Investment Plan as a Mechanism for Lowering Carbon Emissions.” *World Bank Policy Research Working Papers* no. WPS 7381 (2015): 1-34.

Williams, James H, Andrew Debenedictis, Rebecca Ghanadan, Amber Mahone, Jack Moore, William R Morrow, Snuller Price, and Margaret S Torn. "The Technology Path to Deep Greenhouse Gas Emissions Cuts by 2050: The Pivotal Role of Electricity." *Science* 335, no. 6064 (2012): 53-9.

Zimmerman, and Faris. "Climate Change Mitigation and Adaptation in North American Cities." *Current Opinion in Environmental Sustainability* 3, no. 3 (2011): 181-87.

1. Climate Action Plans

City of Alexandria. “City of Alexandria Energy and Climate Action Plan Update.” Government Plan, Alexandria, VA, 2018.

City of Emeryville. “City of Emeryville Climate Action Plan 2.0.” Government Plan, Emeryville, CA, 2016.

City of Evanston and Residential Working Group. “Climate Action and Resilience Plan.” Government Plan, Evanston, IL, 2018.

City of Hoboken. “Hoboken Climate Action Plan and Greenhouse Gas Emissions Inventories.” Government Plan, Hoboken, NJ, 2019.

City of Pittsburgh. “Climate Action Plan 3.0.” Government Plan, Pittsburgh, 2018.

Department of Public Health & Environment, City of Denver. “Denver 80x50 Action Plan.” Government Plan, Denver, 2018.

Envision Charlotte, Carbon Captured Ltd., and City of Charlotte. “Toward Resilience: Strategic Energy Action Plan.” Government Plan, Charlotte, NC, 2018.

The Great Plains Institute. “Climate Action and Resilience Draft Plan.” Government Plan, St. Paul, MN, 2019.

VII. Appendix A: *We Are Still In* Cities

Characteristics of Signatory Cities to the *We Are Still In* Pledge as of February 1, 2019

City name	State	Census region	CAP present?	Year adopted	Plan length (pages)	2017 population estimate (ACS 5-Y)
Acton	Massachusetts	Northeast	No			23,455
Alameda	California	West	No			78,246
Albany	New York	Northeast	Yes	2012	27	98,498
Albuquerque	New Mexico	West	Yes	2008	N/A	556,718
Alexandria	Virginia	South	Yes	2018	70	154,710
Allentown	Pennsylvania	Northeast	No			120,128
Ambler	Pennsylvania	Northeast	No			6,525
Anchorage	Alaska	West	Yes	2019	106	298,225
Anderson	South Carolina	South	No			27,011
Ann Arbor	Michigan	Midwest	Yes	2012	188	119,303
Apalachicola	Florida	South	No			2,257
Arcata	California	West	Yes	2006	74	17,814
Arden	Delaware	South	No			359
Arlington	Massachusetts	Northeast	Yes	2005	63	44,992
Arvin	California	West	No			20,826
Asheville	North Carolina	South	No			89,318
Ashland	Oregon	West	Yes	2017	128	20,733
Aspen	Colorado	West	Yes	2018	55	7,097
Atlanta	Georgia	South	Yes	2015	53	465,230
Augusta	Georgia	South	No			196,899
Austin	Texas	South	Yes	2015	86	916,906
Bainbridge Island	Washington	West	No			23,689
Baltimore	Maryland	South	Yes	2013	88	619,796
Baton Rouge	Louisiana	South	No			227,549
Beaufort	South Carolina	South	No			13,413
Beaverton	Oregon	West	Yes	2014	25	95,710
Bedford	New York	Northeast	Yes	2010	123	17,955
Belfast	Maine	Northeast	No			6,680
Bellingham	Washington	West	Yes	2018	110	85,388
Belmont	Massachusetts	Northeast	Yes	2009	121	27,110
Belmont	California	West	Yes	2017	80	25,965
Berkeley	California	West	Yes	2009	187	120,179
Bethlehem	Pennsylvania	Northeast	No			75,240
Bloomington	Indiana	Midwest	Yes	2018	29	83,636
Boston	Massachusetts	Northeast	Yes	2014	80	669,158
Boulder	Colorado	West	Yes	2017	60	106,271
Bowling Green	Ohio	Midwest	No			31,529
Bozeman	Montana	West	Yes	2011	99	43,132
Breckenridge	Colorado	West	Yes	2019	42	4,833
Bridgeport	Connecticut	Northeast	Yes	2010	100	147,586
Brisbane	California	West	Yes	2015	98	4,642

