CAN CITIES ACHIEVE WHAT KYOTO FAILED TO DO?

A CASE STUDY OF SEATTLE'S CLIMATE POLICY

by

Lucy A. Gelderloos

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Lucy A. Gelderloos

has been approved for

The Evergreen State College

by

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Edward A. Whitesell
Member of the Faculty

_____

Date

ABSTRACT

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The proportion of the world's population and its economic activity that is centered in cities is constantly growing. At the same time, as international climate policy negotiations prove disappointing, cities are working to create policies that address climate change at the local level. In many cases, climate policy analysts still focus on the national and international level, but this study joins a growing body of research investigating the processes by which cities have become players on the international climate policy stage, their policy capabilities, and the advantages and disadvantages of making climate policy at the local level. The city of Seattle is a pioneer in this area, having acknowledged the threat of climate change in 1992, made its city-owned electric utility carbon-neutral in 2005, and reducing emissions to 7% below 1990 levels in 2008. This case study of Seattle's climate policy demonstrates that, ultimately, a multi-scale approach to climate policy with cities as key players will be the most effective way to combat global climate change. Cities, driven by concerns about the threats they face from climate change and by the potential for economic and other benefits from implementing climate policies, face unique advantages and disadvantages in the policy process. On the one hand, they are able to take a very fine-grained approach to climate policy, addressing emissions, adaptation, and other concerns at the level of neighborhoods or even individual buildings. They are able to interact with citizens and build trust in a way that is not practical at the state or federal level. On the other hand, cities often lack jurisdiction in key areas, including raising funds. These disadvantages could be counteracted by supporting actions at the regional, state, and national level, while cities' advantages could support policies at those levels, building a comprehensive and robust global climate policy.

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1. Introduction

As of 2008, 50% of the world's population lived in cities, with this percentage estimated to be higher in industrialized countries. In every country, cities are centers of economic and industrial activity (Corfee-Morlot et al., 2009; Friedman & Cooke, 2011). Some researchers estimate that activities within the authority of city governments account for up to 75% of the world's greenhouse gas emissions (Bulkeley, 2010; Satterthwaite, 2008). At the same time that the proportion of the world's population living in cities is growing, national and international governing bodies are in many cases failing to make meaningful progress in reducing greenhouse gas emissions or implementing other sustainable behaviors. The Kyoto Protocol, the first major international agreement on climate change, did not even set emissions reductions targets for many countries, and most of the ones it did cover failed to meet their requirements. On the national stage, results vary by country, but the United States, the world's second-largest emitter of greenhouse gases, has failed to take any meaningful federal action to address climate change.

If we take the view, then, that global problems such as climate change must be addressed at a global scale, with national and international policy initiatives, the situation appears bleak. In fact, however, cities have been taking the initiative and have been addressing climate issues on their own since 1990, when Toronto instituted the first municipal emissions reduction targets (Kousky & Schneider, 2003). For a variety of reasons, ranging from perceived threats from climate change to potential economic and political opportunities, cities all over the world have been working to reduce their greenhouse gas emissions, beginning with their own municipal operations and scaling up

their efforts as the ideas become more accepted. As the world becomes more globalized, cities gain access to more technological, political, and communications resources than ever before, allowing them to make decisions that are often independent of national policy. Cities can use tools such as building codes, road tolling, taxes, and city services to encourage or require climate-friendly behavior from residents and resident businesses, while national politicians negotiate and attempt to toe the party line.

These city policies are not merely stopgap measures, however. Instead, they demonstrate what scholars are increasingly beginning to realize—that, even if there were successful climate policies at the national and international levels, a multi-scale policy approach is the most effective way to tackle this issue. After all, while climate change is a global issue, the greenhouse gas emissions that cause it are undeniably local. And cities have some advantages in policymaking that make them uniquely suited to address some aspects of climate change. For instance, cities can take a much more fine-grained approach to policy, tailoring climate responses to individual neighborhoods or even individual developments. By virtue of being more accessible, city governments may reassure citizens that their concerns are being heard and may be able to encourage people to support climate policies in ways that they might not if the policies came from a higher level of government. Policies developed at the local scale may even be scaled up to regional or even national programs.

Seattle is one of the pioneering cities in the climate policy arena. In 1992, the city council passed Resolution 28546, recognizing global warming and the need for the city to begin reducing its greenhouse gas emissions (Harris, 1992). In 2000, the city set out to make Seattle City Light, the city-owned electric utility, the nation's first carbon-neutral

utility; it achieved this goal in 2005. That same year, Mayor Greg Nickels, frustrated with the United States' failure to sign the Kyoto Protocol, started the US Mayors Climate Protection Initiative, asking mayors around the country to join Seattle in committing to meeting Kyoto's emissions reduction target of 7% below 1990 levels by 2012 (OSE, 2013). Seattle achieved this goal in 2008, and in 2012, the end of the Kyoto commitment period, the city council passed Resolution 31312, which sets a goal for the city and its residents of carbon neutrality by 2050 (Conlin, 2011; OSE, 2013). The city's policy goals are ambitious—it hopes to create a number of high-density, transit-oriented developments that will eventually hold 50% of the city's residents and 80% of its jobs, divert 70% of the city's waste to recycling and composting facilities rather than landfills, and maintain City Light's carbon neutrality. Seattle also plans to work with other regional actors, including King County, the state of Washington, and various public and private entities, to encourage emissions reductions in areas that it cannot control (DPD, 2005; OSE, 2013; Seattle Mayor's Office, 2006).

Seattle's actions raise the central question of this research: is it a good idea to make climate policy at the city level? Are the contributions cities are able to make significant in the long term, and can these policies provide a substitute for meaningful action at the national and international level? The answer appears to be a qualified "yes." City policy cannot be a replacement for national and international policy—there are some aspects of climate change that can only be addressed by a national authority. However, it is equally true that national and international efforts are insufficient, since all greenhouse gas emissions ultimately have a local source and since cities have a huge amount of influence over how their citizens live their lives and go about their business. This

research demonstrates the need for a multi-scale approach to climate policy that integrates the steps that cities are able to take with policies at all levels of government.

This thesis begins with an exploration and a critique of the research that has been undertaken so far on the subject of local-level climate policy, beginning with authors who discuss the new role of national, regional, and local governments in an increasingly interconnected and globalized world. The review of existing research then turns to the process of policy devolution from the national to the local level, as subnational governments use informal policy avenues to fill in the gaps in higher-level climate policy. This leads into the potential advantages and disadvantages of creating policy at the local level, and the desirability of taking a multi-scale approach to climate policy, rather than restricting efforts to either the national or local level. Next, the thesis looks at the process of making municipal climate policy, including how cities make climate change relevant to the city's residents, how city policymakers formulate and implement policies, how those policies are evaluated, and how effective they have been so far. Finally, the literature on Seattle is reviewed, as well as gaps in existing research.

The thesis then turns to exploring Seattle's policy, using a case study approach. After an overview of Seattle's emissions reduction actions, this section provides a background on the city's climate policy before discussing some specific aspects of the policy in the context of previous research and experience, including whether and how the city works with other actors, the way it formulates, implements, and monitors its policies, and obstacles it is facing. This section also reviews Seattle's reasons for addressing climate change, and ways in which the city's culture means that these policies are accepted by its residents. Using the research on Seattle, the thesis then revisits the

potential advantages and disadvantages of making climate policy at the local level, ultimately concluding that a multi-scale approach, where climate policy from the international to the local level is implemented in a complementary way, is the approach that is most likely to be effective. Each level has its own advantages and disadvantages; focusing on only one, as much of the research and as the international policy process has, will not result in robust policy that addresses the growing problem of global climate change.

2. Unobtrusive Climate Policy:

What Cities are Doing and What We Know about It

For over two decades, researchers have been investigating the role that cities can play in global climate change mitigation policy (Betsill & Bulkeley, 2006). They have acknowledged that the unique nature of the climate change problem—one with local causes and global effects—means that it cannot be addressed solely from the international or national level (Betsill & Bulkeley, 2006; Bulkeley, 2005), and that even if an approach oriented entirely toward national-level governments were feasible, action on the national level has been reluctant and insufficient, and progress on the international stage has been sluggish at best (Bulkeley & Betsill, 2003; Corfee-Morlot et al., 2009; Kates & Wilbanks, 2003; Klyza & Sousa, 2008; Koehn, 2008; Lutsey & Sperling, 2008; S. C. Moser, 2007; Rabe, 2007). To wait for meaningful policy leadership from either of these levels is to court disaster. While national and international participation will ultimately be necessary, local governments that want to address climate change are increasingly doing so with little or no policy guidance from higher levels of government.

This leads to the driving question of this research: what can Seattle's climate policy tell us about the ways that cities address climate change and about their effectiveness? If cities, as the literature in this section will suggest, are to be a major player on the climate policy scene, it is important to understand the processes through which municipal climate policy happens (or does not happen). This chapter first describes the theory of environmental governance, where national governments are not necessarily the only or most powerful actors on the environmental policy stage, and the transnational networks that form between cities and that some authors argue are critical to the local

environmental policy process. Next, the chapter explores the policy shift to the city level from the national and international levels, focusing particularly on cities' policymaking processes and the reasons they might have for addressing climate change, as well as looking at advantages and disadvantages of thinking about climate policy on a local scale and what actually happens in the real world when cities try to implement climate policy. The third section of the chapter focuses on what it looks like when cities implement climate policy, including how the policy is framed and localized, how it is formulated and implemented, how it is evaluated, and how often it succeeds. The final two sections explore the small amount of literature that is available about Seattle itself, describing what is missing from the existing research. This literature helps to explain how and why a problem that is clearly global in scale can end up being addressed by governments that represent a tiny fraction of the Earth's surface area.