City name	State	Census region	CAP present?	Year adopted	Plan length (pages)	2017 population estimate (ACS 5-Y)
Buchanan	Michigan	Midwest	No			4,359
Burlington	Vermont	Northeast	Yes	2013	25	42,453
Calistoga	California	West	Yes	2014	42	5,281
Cambridge	Massachusetts	Northeast	Yes	2002	120	110,893
Carmel	Indiana	Midwest	No			88,595
Charleston	South Carolina	South	Yes	2010	187	131,204
Charlotte	North Carolina	South	Yes	2018	120	826,060
Charlottesville	Virginia	South	No			46,487
Chicago	Illinois	Midwest	Yes	2008	60	2,722,586
Chula Vista	California	West	Yes	2017	73	264,101
Cincinnati	Ohio	Midwest	Yes	2018	273	298,957
Clarkston	Georgia	South	No			12,702
Cleveland	Ohio	Midwest	Yes	2018	82	388,812
College Park	Maryland	South	Yes	2015	17	32,186
Columbia	Missouri	Midwest	Yes	2019	50	118,620
Columbia	South Carolina	South	Yes	2018	6	132,236
Columbus	Ohio	Midwest	Yes	2018	123	852,144
Concord	New Hampshire	Northeast	No			42,717
Corvallis	Oregon	West	Yes	2016	81	56,224
Culver City	California	West	No			39,432
Cupertino	California	West	Yes	2015	476	60,687
Dallas	Texas	South	Yes	2015	71	1,300,122
Denver	Colorado	West	Yes	2018	28	678,467
Des Moines	Iowa	Midwest	No			214,778
Detroit	Michigan	Midwest	Yes	2017	80	679,865
Dryden	New York	Northeast	No			2,040
Dubuque	Iowa	Midwest	Yes	2013	136	58,410
Duluth	Minnesota	Midwest	No			86,066
Durham	North Carolina	South	Yes	2007	137	257,232
East Lansing	Michigan	Midwest	Yes	2012	22	48,281
Easton	Pennsylvania	Northeast	No			27,045
Eden Prairie	Minnesota	Midwest	No			63,660
Elgin	Illinois	Midwest	Yes	2011	122	112,628
Emeryville	California	West	Yes	2016	89	11,524
Encinitas	California	West	Yes	2018	97	62,595
Englewood	New Jersey	Northeast	No			28,509
Eugene	Oregon	West	Yes	2010	53	163,135
Evanston	Illinois	Midwest	Yes	2018	43	75,557
Everett	Washington	West	Yes	2011	61	107,560
Fairfield	Iowa	Midwest	Yes	2009	35	10,125
Fairfield	Connecticut	Northeast	Yes	2018	11	61,611
Falls Church	Virginia	South	No			13,843
Fayetteville	Arkansas	South	Yes	2018	90	81,889
Forest Hills	Pennsylvania	Northeast	No			6,439
Fort Bragg	California	West	Yes	2012	66	7,269
Fort Collins	Colorado	West	Yes	2015	56	159,150
Fort Lauderdale	Florida	South	No			177,175