Environmental Governance and Transnational Networks

Two key concepts can help situate city climate policy in an international framework: the theory of governance and the role of transnational networks. Governance serves as an alternative to traditional theories of international government, which consider official national governments to be the only seat of power. Governance, in contrast, explores the roles that different governments and organizations play in the creation of policies at every level. This interaction is considered especially relevant to environmental policy because of the range of actors whose actions both contribute to and can help mitigate climate change. A type of organization that is particularly relevant to analyses of environmental governance is the transnational network, where entities (such

as cities, for example) that feel that their interests are similar, even though they are in different countries, may work together to set climate goals and share information.

Governance. Most analysis of climate policy has focused on international treaties (Corfee-Morlot et al., 2009). However, in an increasingly globalized world, the roles of governments at different scales are shifting. While national-level governments are hardly irrelevant, they are no longer the only players on the international stage; instead, policy forms and decisions are made in a process "…through which collective goals are defined and pursued in which the state (or government) is not the only or most important actor" (Betsill & Bulkeley, 2006, p. 144). This process is called governance and, under it, supranational governments such as the EU; subnational governments such as cities, states, and regions; multi-government entities such as associations between regions, cities, or countries; and non-governmental organizations may all participate in policy making alongside national governments. These organizations are not restricted to conventional political boundaries—cities may work with NGOs, which may work with regional associations or with governments at all levels. Under this model, power comes less from the ability to use force[1] and more from the ability to coordinate communication and resources (Bulkeley & Betsill, 2003; Corfee-Morlot et al., 2009; Okereke, Bulkeley, & Schroeder, 2009).

This contrasts with the framework used by many, if not most, analysts in recent decades to understand international relations: regime theory. Harriet Bulkeley and Michelle Betsill argue (2006; 2003) that this traditional political science approach, which places power with the national government and views all subnational governments as

[1] This refers to Max Weber's definition of the state: "An *institutionalised* political *organisation* is to be called a *state*, if and only inasmuch as its governing staff successfully claims the monopoly of legitimate physical compulsion for the execution of its ordinances" (1994, p. 379).

acting only under the influence of the national level, is outdated in contemporary conditions. Scales of government no longer represent distinct strata that require the national government to mediate interactions between actors at other levels on the global stage (Bulkeley, 2005, 2010; Parker & Rowlands, 2007; Rice, 2010; Toly, 2008). Regime theory also often fails to take into account internal dynamics within the national government that can make policy outcomes unpredictable. Instead, users of the governance framework argue that governments at all levels, from states to local entities, are dynamic and shifting groups that interact based on many different factors and that influence each other's decision-making. Public and private organizations can wield considerable unofficial influence, further complicating the analysis of the policy process (Bulkeley & Betsill, 2003; Bulkeley, 2010; Corfee-Morlot et al., 2009; Okereke et al., 2009; Parker & Rowlands, 2007). Of these, some of the most important, or at least the most studied, are networks that cities and other organizations form across national boundaries.

Transnational networks. A great deal of the attention being paid to cities and climate policy has focused on the role that international organizations may play in helping cities create these policies. It is true that a large number of cities have joined international organizations, such as Cities for Climate Protection, which can give them access to resources and knowledge, and increase their attractiveness to investors in climate projects (Betsill, 2001; Bulkeley, 2010; Koehn, 2008; Kousky & Schneider, 2003; Lutsey & Sperling, 2008; Rice, 2010). Several authors consider these organizations to be one of the keys to effective city policy (Betsill & Bulkeley, 2004, 2006; Bulkeley, 2010; Kern & Bulkeley, 2009). However, while these organizations are becoming more

widespread, it is not clear what impact they actually have (Corfee-Morlot et al., 2009). Cities cannot make binding commitments to international organizations for constitutional reasons, and participation in international talks is not necessarily a good indicator of domestic policies (McKinstry, 2004; Rabe, 2007). In many cases, programs with incidental emissions reduction, that cities would have implemented regardless of any climate policy commitment, are counted as part of emissions reduction programs. While the emissions reductions are still helpful, they do not represent a causal link between participation in transnational networks and implementation of climate policy (Betsill, 2000, 2001; Lindseth, 2004).

The most important role of international organizations may have more to do with helping cities communicate than with requiring emissions reductions. They can help cities share best practices information and tools for making greenhouse gas inventories through workshops and conferences (Betsill, 2000, 2001; Bulkeley & Betsill, 2003; Bulkeley, 2010; Rice, 2010). This kind of communication can create an environment where cities work together to manage climate resources more effectively than they could individually. Communication can help to build a system where the participants trust each other, which is very important in an issue like this one that can often be nearly overwhelmed by arguments about whether any entity should reduce its emissions if others are simply going to reap the benefits of those reductions without taking actions of their own (Ostrom, Burger, Field, Norgaard, & Policansky, 1999; Ostrom, 2010). Cities are also likely to look to neighbors, or at least cities in the same country, as role models, and city networks can help facilitate this kind of communication (Bulkeley, 2010; Kousky & Schneider, 2003). Conversely, international organizations may be able to

foster competition between cities, which has proven in other contexts to be a powerful motivator for conservation (Ostrom, 2010). While membership in a transnational climate policy network should not be considered evidence of climate action on its own, it is clear that these organizations can play a key role in helping cities develop climate policy.

An understanding of the concept of environmental governance and the role of transnational networks helps situate city-level climate policy within a global context. The next two sections will address how policy actually gets from the national level, where it is generally presumed to reside, to the city level, as well as what it looks like when cities create climate policy.

Policy Devolution and the Policy-Making Process

International and national-level governments have failed to make meaningful climate policy, to the point where many people are questioning whether it is preferable or even possible to make policy at those levels (Bulkeley & Betsill, 2003; Corfee-Morlot et al., 2009; Kates & Wilbanks, 2003; Klyza & Sousa, 2008; Koehn, 2008; Lutsey & Sperling, 2008; S. C. Moser, 2007; Prins & Rayner, 2007; Rabe, 2007). The US federal government in particular, citing economic concerns, has limited its climate action primarily to encouraging research and voluntary greenhouse gas emissions reductions, along with creating tools to track emissions, and it does not appear likely to reverse this position (Engel & Saleska, 2005; McKinstry, 2004; Rabe, 2007). The idea of devolving policy authority from national governments to regional and local governments is not necessarily a new one—the idea that issues should be addressed at the most local level possible because those governments are most aware of local issues and best placed to address them in accordance with local values is well established in US and other politics

(Betsill, 2000, 2007; Koehn, 2008; Sovacool & Brown, 2009). However, in the case of climate policy, this process is not necessarily formal and is often triggered by national governments being perceived to have dropped the ball on climate policy issues. This section explores the reasons that cities might address climate change, the conditions in a city that make climate policies more likely to be made and implemented, the advantages of and disincentives to thinking locally for climate policy and, finally, the potential effectiveness of a multi-scale approach.

Why cities address climate change. Cities generally address climate change for two reasons: because they see benefits beyond emissions reduction (that is, co-benefits) that can come from implementing climate policies, and because they feel threatened by climate change. Of these, potential co-benefits are most influential, but threats are beginning to have a greater effect as the potential destructive power of climate variations becomes clearer, as will be shown below.

Some of the possible co-benefits of climate and environmental policies can include "reduction[s] in traffic congestion, reduced maintenance and operating costs from more energy-efficient technologies, reduced air pollution, and a decrease in the volume of municipal solid waste generated" (Engel, 2005, p. 63). Cost savings are a particularly big motivator, especially in the energy sector, where some cities have been working on measures to increase efficiency for decades (Bulkeley & Betsill, 2003; Bulkeley, 2010; Corfee-Morlot et al., 2009; Kousky & Schneider, 2003). Protecting the environment can also appeal to people on the basis of raising their standard of living, both by increasing public health and by making cities more pleasant to live in (Betsill, 2001; Corfee-Morlot et al., 2009; Koehn, 2008; McKinstry, 2004). One major incentive to creating climate

policy is the possibility of increased economic stability or growth (Betsill, 2001; Corfee-Morlot et al., 2009; Engel & Saleska, 2005). Contractors may find jobs in green building, or cities may start manufacturing green products (Betsill, 2001; Corfee-Morlot et al., 2009; McKinstry, 2004; Rabe, 2007).

Cities may also make climate policy in part because they want to be seen as leaders. Demonstrating that they are on the front line of addressing climate issues can give cities a competitive advantage over nearby rivals when they adopt and adapt to regulations that are not yet widespread, but soon may be (Engel, 2005), or when they demonstrate an ability to partake in increasingly green-focused economic activity (Corfee-Morlot et al., 2009; Koehn, 2008). Environmental protection can also be a selling point when convincing some people or companies to move to the city (Bulkeley & Betsill, 2003). Additionally, many politicians are looking for ways to stand out. Addressing climate policy can be a way for them to do that, whether or not they actually make any changes (Betsill, 2001; Bulkeley, 2010; Engel & Saleska, 2005; Rice, 2010). Perceiving a city as a pioneer can help motivate its politicians and citizens to overcome some of the obstacles to cities addressing climate change (Lutsey & Sperling, 2008).

Perceived threats also serve as a motivator for cities to address climate change. Cities' risks from climate change are the same as the risks of the regions in which they are situated, but their high concentrations of people, activity, and infrastructure make cities especially vulnerable (Bulkeley, 2010; Corfee-Morlot et al., 2009; Mehrotra et al., 2011; Rosenzweig, Solecki, Hammer, & Mehrotra, 2011). Cities can face direct and indirect risks, including "sea-level rise; an increase in the frequency of heat waves, storms, and floods; and more gradual changes that increase risks or exacerbate resource

constraints" (Dodman, 2009, p. 197). Since these risks are unevenly distributed in geographic terms, regional and national-level risk assessments may not adequately address them (Corfee-Morlot et al., 2009). A study by Warden (2011) found that, out of 125 cities surveyed, 25 mentioned potential local consequences as an incentive for them to create climate policy. Climate change's effects are difficult to quantify and to convey to city residents, but their influence in policymaking is growing (Storbjörk, 2007). These negative incentives join the positive incentives of co-benefits to give cities strong reasons to address climate change.