City name	State	Census region	CAP present?	Year adopted	Plan length (pages)	2017 population estimate (ACS 5-Y)
Fort Wayne	Indiana	Midwest	No			262,450
Fremont	California	West	Yes	2012	120	230,964
Gainesville	Florida	South	No			129,394
Gaithersburg	Maryland	South	No			67,417
Garrett Park	Maryland	South	No			1,020
Glendale	Wisconsin	Midwest	No			12,868
Grand Rapids	Michigan	Midwest	Yes	2016	27	195,355
Grandville	Michigan	Midwest	No			15,902
Guilford	Vermont	Northeast	No			2,065
Hartford	Connecticut	Northeast	Yes	2017	80	124,390
Hastings-on-Hudson	New York	Northeast	Yes	2010	16	7,993
Healdsburg	California	West	Yes	2016	370	11,721
Highland Park	Illinois	Midwest	Yes	2017	26	14,250
Highland Park	New Jersey	Northeast	Yes	2007	105	29,796
Hoboken	New Jersey	Northeast	Yes	2019	150	54,117
Honolulu	Hawaii	West	No			990,060
Hood River	Oregon	West	No			7,526
Houston	Texas	South	No			2,267,336
Indianapolis	Indiana	Midwest	Yes	2019	90	853,431
Iowa City	Iowa	Midwest	Yes	2019	85	73,415
Ithaca	New York	Northeast	Yes	2011	17	30,720
Jersey City	New Jersey	Northeast	No			265,932
Kansas City	Missouri	Midwest	Yes	2008	35	476,974
Keene	New Hampshire	Northeast	No			23,204
Kent	Ohio	Midwest	No			29,771
Ketchum	Idaho	West	No			2,718
Key West	Florida	South	Yes	2009	64	25,316
Knoxville	Tennessee	South	No			184,465
Lakewood	Colorado	West	Yes	2015	190	151,411
Lancaster	Pennsylvania	Northeast	Yes	2019	2	59,556
Laredo	Texas	South	No			255,305
Larkspur	California	West	Yes	2010	51	12,367
Lauderhill	Florida	South	No			70,963
Laurel	Maryland	South	No			25,913
Lawrence	Kansas	Midwest	Yes	2008	48	93,954
Lexington	Massachusetts	Northeast	Yes	2018	37	33,339
Little Rock	Arkansas	South	Yes	2018	5	197,780
Long Beach	California	West	No			470,489
Longmont	Colorado	West	No			91,730
Los Angeles	California	West	Yes	2019	154	3,949,776
Louisville	Kentucky	South	No			615,478
Lowell	Massachusetts	Northeast	No			110,964
Lyons	Colorado	West	No			2,085
Madison	Wisconsin	Midwest	Yes	2011	80	248,856
Malibu	California	West	No			12,871
Manhattan Beach	California	West	Yes	2010	31	35,698

City name	State	Census region	CAP present?	Year adopted	Plan length (pages)	2017 population estimate (ACS 5-Y)
Maplewood	Missouri	Midwest	No			7,975
Maplewood	New Jersey	Northeast	No			24,706
Menlo Park	California	West	Yes	2018	18	33,661
Mercer Island	Washington	West	No			24,768
Miami	Florida	South	Yes	2008	42	92,187
Miami Beach	Florida	South	No			443,007
Middletown	Connecticut	Northeast	No			46,747
Milwaukee	Wisconsin	Midwest	Yes	2013	106	599,086
Milwaukie	Oregon	West	Yes	2018	76	20,627
Minneapolis	Minnesota	Midwest	Yes	2013	47	411,452
Moab	Utah	West	No			5,232
Montpelier	Vermont	Northeast	No			7,584
Morningside	Maryland	South	No			1,352
Mount Rainier	Maryland	South	No			8,097
Mount Vernon	New York	Northeast	No			68,671
Mountain View	California	West	Yes	2015	90	80,076
Nashville	Tennessee	South	Yes	2016	48	654,187
New Bedford	Massachusetts	Northeast	No			95,125
New Castle	Pennsylvania	Northeast	No			22,434
New Haven	Connecticut	Northeast	Yes	2017	41	130,884
New Orleans	Louisiana	South	Yes	2017	76	388,182
New Rochelle	New York	Northeast	Yes	2010	156	79,877
New York City	New York	Northeast	Yes	2017	64	8,560,072
Newark	New Jersey	Northeast	Yes	2013	112	282,803
Newton	Massachusetts	Northeast	Yes	2019	49	88,479
Niagara Falls	New York	Northeast	No			48,976
Northampton	Massachusetts	Northeast	No			28,548
Oak Park	Illinois	Midwest	Yes	2011	99	52,229
Oakland	California	West	Yes	2018	141	417,442
Oberlin	Ohio	Midwest	Yes	2013	83	8,317
Orlando	Florida	South	Yes	2018	56	269,414
Palm Springs	California	West	Yes	2013	76	47,140
Palo Alto	California	West	Yes	2016	48	67,082
Park City	Utah	West	No			8,167
Philadelphia	Pennsylvania	Northeast	Yes	2016	103	1,569,657
Phoenix	Arizona	West	Yes	2009	27	1,574,421
Pine Bluff	Arkansas	South	No			44,509
Pittsburgh	Pennsylvania	Northeast	Yes	2018	101	305,012
Portland	Oregon	West	Yes	2015	162	630,331
Princeton	New Jersey	Northeast	Yes	2019	62	30,722
Providence	Rhode Island	Northeast	Yes	2014	71	179,509
Raleigh	North Carolina	South	Yes	2012	80	449,477
Reno	Nevada	West	No			239,732
Richmond	Virginia	South	No			108,853
Richmond	California	West	Yes	2016	427	220,892
Rochester	New York	Northeast	Yes	2017	102	209,463
Rockville	Maryland	South	No			66,420

City name	State	Census region	CAP present?	Year adopted	Plan length (pages)	2017 population estimate (ACS 5-Y)
Sacramento	California	West	Yes	2015	64	489,650
Saint Paul	Minnesota	Midwest	Yes	2019	60	300,820
Salem	Massachusetts	Northeast	No			43,146
Salt Lake City	Utah	West	Yes	2016	26	194,188
San Antonio	Texas	South	No			1,461,623
San Diego	California	West	Yes	2015	74	1,390,966
San Fernando	California	West	No			24,581
San Francisco	California	West	Yes	2017	173	864,263
San Jose	California	West	Yes	2018	260	1,023,031
San Leandro	California	West	Yes	2009	115	89,910
San Luis Obispo	California	West	Yes	2012	91	46,997
San Rafael	California	West	Yes	2019	33	59,180
Santa Barbara	California	West	Yes	2012	142	91,443
Santa Cruz	California	West	Yes	2012	80	63,993
Santa Fe	New Mexico	West	Yes	2018	116	82,980
Santa Monica	California	West	Yes	2019	59	92,495
Santa Rosa	California	West	Yes	2012	235	174,244
Saratoga Springs	New York	Northeast	No			27,682
Schenectady	New York	Northeast	No			65,705
Seattle	Washington	West	Yes	2013	96	688,245
Shaker Heights	Ohio	Midwest	No			27,749
Shoreline	Washington	West	Yes	2013	89	55,431
Snoqualmie	Washington	West	No			12,944
Solana Beach	California	West	Yes	2012	146	13,362
Somerville	Massachusetts	Northeast	Yes	2018	150	79,983
South Bend	Indiana	Midwest	No			101,928
South Kingstown	Rhode Island	Northeast	No			30,712
South Miami	Florida	South	No			12,255
St. Louis	Missouri	Midwest	Yes	2018	96	314,867
St. Petersburg	Florida	South	Yes	2019	68	256,031
State College	Pennsylvania	Northeast	Yes	2007	146	42,224
Sunnyvale	California	West	Yes	2019	64	151,565
Surfside	Florida	South	No			5,844
Swarthmore	Pennsylvania	Northeast	Yes	2006	46	6,243
Syracuse	New York	Northeast	Yes	2012	77	144,405
Takoma Park	Maryland	South	Yes	2014	56	17,643
Talent	Oregon	West	No			6,349
Tallahassee	Florida	South	No			188,463
Tampa	Florida	South	No			368,087
Teaneck	New Jersey	Northeast	No			40,977
Tempe	Arizona	West	No			178,339
Tucson	Arizona	West	No			530,905
Union City	New Jersey	Northeast	No			69,815
Union City	California	West	Yes	2010	202	74,354
University City	Missouri	Midwest	No			34,922
University Park	Maryland	South	No			2,645
Ventura	California	West	No			110,153

City name	State	Census region	CAP present?	Year adopted	Plan length (pages)	2017 population estimate (ACS 5-Y)
Washington	DC	South	Yes	2010	54	672,391
Washington Grove	Maryland	South	No			633
West Hollywood	California	West	Yes	2011	113	36,148
West Palm Beach	Florida	South	Yes	2012	123	106,805
West Sacramento	California	West	Yes	2010	157	52,206
West York Borough	Pennsylvania	Northeast	No			4,580
Westport	Connecticut	Northeast	No			27,777
White Plains	New York	Northeast	No			58,404
Windsor	California	West	Yes	2012	54	27,423
Winston-Salem	North Carolina	South	Yes	2008	43	240,193
Yonkers	New York	Northeast	No			200,999