Conditions that encourage climate action. The incentives to address climate change apply to all cities, but not all cities are making climate policy. In fact, there are a few specific conditions that make cities more likely to tackle this issue. A policy champion—a person or group of people advocating a certain policy and organizing others—can be a key factor. While these people are not capable of passing policies without the support of other institutions—support that is often gained through arguments about co-benefits and avoided costs—the role of policy champions is very important (Bulkeley & Betsill, 2003; Bulkeley, 2010; Corfee-Morlot et al., 2009; Kousky & Schneider, 2003; Rice, 2010). Another factor that contributes to climate policy success is the city's experience in making other kinds of policy in a certain arena. For some cities, this means that they build on a history of making environmental policy; many cities have been addressing environmental issues such as water quality for a long time and have built ties to stakeholders and trust among city residents, so they are able to work smoothly in those areas (Betsill, 2000; Bulkeley & Betsill, 2003; Koehn, 2008; Kousky & Schneider, 2003; Sovacool & Brown, 2009). Even when cities' experience is not specifically in

environmental issues, however, there are still policy areas in which they generally have experience, such as building codes and land use requirements, on which they can build policy in new directions (Bulkeley, 2010). These conditions can turn a city from just being aware of climate change to creating policies to address it.

Advantages of thinking local. Early environmental movements integrated public health concerns with the pollution- and conservation-oriented viewpoints we associate with environmentalists today. Those movements focused on cities, as places where many people live and work and where industrial hazards were concentrated, as opportunities for building more holistic communities where people could work, live, and experience nature. However, as the 20th century progressed, this movement more or less split between the professional environmentalists, who want to preserve nature with minimal human interaction, and the social activists who want to improve quality of life for disadvantaged groups (Gottlieb, 2005). While there are still many local-level activists who consider the two issues connected, in the contemporary environmental mainstream, cities have not been considered prime targets for environmentalist and conservationist goals (Bulkeley & Betsill, 2003; Gottlieb, 2005). However, the global population is becoming increasingly urban. Concentrated populations mean cities are also concentrated areas of energy and resource consumption, waste generation, water use and treatment, and industrial activity, all of which affect ecosystems near and far (Bulkeley, 2010). In the face of continuing insufficient action on the national and international scales, academics are returning, with varying levels of reluctance, to cities as a place to begin addressing climate change.

Cities are more than just "not bad" places to address climate, however; they have several distinct advantages over addressing the problem at higher levels. First, working at the city level can account for more local variations in economic, population, and climate patterns. Second, cities have authority in policy areas that can have a significant impact on emissions and other environmental issues, and have been making policy in these areas for a long time. Third, cities can serve as testing grounds for various different approaches to climate policy that can, if successful, be scaled up to regional, state, and national levels. Finally, people tend to trust local regulators more than regional or national ones; trust that policies are being made for the good of the local population can increase compliance and decrease implementation costs.

Generally, people talk about climate change in terms of global or national greenhouse gas inventories. These analyses, however, cannot take into account local-level variations in climate and in economic and social patterns that could be driving emissions differently. Understanding what forces affect the ways that cities emit greenhouse gases can help policymakers craft policies that are relevant to the city and therefore more likely to succeed (Corfee-Morlot et al., 2009; Kates & Wilbanks, 2003; Sovacool & Brown, 2009; Young, 2002). Local and regional efforts can match policies to "specific geographic, climatic, economic, and cultural conditions" (Corfee-Morlot et al., 2009, p. 30). A relevant example can be seen in fisheries, where national and international efforts to govern have not succeeded in accounting for local variations and customs (Ostrom, 2010). Cities provide a good compromise in this area, because they are large enough to work with stakeholders, but small enough to implement very local changes. It is becoming more and more obvious that we need local and regional

knowledge and input for successful climate policies, and that climate policies work much better when they account for local variations (Corfee-Morlot et al., 2009; Young, 2002).

Cities' authority can be fairly limited (as discussed further below), but the areas they generally have control over—building codes, waste management, energy regulation, public transportation, and land use planning, for example—can have a significant impact on a city's emissions (Betsill, 2000, 2001; Bulkeley & Betsill, 2003; Corfee-Morlot et al., 2009; Koehn, 2008). Moreover, cities have been working on environmental problems in these areas for decades (in the case of air pollution, for example) and sometimes centuries (in the case of waste management and disposal). This means that, while cities may not have a great deal of experience working specifically with mitigation of greenhouse gas emissions, they have extensive experience with the resources and mechanisms available and required to address citywide environmental problems (Bulkeley & Betsill, 2003). Cities have also demonstrated their ability to address major environmental emergencies when it becomes clear that they must (Kates & Wilbanks, 2003).

As discussed above, cities often look to other cities in their area for best practices information and advice on how to implement policies. However, there is another way that cities can impact climate policy outside their borders. Supporters of city action on climate change argue that successful city policies can encourage action at higher levels of government. There are several avenues through which this could happen. For instance, an unequal regulatory playing field could push interest groups to lobby regional and national governments to standardize environmental regulations, or producers of environmentally-friendly technologies could work to expand markets for their goods (Engel & Saleska, 2005; Engel, 2005). Also, city policies can provide templates for regional and national

policies, demonstrating what kinds of policies work so that higher level governments are more open to implementing them; this can also save a great deal of money and time, as an unsuccessful policy on the city level is likely to do much less damage than one on a national or international level (Bulkeley & Betsill, 2003; Corfee-Morlot et al., 2009; Engel & Saleska, 2005; Engel, 2005; Kousky & Schneider, 2003; Lutsey & Sperling, 2008; McKinstry, 2004; Ostrom, 2010; Selin & VanDeveer, 2007; Sovacool & Brown, 2009). Finally, involvement by city residents can encourage lobbying for action on other levels, pushing issues onto regional and national agendas (Betsill, 2000; Bulkeley & Betsill, 2003; Corfee-Morlot et al., 2009; Sovacool & Brown, 2009). Some argue that there isn't a great deal of evidence that local policies have affected national ones in the past (S. C. Moser, 2007), but many others disagree (Bulkeley & Betsill, 2003; Corfee-Morlot et al., 2009; Engel, 2005; Kousky & Schneider, 2003; Lutsey & Sperling, 2008; McKinstry, 2004; Rabe, 2007). A particular advantage to using cities as testing grounds is the fact that national and international organizations generally follow the lead of climate policy analysts in discounting cities as a place to make climate policy, focusing partisan attention away from local activities; this gives city policies a better chance to be implemented and tested with much less contention (Betsill, 2000; Bulkeley, 2010; Engel & Saleska, 2005; Rabe, 2007).

Another advantage of working at the city level is increased trust from the populace. When people feel that laws are just, they are more likely to follow them. They are more likely to feel laws are just if the laws are made by people they trust, and they are more likely to trust local officials. Local officials are seen as being more understanding of local problems and easier to approach (Kates & Wilbanks, 2003; Sovacool & Brown,

2009). Local-level action can lead to interaction between experts and local stakeholders; if there is some regional autonomy to carry out policies, and if those interactions are institutionalized, they can be effective to the point that social norms encouraging climate protection may evolve. Early action can create a "virtuous policy circle," which could open the way for more policy in the future (Corfee-Morlot et al., 2009). Government policies that people approve of and that are perceived to be fairly enforced generate a feeling that people should comply, significantly reducing both social and economic enforcement costs (Ostrom, 2010).

These advantages, coupled with the potential recognized by older environmental movements for cities to become environmentally healthy communities, show that cities should not be considered a last-ditch venue for climate policy, to be used only when all others fail. Rather, they should be integrated into climate policy planning and analysis so that policymakers can take full advantage of their strengths.

Disincentives to thinking local. While there are many advantages to thinking about climate policy on a local scale, there are also some obstacles that are unique to cities and that can hinder the policy process. The main obstacles that cities face when addressing climate policy are a focus on short-term results, budget constrictions, a lack of appropriate institutional infrastructure, disagreement about where emissions come from and whom they belong to, and jurisdictional concerns. Debates can include whether to count the emissions of people who commute to or from the city, as well as lifecycle emissions of goods imported for use by city residents, and analysts also have to determine who is "responsible" for each emissions source (Betsill, 2000; Corfee-Morlot et al., 2009; S. Kennedy & Sgouridis, 2011; Rice, 2010; Schaltegger & Csutora, 2012).

Cities can run into issues with implementation because of their relatively limited jurisdiction. In the US, states determine how cities are allowed to raise money (Bulkeley & Betsill, 2003). Cities generally have authority in the areas of energy, building codes, land-use planning, and waste disposal (Bulkeley, 2010; Friedman & Cooke, 2011). However, even these powers exist within a regional or national setting, and higher-level governments may have different priorities than the city do, and they may not welcome city action (Bai, 2007; Bulkeley & Betsill, 2003; Bulkeley, 2010; Corfee-Morlot et al., 2009; Kates & Wilbanks, 2003). Cities may even be legally barred from taking desired actions; for instance, they cannot make binding agreements with cities in other countries because, constitutionally, only the federal government is allowed to make treaties. The Clean Air Act expressly disallows fuel efficiency standards at other than the federal level, and taxes cities might want to implement can be legally challenged for "discriminating" against commerce (Corfee-Morlot et al., 2009; McKinstry, 2004). These confusions over jurisdiction can have negative impacts on both climate policy and industry by creating a patchwork of different regulations, making it unclear which jurisdiction is responsible for regulating what activity, and leading to expensive duplication of regulatory efforts (Corfee-Morlot et al., 2009; Lutsey & Sperling, 2008). There are also problems that cities would not be able to address unilaterally even if they had the authority. Large-scale traffic congestion, for instance, often occurs between cities, and needs to be addressed on a regional or national level (Betsill, 2001). Also, suburban residents use city services and emit greenhouse gases (GHGs) in cities, but are not subject to city laws and do not pay city taxes (Bulkeley & Betsill, 2003). Two of the most common reasons that climate policies fail to achieve their goals is that they are not appropriate to the jurisdiction of the

entity making them—policy makers sometimes bite off more than they are allowed to chew—and that they do not have support from the jurisdictions that do have power over those areas (Bailey, 2007; Kates & Wilbanks, 2003; Sovacool & Brown, 2009). Because of this, city efforts are often limited to municipal activities, rather than attempting to regulate the community (Bulkeley & Betsill, 2003).

Even if cities overcome these obstacles, there is a danger in basing national or regional climate policy entirely on local actions. Working only at the local level can create a patchwork of requirements across geographic boundaries, which may simply result in polluting industries moving from one city to another. This may reduce the emissions of one city, but does not lower the overall amount of CO_2 going into the atmosphere (Bulkeley & Betsill, 2003; McKinstry, 2004; Sovacool & Brown, 2009). There can also be inefficiencies when working only at the local level. Independent regulators can duplicate work or have to renegotiate things that others have already dealt with. It is not efficient for every city to recalculate, for example, the amount of CO_2 in a gallon of gas (Sovacool & Brown, 2009). These concerns suggest that, while a local-only climate policy is better than nothing, an approach that takes into account the strengths of all policy scales would be the most effective.

A multi-scale approach. The combination of advantages and disadvantages of addressing climate change at the local level has led many analysts to suggest that a multi-scale approach would be the most effective in addressing this issue. They argue that we need action at every level—from the international to the individual—to create an effective response. Without federal action, local efforts will not have the authority, capacity, or resources to succeed (Bailey, 2007; Corfee-Morlot et al., 2009). Federal and

global policies have the advantages of consistency, economy of scale, and a minimization of free-rider issues (Sovacool & Brown, 2009). They can also deal with problems on the scale of entire ecosystems (Young, 2002). National governments could encourage action on the local level by instituting tax incentives, fees for emissions, more stringent vehicle standards, and mandatory emissions limits, thereby helping local actions mesh with regional and national climate regimes (Corfee-Morlot et al., 2009; Kates & Wilbanks, 2003). On the other hand, local action can improve diversity, flexibility, and accountability, and local governments are more attached to and knowledgeable about local systems (Kates & Wilbanks, 2003; Sovacool & Brown, 2009; Young, 2002). The key, therefore, is to allocate policy tasks to the level best equipped to handle them (Young, 2002). This combined approach has the best chance of transmitting lessons learned at the local level to the national and international levels, while providing local policies with the support they need (Corfee-Morlot et al., 2009; Dernbach, 2000; Kates & Wilbanks, 2003; Ostrom et al., 1999; Ostrom, 2010; Prins & Rayner, 2007; Young, 2002).

This kind of cooperation must be pursued before the local and national levels become so disconnected that they have a difficult time working together again. Devolution has progressed to the point that much local-level activity is mostly or entirely decoupled from national policy and, at this point, it may be difficult to return authority to the national government (Corfee-Morlot et al., 2009; Klyza & Sousa, 2008; S. C. Moser, 2007; Parker & Rowlands, 2007). This can become a problem for cities and other entities because policy pathways outside of the national government can be less legally robust and more open to challenge (Klyza & Sousa, 2008).

What Does it Actually Look Like When a City Implements a Climate Policy?

Framing and localizing climate change. A recurring theme in existing research about local level climate policy is the idea that climate change must be framed as a local issue in order for city policies to be successful. Climate change on a global scale is often seen as more abstract than concrete; successful climate policy requires that citizens see it as relevant to their own lives and activities (Kates & Wilbanks, 2003; Rice, 2010). One of the primary ways this can happen is by using CO_2 emissions as a measurable representation of the amount of environmental damage that city and citizen activities might cause (Bulkeley & Betsill, 2003; S. Kennedy & Sgouridis, 2011; Rice, 2010). This process makes the abstract of carbon molecules in the atmosphere relevant to actual processes happening within the boundaries (and therefore, control) of the city and its residents (Rice, 2010).

Using local issues as "hooks" can also bring climate change down to a meaningful level for cities and their residents, bypassing the seemingly insurmountable issue of global emissions, in order to make policy changes seem more achievable (Bai, 2007; Betsill, 2000, 2001; Corfee-Morlot et al., 2009; Kates & Wilbanks, 2003; Lindseth, 2004). People who understand the benefits to themselves of preserving a resource are much more likely to want to preserve it and, while understanding the threat from climate change is the first step in addressing it, research has shown that, when it comes to policy implementation, political will is more important on the city level than scientific knowledge of the threat (Betsill, 2000; Kates & Wilbanks, 2003; Kousky & Schneider, 2003; Lindseth, 2004; Ostrom et al., 1999; Prins & Rayner, 2007). In fact, some authors argue that "…the most effective way to get municipal governments to mitigate global

climate change is by *not* talking about global climate change" (Betsill, 2000, p. 24, emphasis in original). Instead, climate policy advocates should focus on the threats individual cities face from climate change and the benefits they may get from implementing climate policy. A vague global threat holds much less motivational power than more specific concerns (Betsill, 2000).

Emphasizing co-benefits can also be important because the effects of climate legislation are not immediately apparent at the local level and, in some cases, ideological issues can make policies that are explicitly climate oriented untenable. By basing climate policy on issues that are already on local agendas, and framing it as a way to address those issues, policy advocates may be able to avoid this pitfall (Betsill, 2000; Koehn, 2008).

Formulating and implementing policy. The process of policy formulation usually begins with "…the establishment of an expert body or commission composed of stakeholders and policy leaders who meet to discuss goals, potential areas of action, priorities, implementation strategies and monitoring mechanisms" (Corfee-Morlot et al., 2009, p. 33). Once the group has agreed on what the problem is, they will try to develop a policy that has benefits in multiple areas and that can take advantage of existing infrastructure to the greatest extent possible (Corfee-Morlot et al., 2009; Engel & Saleska, 2005; Kousky & Schneider, 2003). The planning process must also include metrics and benchmarks, which have to be based on a GHG inventory (Corfee-Morlot et al., 2009).

The implementation of climate policy is obviously a key part of the process, but less has been written about the ways that cities implement policy in environmental

arenas, as opposed to other areas. As illustrated in Table 1, cities can take several roles in implementation: direct, enabling, providing, or regulating (Corfee-Morlot et al., 2009).

Table 1: City Roles in Policy Implementation.

Role	**Characteristics**	**Examples**
Direct	City limits emissions from municipal buildings and activities, often getting financial benefits from energy savings; this is the most common form of city action, since it doesn't require cooperation or permission from other actors.	Denver, CO installs LED lights in traffic lights and "Don't walk" signs (Betsill, 2000). Local governments in Germany and the UK purchase renewable energy and create green energy demonstration projects (Bulkeley & Kern, 2006).
Enabling	City works with private and community actors to help them reduce their emissions.	Portland, OR develops and implements green building program (Corfee-Morlot et al., 2009). Local governments in the UK work with private partners to help fulfill their requirements under national law (Bulkeley & Kern, 2006).
Providing	City uses its resources to provide material and infrastructure support to encourage some actions and discourage others.	Fort Collins, CO reduces VMT by four million miles by providing van service (Betsill, 2000). Portland, OR diverts methane from landfill to use as a residential energy source (Betsill, 2000).
Regulating	City uses its powers to mandate climate-friendly activities.	St. Paul, MN uses building codes to mandate energy efficiency, achieves "substantial" CO_2 reductions (Betsill, 2000). Waterloo, ON, Canada institutes water efficiency measures (Parker & Rowlands, 2007).

They can take a direct role, limiting their own consumption and emissions, often getting financial benefits from energy savings. This is where most cities start, since it is in this area that they have the most authority. Some of the earliest cities to address climate change began implementing changes to their own operations in the 1990s. Many cities stay in this stage, and never make significant inroads into managing activities

outside of their own estate (Bulkeley, 2010). Cities can also take an enabling role, where they work with private and community actors to help them reduce their emissions. Bulkeley and Kern (2006) explore this, as well as the other four modes of government, in their paper on local-level climate government in the UK and Germany. Cities can take a provider role, where they use city services to provide material and infrastructure support (or lack thereof) to encourage certain actions and discourage others. Finally, they may act as regulators if they have the jurisdictional authority to do so.

Quite a few authors, using multilevel governance or similar frameworks, have explored how cities have been working with a variety of stakeholders whose support is crucial to successful environmental policy. The most successful city policies will have support and cooperation from various actors (Lindseth, 2004; Ostrom et al., 1999). Cities can engage with private actors to build tools for assessment of greenhouse gas emissions, or they can work with institutions such as universities, both to build knowledge and to help the universities reduce their own emissions (Bulkeley, 2010; Koehn, 2008). Cities can serve as facilitators for actions by other stakeholders (Bulkeley & Betsill, 2003; Corfee-Morlot et al., 2009). Private and other non-governmental actors can help coordinate policies and test new ones, provide information, and create networking opportunities (Corfee-Morlot et al., 2009). This view acknowledges the reality that government and society are closely intertwined; while this is true at all levels, it is perhaps more obvious at local levels, where there can be more direct interaction between all actors (Corfee-Morlot et al., 2009; Okereke et al., 2009).

Cities can face a number of obstacles to implementing effective policy. While many of the city officials who implement policies are unelected, the ones who actually

push for and make policies generally often have relatively short terms in office. This means that they tend to focus on programs that have short-term, visible results, even if this results in a patchwork policy environment rather than a comprehensive, long-lasting one (Bai, 2007; Corfee-Morlot et al., 2009). As with any policy issue, budgets also play a major role in how and whether climate policy is made. Even the most powerful issue champion will not be able to save climate policies in the face of a lack of funding, and these programs are often seen as expendable when cities are looking for places to make cuts (Betsill, 2001; Kousky & Schneider, 2003). Climate policies may also require significant upfront investments, which cities are unwilling to make all at once, so officials often have to make small, piecemeal improvements (Betsill, 2000; Bulkeley, 2010). Climate policy can also suffer from a lack of an institutional home. Many cities have long-established political structures, where separate departments with clearly delineated duties rarely collaborate in the way that climate policy requires (Betsill, 2000, 2001). Environmental protection often falls under the jurisdiction of several of these departments (waste, transportation, etc.), so climate policy may not have an explicit "institutional home" or dedicated staff, which is essential to creating effective policy (Bailey, 2007; Betsill, 2000, 2001; Bulkeley & Betsill, 2003). As the number of departments involved in climate policy increases, management schemes become less effective (Ostrom et al., 1999). Even when there is an environmental department that is not a subdivision of another department, it is often marginalized in terms of power and budget (Bulkeley, 2010; Corfee-Morlot et al., 2009). This can be a major barrier in creating climate policy—environment departments may not have the financial, personnel,

or technical resources to create good policies, and may not have the jurisdiction to implement them (Betsill, 2001; Bulkeley & Betsill, 2003; Bulkeley, 2010).

Evaluating policy. Most large-scale city climate policies were launched fairly recently and have not been evaluated. However, evaluation is necessary to ensure that cities are actually making progress, rather than simply developing goals that look good on paper (Corfee-Morlot et al., 2009). The many co-benefits of climate policies may also mean that related policies may be redefined as climate-related once a city decides to address the issue, and there is not really a comprehensive assessment protocol to prevent this (Bai, 2007; Engel & Saleska, 2005; S. Kennedy & Sgouridis, 2011; Lindseth, 2004). One key to successful climate policy is having an inventory of greenhouse gas emissions. Without this inventory, there is no way to understand what areas programs should target and whether they are working, which may reduce incentives to continue the programs (Bulkeley & Betsill, 2003). Unfortunately, there is no widely-accepted standard for city emissions inventories, so cities have to use substitute metrics, such as vehicle miles traveled, and have to come up with their own way to decide what emissions are "theirs" and what belong to other jurisdictions (Bailey, 2007; Rice, 2010). Developing a common set of metrics would allow cities to compare their emissions with other cities, and with their own past emissions; it might also allow for recognition of their emissions reductions under the Kyoto Protocol (Corfee-Morlot et al., 2009).

How often do they succeed or fail? At this point, there is not a great deal of information about whether city climate programs are succeeding. This is in part because policy impacts are difficult to measure in any context, and in part because people who are studying changes in cities' emissions inventories have not taken the further step of

linking those changes to climate policy within the city (Bulkeley, 2010). Most large-scale policies are still quite new, as well, so there hasn't been time to evaluate them properly (Corfee-Morlot et al., 2009). However, what research has been done suggests that, generally, urban climate policies have not had as much of an effect as was intended (Bailey, 2007; Corfee-Morlot et al., 2009). While city reductions may be significant relative to cities' previous impacts, they have not been hugely significant to the global problem (Kousky & Schneider, 2003). Their biggest effect may be contributing to a policy atmosphere of reductions (Engel, 2005). This is not unique to cities—worldwide, only three countries met their UNFCCC (United Nations Framework Convention on Climate Change) goals for GHG reductions, and this had more to do with economic circumstances than with emissions reduction policies (Bulkeley & Betsill, 2003). However, there are some documented cases of cities making some significant reductions (Corfee-Morlot et al., 2009; C. Kennedy, Demoullin, & Mohareb, 2012). For example, in the period between 2004 and 2007, Berlin reduced its emissions by 5.07% while its population grew by 0.15%. During the period between 2005 and 2009, New York's population grew by 1.37% but the city reduced its emissions by 2.65% (C. Kennedy et al., 2012).

Adaptation

In the literature about cities' approach to climate change, there is a striking division between discussions of possible mitigation actions and possible adaptation actions. The majority of the literature to date that discusses city climate policy focuses on the mitigation side, discussing what cities can do to reduce their carbon footprint and their impact on the global climate (Bulkeley, 2010; Heinrichs et al., 2011; C. Moser,

2011). This mirrors the international approach to climate change, where talking about adaptation is considered secondary, and is often explicitly discouraged by members of the climate change community as distracting from the more pressing need for agreements on mitigation (Heinrichs et al., 2011; Prins & Rayner, 2007). However, even if global greenhouse gas emissions were to drop to the Kyoto goal level tomorrow, the accumulation of gases in the atmosphere to date means that we are committed to some level of warming (Heinrichs et al., 2011; Ostrom, 2010; Prins & Rayner, 2007). Indeed, Corfee-Morlot, et al. argue that "climate-related disasters may already account for the majority of urban disasters" (2009, p. 19).

Additionally, a number of authors are questioning the Kyoto-style approach, which not only focuses entirely on emissions but also hinges on international agreement to set emissions reduction goals. The process has been excruciatingly slow, and the requirement for international agreement means that negotiated targets are often ultimately inadequate to address the actual scale of the problem (Bulkeley & Moser, 2007; Prins & Rayner, 2007). Prins and Rayner (2007) go so far as to argue that Kyoto was doomed from the start, due to a fundamental misunderstanding of the type of problem that climate change is, and that it has wasted crucial resources that could have gone toward making a real difference. While most other authors do not go quite this far, many agree that Kyoto has failed to achieve what it set out to do, and that a new approach to both research and implementation that includes adaptation is necessary (Corfee-Morlot et al., 2009; Dodman, 2009; Heinrichs et al., 2011; Kates & Wilbanks, 2003; Rabe, 2007; Storbjörk, 2007).

In many cases, cities have already embraced this message, and are including adaptation in their climate policies in increasing numbers; in fact, Storbjörk notes that "recent research [shows] that adaptation to current climate variability is more common than concrete initiatives related to climate change" (2007, p. 458). Several authors note that some adaptation measures can even serve as gateways to more comprehensive climate policies by linking issues that city residents directly experience, such as extreme weather, to climate change (Bulkeley, 2010; Heinrichs et al., 2011; Storbjörk, 2007). This increased awareness of their vulnerability to climate change can make city residents more receptive to other climate-related policies, including mitigation measures (Heinrichs et al., 2011).

There is still a great deal missing from the literature on how cities are considering adapting to climate change. A particular issue is that the literature still treats mitigation and adaptation as separate strategies when, realistically, they are likely to be implemented together, or at least as complementary strategies (Corfee-Morlot et al., 2009; Dodman, 2009; Prins & Rayner, 2007; Storbjörk, 2007). For instance, adapting to potential energy instability could mean increasing efficiency and installing smaller, renewable, local energy sources. This could make a city's electric grid more flexible and therefore more able to handle future climate-related uncertainties, and would also reduce its emissions (Prins & Rayner, 2007).

Seattle

There is not a great deal of peer-reviewed literature available on Seattle's approach to climate policy. Jennifer Rice (2010) wrote perhaps the only article dealing exclusively with the city's climate policy process. She describes the process through

which Seattle's city and citizen activities became "carbonized"—that is, explicitly linked to climate change through the amount of CO_2 they produce. Two other papers use Seattle to illustrate some key concepts. Corfee-Morlot, et al. (2009) described the process of creating Seattle's Climate Action Plan, in which a policy champion or entrepreneur (in this case, Mayor Greg Nickels) put together a Green Ribbon Commission including people from a variety of backgrounds to study which activities should be addressed and to develop recommendations as to how to address and assess them. In the other paper, Bailey (2007) described some of the specific actions taken by the city to reduce GHG emissions from its municipal operations.

What is Missing from the Literature?

The biggest gap in the literature is a lack of assessment of how well city programs actually work. There is plenty of research that supports action on the local level, but most analysis has consisted of descriptions of or recommendations for programs, rather than studies of whether they work (Parker & Rowlands, 2007). There is a lot of literature that looks at what cities say they are going to do, but much less on whether they have actually achieved those goals. There is also very little literature that deals with the social implications of emissions reduction or adaptation actions. A key exception to this rule is Caroline Moser's work on developing a framework for climate policy that would combine adaptation actions with policies to reduce the potential for vulnerable populations to suffer when cities implement new policies (2011). The rest of the literature reviewed for this study, however, either bypasses discussions on equity altogether or lists it as something that cities should do without exploring how they would.

Conclusion

It is clear from this literature that, if cities are not supposed to be addressing climate change, nobody told them about it. Cities all over the world have begun instituting climate policies, ranging from reducing emissions from their own operations to partnering on renewable energy projects, to committing to carbon neutrality goals. The literature shows us that these cities, both alone and in partnership with others through transnational networks, are becoming players on the international stage in their own right, taking on policy issues that analysts had previously assumed to be entirely within the purview of national or international governments. Cities are aware of the threats they face from climate change and the potential economic and social benefits of implementing sustainable, climate-friendly policies. They work to connect climate change to the actions of their citizens and of the businesses in their borders. While they only represent a tiny fraction of the earth's surface, cities have shown that they can use their economic and political power to have a significant effect on climate change.

The literature reviewed here provides a fascinating suggestion of how cities can address climate change, but the only way to know if the suggestions are accurate are to examine how they apply to real world cities. The next part of this research does just that, by reviewing emissions inventories and policy documents published by the city of Seattle. The literature suggests that the city's policies will follow certain patterns, face certain obstacles, and be inspired by certain motivations. If the literature accurately describes the past processes of climate policy in the city, it is likely that we can use it to analyze the existing system and create a framework for the maintenance and implementation of a successful climate policy structure.

3. Addressing Climate Change in the Emerald City

This study seeks to understand whether addressing climate change at the city level is an effective use of policy and other resources. To do so, it investigates various aspects of Seattle's climate-related policies and, to the extent possible, the outcomes of those policies. This section begins with a review of Seattle's emissions inventories, demonstrating that emissions have been declining but that the city will face challenges in the future relating to continued economic and population growth. The section turns next to climate policy, first providing an overview of the city's policies, including the mix of mitigation and adaptation policies the city is pursuing, and then exploring some specific facets from the literature, including how the city works with other actors, how it formulates, implements, and assesses its policies, and obstacles it faces. In these areas, Seattle's experience generally supports the literature, but there are some differences, particularly in the very small role played by transnational organizations. Next, the section looks at city policies in context, including why Seattle chose to address climate change, the ways that the city's culture has encouraged climate action, and the city's interdisciplinary approach. Finally, the section explores what Seattle's experience says about the advantages and disadvantages of thinking locally, demonstrating that, while local-level climate policy is desirable, the best approach to climate change is covers multiple scales, using the strengths of each one to compensate for the weaknesses of the others.

This study uses a case study method to address data both about Seattle's greenhouse gas reductions and about the city's motivations and policy capabilities. Case studies are most appropriate for investigations into present social or political phenomena

over which the researcher has no experimental control. Even if the policies were not already established, it would be impossible for a researcher to attempt to experiment on such a large scale in a process that can affect the lives of so many people. A case study is also the best method for dealing with multiple sources of data, as is the case in this study. Policy formulation and implementation is a complex process that is best viewed through several different lenses; using different sources of information helps with this. Seattle makes an excellent city for a case study of climate policy because it has a long history of addressing the issue and can therefore show us how the evolution of a city's climate policy can look. It is important to understand the process that early climate policy adapters go through, so that other cities can learn from their successes and failures and do not have to repeat the same mistakes.

The data in this section come primarily from city government documents, including the city's greenhouse gas inventories, its Climate Action Plan (CAP) and associated documents, and its Comprehensive Plan (DPD, 2005; GRC, 2012a, 2012b, 2012c, 2012d, 2012e, 2012f, 2012g, 2012h; OSE, 2013; Seattle Mayor's Office, 2006). The Climate Action Plan was first developed in 2006 from the recommendations of the Green Ribbon Commission (GRC), a group of local business and community leaders. The GRC was convened again in 2012 to update the CAP. The updated version of the CAP (published in April, 2013), the 2006 version, as well as the GRC's meeting notes and ultimate recommendations, provide insight into Seattle's climate policy. The Comprehensive Plan, which was first introduced in 1994 to guide the city's development over the following 20 years, shows how climate policy fits into the city's overall policy

regime. The Comprehensive Plan has been updated multiple times since its introduction, and is still highly relevant to the day-to-day operations of the city.

Seattle's Emissions

The question of whether Seattle has reduced its emissions is relatively easy to address. Seattle has detailed emissions inventories dating back to 1990. While its inventories were originally for municipal activities only, it has since expanded to community inventories, which include emissions from all activities within the city's borders, including those of businesses and residents.[2] Municipal inventories are available for 1990, 2005, 2008, 2009, and 2010, and community inventories are available for 1990,[3] 2005, and 2008, with another one scheduled to be completed at the end of 2013 (OSE, 2005, 2009a, 2011a, 2011b, 2013). This study focuses on the community inventories because not only do they include municipal emissions, but also, the city's policy focus has shifted to include both municipal and community emissions. Ultimately, emissions from municipal activities only make up four percent[4] of the city's total; the city knows that without significant community reductions, it will be unable to make any meaningful contribution to the fight against global climate change (OSE, 2009a, 2011a).

The main concern when determining whether emissions have been reduced over a time period is ensuring that they have been uniformly measured. Since the 1990 and 2005 community inventories were both conducted in 2005, the methodologies can be assumed to be compatible (OSE, 2005). The 2008 inventory follows the same methodology,

[2] For a complete explanation of what emissions the city does and does not measure, see the Appendix.
[3] The 1990 inventory was conducted in 2005 using historical data, to provide a baseline against which to evaluate 2005 emissions (OSE, 2005).
[4] In 2008, municipal emissions totaled 256,900 metric tons of CO_2e; community emissions totaled 6,770,000 tons (OSE, 2009a, 2011a)

though the reporting methods in the publicly available report are slightly different (OSE, 2009a). While this could be problematic when comparing the changes in individual sources of emissions (for instance, transportation emissions in the 2005 report are broken down by whether they are direct emissions, emissions from imported energy, or other, while transportation emissions in the 2008 report are not divided in this way), it allows for a direct comparison of the city's total emissions between the base year of 1990 and the most recent inventory in 2008, showing a drop in total emissions of 610,000 tons, or 7% (OSE, 2005, 2009a).

While emissions come from a variety of sources, Seattle's fall into two main categories—transportation and building operations. In 2008, emissions from transportation made up 62% of total community emissions, while emissions from buildings (using other energy sources such as natural gas for heating) and equipment made up 21% of the total. Industrial activities accounted for the final 17% (OSE, 2009a). Emissions were calculated in a variety of different ways. Road transportation emissions were based on estimates of vehicle miles traveled (VMT)—supplied by the Seattle Department of Transportation (SDOT)—multiplied by average emissions factors[5] for different types of transportation (cars vs. trucks vs. buses). Some numbers were provided directly—for instance, Puget Sound Energy, which supplies the city's buildings with natural gas for heating, was able to tell the city exactly how much natural gas was used by which customers in the target year. Other numbers had to be modified from other sources. In the case of oil heating for the 2008 inventory, the city took statewide oil use data from 2007, scaled them using 2000 census data of the ratio of oil-using homes in

[5] Emissions factors were the same for 2005 and 2008 inventories, and were based on U.S. government estimates.

Seattle to oil-using homes in the rest of the state, and finally extrapolated those numbers based on population growth to estimate the amount of oil used for heating in Seattle in the target year. While this kind of scaling can raise accuracy concerns, the methods used in both the 2005 and 2008 inventories were similar enough to allow comparison between the two (OSE, 2005, 2009a).

In 2005, Seattle set a goal of reducing its emissions to 7% below 1990 levels by 2012 (Seattle Mayor's Office, 2006). The 2008 inventory shows that the city achieved this goal that year. The city plans to complete an inventory of 2012 emissions in late 2013, which will show whether it managed to stay at that level (OSE, 2013). The city continues to grow, and VMT and related emissions actually increased significantly between 2005 and 2007; the fact that there was an overall drop in emissions is due to increased motor vehicle efficiency and reductions made in other sectors. On the other hand, the situation is not hopeless—between 1990 and 2008, per capita emissions dropped 7% in the transportation sector, 21% in the building sector, and 40% in the "industry and other" sector (OSE, 2009a). This drop came alongside a 16% increase in population (OSE, 2005, 2009a). As of the 2009 CAP progress report, the city's per capita carbon footprint was 20% below 1990 levels, but the city keeps growing, which will make meeting targets difficult (OSE, 2010). The city has made significant strides in its own activities, reducing emissions from municipal operations by 77% since 1990, but community reductions are necessary to make a real impact (OSE, 2005, 2009a). We will find out at the end of 2013 whether the city has maintained the emissions reductions it achieved in 2008 in the face of budget constraints and continued growth.

In 2011, with the close of the Kyoto commitment period approaching, Seattle needed a new plan. Accordingly, Seattle City Council passed Resolution 31312, which committed the city to reaching carbon neutrality by 2050 (Conlin, 2011). This commitment is reflected in the city's most recent Climate Action Plan (CAP), published in April of 2013. The city believes that by 2030, "the package of actions detailed in this Plan has the potential to reduce GHG emissions in the passenger transportation and building energy sectors by 62%," which would be a significant step toward carbon neutrality (OSE, 2013, p. 6). However, as discussed in the next section, emissions are only part of the 2013 CAP's focus.

Seattle's Climate Policy

Even the most ambitious climate policy can fail if it is not integrated into a city's operations. This second portion of the chapter provides an overview of Seattle's climate policy, and then explores the process of making that policy and the way that it is integrated into the city's overall policy structure. Data for this portion come primarily from publicly available municipal documents, which were examined to determine whether Seattle's experience demonstrates that local-level climate policy is an effective use of policy and other resources. These documents include Seattle's 2006 and 2013 Climate Action Plans, progress reports from the 2006 Climate Action Plan, the notes and recommendations of the Green Ribbon Commission (GRC) that was convened to update the Climate Action Plan in 2012, other supporting documents, and the city's Comprehensive Plan (the Comp Plan) (DPD, 2005; GRC, 2012a, 2012b, 2012c, 2012d, 2012e, 2012f, 2012g, 2012h; OSE, 2009b, 2010, 2013, 2008; Seattle Mayor's Office, 2006). The Comp Plan is particularly important because it shows the context of Seattle's

climate policies—how much support they get from other city departments, for example, and how they fit into the city's overall growth plan, as well as some idea of how the city works with other political entities such as the state and federal governments. Both the climate policy documents and the Comp Plan will show what the city's priorities are in terms of addressing climate change, what it actually has the authority to accomplish, and what obstacles it faces. The final data source for this project is an interview with a Seattle City Council member, who is active in the city's environmental policy. This provides some perspective that documents cannot. The interview lasted approximately 30 minutes and was semi-structured; the researcher took handwritten notes.

This section will address not only the city's priorities within its climate policies, but the way that climate policy is integrated into the city's overall policy regime. Integration is in fact the key concept here, as recent policies mark a distinct shift from focusing on reducing the city's emissions in the city's first Climate Action Plan (Seattle Mayor's Office, 2006) to creating a resilient, sustainable city (one aspect of which is carbon neutrality) in the city's Comprehensive Plan and the recommendations of the 2012 GRC (DPD, 2005; GRC, 2012a; OSE, 2013). This does not mean that the city is not paying attention to its greenhouse gas emissions; for one thing, emissions provide a metric that is measureable and relatively easy to understand, without which city climate policy could not be successful (OSE, 2009b, 2010). Resolution 31312, passed by the City Council in 2011, reinforces the city's commitment to reducing greenhouse gas emissions and becoming carbon neutral by 2050 (Conlin, 2011). However, the city also recognizes that carbon neutrality is not something that people easily get excited about, while they can easily comprehend the potential benefits of efficient, healthy communities and of

adaptation measures (GRC, 2012e). Emissions reduction has therefore become one of several guiding principles, rather than the city's primary goal (DPD, 2005; GRC, 2012e).

Policy overview.

Seattle's climate policy strives to be as comprehensive as possible. It isn't intended to be "about austerity, wool sweaters, or sitting in the dark," but rather "about creating great places to live, work and play that preserve the environment" (OSE, 2013, p. ii). The two main goals of the 2013 CAP are to "reach Zero Net GHG Emissions by 2050" and "Prepare for the likely impacts of climate change" (OSE, 2013, p. 3). To do this, the plan addresses a wide variety of systems, including transportation, neighborhoods, buildings, energy, and utilities, as well as social concerns, including equity and community involvement in climate policy.

Transportation. Emissions from road transportation made up 40% of Seattle's greenhouse gas emissions in 2008, so it makes sense that the city's policies would focus on this area very closely (OSE, 2013). These emissions come from "cars, trucks, transit, and freight vehicles as they travel through the [c]ity moving people and goods" (OSE, 2013, p. 16). The biggest theme of this element of the policy was encouraging citizens to walk, ride bikes, or take public transit rather than driving to their destinations. By 2030, the city hopes to "reduce emissions from passenger vehicle transportation by 82%, vehicle miles traveled by 20%, and emissions per mile traveled by 75% from a 2008 baseline" (OSE, 2013, p. 19). This is exemplified by the "complete streets" idea, which relies on conceiving streets not in terms of how many cars can use them, but in terms of how efficiently and effectively they can move goods and people from place to place, taking into account all forms of transportation (DPD, 2005; OSE, 2011c, 2013). This is

complicated by the fact that Seattle's streets are already established, so transit improvements will have to work with existing infrastructure (DPD, 2005; OSE, 2010). Recommendations also emphasized improving bicycle and pedestrian infrastructure of all types, including improving sidewalks and trails and expanding a program that helps students get to school safely by walking or biking (DPD, 2005; GRC, 2012e, 2012f, 2012h; Seattle Mayor's Office, 2006). For those situations where biking or walking are not feasible, there were recommendations to increase the frequency and reliability of public transit, while also shifting to hybrid or electric buses to reduce emissions (GRC, 2012a, 2012e, 2012f). A final recommendation was to make non-car transportation a more pleasant experience by making infrastructure as aesthetically pleasing as possible and by using new technologies, including real-time signage and mobile applications, to provide information, such as bus arrival times, that helps residents use transportation more efficiently and makes the experience more pleasant (GRC, 2012a, 2012f, 2012h; OSE, 2013).

In addition to creating more attractive non-car options, there were several measures recommended to make driving and car ownership less attractive. The most potentially effective of these are economic signals, including congestion pricing (putting tolls on roads to discourage driving), which could also generate a great deal of revenue for the city to use for other projects. Unfortunately, the city does not have the authority to implement congestion pricing on the regional roads, whose traffic contributes the most greenhouse gases (GRC, 2012e, 2012f; OSE, 2013; Seattle Mayor's Office, 2006). The city can also regulate on-street parking, banning it in some areas and requiring payment in others (GRC, 2012e). Finally, the city is working with the Department of Energy to

develop infrastructure for electric cars and encourage citizens to buy them (GRC, 2012f, 2012h; OSE, 2013). This approach does raise some concerns, however. Specifically, increasing the cost of driving could disproportionately affect the city's most vulnerable citizens. The city must make sure to improve other transportation options so that the poor and disadvantaged are not left behind (OSE, 2013).

There are a few areas in which the city does not have much control, although it included them in the plan anyway. For instance, the city's progress in emissions reduction would be faster if fuel efficiency standards were to become more stringent. The city does not have a lot of influence over freight, but emissions from heavy- and medium-duty freight trucks account for almost half its transportation emissions. Many actors in the freight community are open to reducing their emissions, and the city can help with that goal by creating infrastructure that is friendly to it—for example, by reducing congestion and lowering the number of passenger vehicles on the road. Other things that can help are flexible programs that encourage climate-friendly actions such as replacing old trucks with newer, more efficient models. Finally, the city can partner with entities such as the Port of Seattle to encourage climate-friendly action, such as building infrastructure that allows cruise ships to connect to the city's power grid when docked rather than idling their engines. Air travel is almost entirely out of the city's control. Its main action in this area, other than spreading information, is trying to reduce emissions from travel by city employees (OSE, 2013).

Neighborhoods. Residents' travel patterns are also affected by where they live. The city's approach to neighborhood development is where we see the most comprehensive policy suggestions, in the form of its urban village designations and

related concepts. This is perhaps the most ambitions section of Seattle's plan. It requires that several departments be involved and that many different segments work together to create a successful outcome. Green space, buildings, transportation, and employment all have to be present and in the right amounts (OSE, 2013). This is also the segment of the plan that is currently attracting the most citizen opposition, as discussed further below.

The urban village concept is most clearly laid out in Seattle's Comprehensive Plan. The idea is that the city can delineate certain neighborhoods and, keeping in mind the area's essential character, influence development to create compact, efficient units within the city where people have easy access to jobs, services, and amenities without having to drive (DPD, 2005). These communities can have multiple benefits beyond reducing greenhouse gas emissions, including improving public health and increasing access to services and amenities (DPD, 2005; GRC, 2012a). By attracting new growth to denser urban developments, Seattle can also help to minimize the impact of new regional residents (DPD, 2005; GRC, 2012h). The urban village strategy is not referenced by that name in the 2006 CAP or in the GRC's recommendations, but the concept of compact neighborhoods developed with transit in mind is a major part of these documents as well (GRC, 2012a, 2012e, 2012f, 2012h; Seattle Mayor's Office, 2006).

To create these compact neighborhoods, the GRC suggested that the city encourage "affordable commercial space and family-sized housing in transit communities through zoning requirements and joint development projects" (GRC, 2012a, 2012e, 2012f, 2012h). Some aspects of this include increasing flexibility of zoning, allowing different kinds and densities of commercial and residential buildings, and paying close attention to pedestrian patterns to make neighborhoods as walkable as possible (DPD,

2005; GRC, 2012a, 2012e, 2012f, 2012h). Eventually, the city hopes to locate 45% of citizens and 85% of jobs in Urban Centers and urban villages (OSE, 2013).

Buildings. Buildings are the second-highest contributor to Seattle's total greenhouse gas emissions at 21% of the total. While creating compact neighborhoods decreases the absolute number of buildings the city's residents and businesses need, those buildings still need to be energy efficient. The city believes the best way to increase building efficiency is through a combination of "information, incentives, and performance requirements" (OSE, 2013, p. 33). The biggest complication in building efficiency is that most of the buildings that will be in use in Seattle in the coming several decades have already been built (GRC, 2012a, 2012c; OSE, 2013). This means that it is not sufficient to focus only on new construction; people have to be encouraged to retrofit with incentives such as attractive financing and pricing and efficiency gains. If these don't work, the city may have to turn to mandates in the form of modifying the building codes that govern remodeling (GRC, 2012a, 2012c, 2012d, 2012f, 2012h; OSE, 2013). Energy efficiency requirements, implemented so that they are as cost-effective as possible, can make building owners take steps that they haven't yet (GRC, 2012f, 2012h). Changes to the building code could also require new buildings to be so thermally stable that they would not require HVAC systems, saving money on both installation and upkeep (GRC, 2012d). The 2013 CAP recognizes these and other co-benefits of building efficiency, saying

> In addition to reducing GHG emissions, investments in building energy efficiency and clean energy help improve our communities. By reinvesting in our building stock, we continue to benefit from high quality buildings, support local job growth in the energy efficiency and clean energy sectors, and keep utility bills low (OSE, 2013, p. 32).

Outcome-based incentives, which can ensure that improvements are actually made, meter-based financing—where costs are tied to the meter regardless of who owns the house—and incentives funded by property taxes were the GRC's top three areas of focus for this area (GRC, 2012e, 2012f, 2012h; OSE, 2013). Meter-based financing is one way of addressing a common issue encountered when trying to increase the energy efficiency of apartment buildings, where the tenants who pay the electric bill get the benefits of upgrades that landlords pay for (the other way to address this is through tax credits that offset the landlord's costs) (GRC, 2012d, 2012f, 2012h). This issue arises in many different rental markets, and has not yet been resolved (GRC, 2012d).

Another big part of the GRC's recommendations involved making building energy use visible to building owners and residents and the community:

> Making smart energy choices requires quality information at key decision points. The decision to buy a home or lease a business space should be informed by data about the operating cost of energy use. When trying to reduce energy bills, understanding how much energy is being used and where it is being used are key. Smart meters and energy assessments can provide information to building operators to help them increase efficiency and save money (OSE, 2013, p. 38).

For large buildings, this would constitute reports; for single-family homes, energy use would be disclosed at the point of sale (GRC, 2012d, 2012f, 2012h). This focus on information is a theme throughout the Climate Action Plan, and ties in to the writings of Ostrom, et al. (1999) on the preservation of common property resources. They argue that if people are aware of the effects that they are having, they are often both willing and able to preserve resources without outside intervention.

Energy. In many cities, electricity use is a major source of greenhouse gas emissions, but this is not the case in Seattle. Seattle City Light is already carbon-neutral;

the city will work to maintain this by requiring that new electricity needs are met first by efficiency, second by renewable resources, and, if neither of these is sufficient, by energy sources that are offset by City Light in other ways (DPD, 2005). Underused rights-of-way could potentially be used for alternative energy generation, such as solar arrays (GRC, 2012f, 2012h). Because Seattle is temperate and its electricity is already fairly cheap, there are not a lot of built-in financial incentives to reduce energy use. The 2012, the GRC suggested using tax levies to fund more incentives (GRC, 2012a, 2012h). It also noted that city buildings could be used as pilot projects and examples for private buildings (GRC, 2012h).

There are, however, other energy needs in the city, primarily in the form of natural gas or steam for heating. To address this issue, the 2012 GRC pointed out that district energy systems, such as those in place on large university campuses, could be applied to neighborhoods such as First Hill, Capitol Hill, South Lake Union, and the University District (GRC, 2012a, 2012d, 2012h; OSE, 2013). These systems are not a universal solution but, in areas for which they are well suited, they can help by utilizing waste energy and moving energy from low-demand to high-demand areas (GRC, 2012a, 2012f, 2012h; OSE, 2013). Heat exchanges could be one way to do this; the 2012 GRC recommended integrating land use and infrastructure planning to maximize these opportunities (GRC, 2012f). Seattle does not own Puget Sound Energy, which supplies the city with natural gas, but can work with it to offer conservation incentives (Seattle Mayor's Office, 2006). The city's overall goals in this area are to increase the flexibility and diversity of its energy supplies, tailoring them to the specific neighborhoods that

need them, as well as helping Seattle City Light maintain the carbon neutrality that is critical for the city's overall emissions reduction goals (OSE, 2013).

Solid waste disposal. Utilities are not necessarily the first area that comes to mind when considering ways to make a city more sustainable, but they have significant potential. One of the areas that the 2013 CAP addresses is waste disposal, which does not have a huge impact on emissions but affects the city's overall sustainability. The city's goals are to achieve a recycling rate of 60% by 2015 and 70% by 2022 for domestic waste (the current rate is 53.7%), and to increase construction and demolition recycling by providing education and coordinating with local builders (GRC, 2012f; OSE, 2013). The city also hopes to implement infrastructure changes to "reduce emissions from waste management activities, including collection, processing, and transportation, and from landfill disposal" (GRC, 2012f, p. 23). One strategy the city is considering would involve reducing garbage pickup to every other week (OSE, 2013). The city also plans to learn about methane capture processes at various landfills, so that it can work with the landfills it contracts with to reduce their methane emissions (OSE, 2013). A final strategy is to encourage emissions reductions through the whole life of a product by increasing rates of repair and refurbishment and encouraging low-impact design and manufacturing (GRC, 2012f; OSE, 2013). This is the area in which the city has the least direct control, and will have to influence emissions reductions through "setting policies, implementing programs, influencing pricing, supporting product stewardship, and educating and engaging residents and businesses" (GRC, 2012f, p. 24).

Adaptation. The 2012 GRC spent a significant amount of time looking at adaptation measures that the city could take in the face of climate change threats. Their

understanding is that, fundamentally, climate change is already underway and will continue, even if Seattle goes carbon neutral tomorrow (GRC, 2012a). Seattle City Light has been a leader in this effort, but the city hopes to develop its own Climate Change Adaptation Plan in 2013. The GRC emphasized that a comprehensive plan was needed to "maximize the efficacy of planning efforts and to maximize co-benefits such as fostering healthy communities, natural systems, social equity, and shared prosperity" (GRC, 2012e, 2012h). Seattle Public Utilities is working on how to adapt to potential disruptions in the water supply and changes in urban drainage needs, including collaborating with the University of Washington (GRC, 2012f). Seattle City Light is also interested in the effects of climate change on the level of water in regional rivers, as the vast majority of the power it provides[6] comes from hydroelectric dams; changing flow could impact power generation as well as infrastructure (GRC, 2012f, 2012h; Seattle City Light, 2012).

At this point, the city's adaptation plans mostly involve gathering information and putting staff and resources in place to analyze impacts on specific projects (GRC, 2012f). The science on adaptation is not as well-developed yet as the science on mitigation, so information gathering is a key part of the city's strategy (GRC, 2012f). However, the GRC noted that the city already deals with many of the issues it will face under a climate change scenario, such as "flooding, heat events, and extreme high tides," so the main challenge is scaling up the city's response to deal with shifts in the "frequency, intensity, and timing" of these events (GRC, 2012h, p. 3). The key recommendation was flexibility and adaptability, as the effects of climate change depend on uncertain future events, such as how successful global greenhouse gas reductions actually are (GRC, 2012h; OSE,

[6] In 2011, 92% of the electricity provided by City Light was generated from hydroelectric facilities in the Pacific Northwest, 4% from wind, 3% from nuclear, and the remaining 1% from a combination of coal, landfill gases, natural gas, biomass, petroleum, and waste (Seattle City Light, 2012)

2013). Agencies and regional actors need to be able to work together to respond to these unpredictable events (GRC, 2012f, 2012h).

There was also an emphasis on making the immediate co-benefits of adaptation measures clear, and working with residents, businesses, and developers to make sure the measures don't get limited to city activities (GRC, 2012f, 2012h). Additionally, pursuing policies with co-benefits and that fit into current city policy structures contributes to a no-regrets approach such that, even if the policies are not needed, their positive effects make them a net gain for the city (GRC, 2012h). The city sees a significant economic advantage to planning for potential extreme weather and climate damage before it happens rather than addressing it after the fact—for example, designing infrastructure such as bridges to withstand temperature changes while building is much cheaper and easier than retrofitting (OSE, 2013). Finally, there is a possibility that Seattle will suffer relatively minor impacts, thereby becoming a magnet for displaced populations from elsewhere; adaptation plans should include this in their analysis (GRC, 2012f). Because of the long-term uncertainty of climate change effects and because the city does not yet have a comprehensive adaptation plan, all of its adaptation actions in the 2013 CAP are short-term (that is, to be implemented by 2015) (OSE, 2013).

These short-term actions include doing a citywide study to determine the ways in which Seattle could be vulnerable to climate change. In addition to an overall city assessment, Seattle intends to assess the impacts of climate change on a number of different areas: natural systems, including urban streams and vegetation; utility systems, including electricity, water supply, and drainage; land use, including transportation and buildings; and community preparedness, including public health, emergency planning,

and food systems. Using these assessments, the city will develop plans in all of these areas to address potential impacts, for example by increasing energy conservation to meet uncertain future demand, reviewing building codes to make sure new and remodeled buildings will be able to withstand potential threats, and continuing to build a system of food sources closer to the city (OSE, 2013).

Building equity. One of Seattle's four guiding principles is increasing equity and social justice (DPD, 2005). In keeping with the integrated nature of climate policy, policymakers emphasized the need for the benefits of climate action to be felt by all residents of Seattle, regardless of race, income, or education and that, if climate actions perpetuate current inequitable situations, they will ultimately be unsuccessful (DPD, 2005; GRC, 2012a, 2012c, 2012g, 2012h; OSE, 2013). Populations such as low-income communities, recent immigrants, and the elderly are also more at risk from the potential health impacts of climate change (GRC, 2012a, 2012d, 2012h; OSE, 2013). One option for this is ensuring that training for jobs in new green industries is made available to disadvantaged populations (GRC, 2012a, 2012c, 2012h; OSE, 2011c). Another option is to gauge energy use using a threshold of people-per-square-foot, to avoid penalizing those who live in smaller, more crowded (and therefore more efficient) housing (GRC, 2012c). The 2012 GRC recommended that policymakers evaluate climate policies for other benefits, to create win-win solutions and maximize benefits to communities (GRC, 2012d, 2012g, 2012h). Although much of the city's focus is on attracting new residents and businesses, the GRC recommended that care be taken to ensure that existing businesses and residents also benefit (GRC, 2012e, 2012g, 2012h). As changes are made, the city should ensure that replacement options are in place and accessible so that

vulnerable people are not adversely affected; this is especially important given that transit communities, the city's biggest policy push, tend to increase costs of living, potentially driving out the people they are meant to serve (DPD, 2005; GRC, 2012e, 2012f, 2012g, 2012h). In order to help ensure that policies are equitable, the city should make sure to include residents in its decision making process (GRC, 2012g). Each major chapter of the 2013 CAP has a section on enhancing equity in the city (OSE, 2013).

Community involvement. A major theme of the 2012 GRC's recommendations is collaboration, specifically with city residents, business leaders, and other public and private organizations. They emphasized that involving people who could communicate with different groups and help increase support of their recommendations would be essential to the smooth and efficient adoption of new policies, especially given that there is still some difficulty gathering public support for climate policies (GRC, 2012d). The GRC itself, convened to help investigate priorities for the city's Climate Action Plan, was composed of "leaders from across Seattle's business, labor, non-profit, government, and academic communities" (Lazarus et al., 2011, p. 3). The recent GRC explicitly noted that it would increase neighborhood outreach relative to the previous committee and questioned whether the city is always the best source for climate messaging (GRC, 2012b, 2012c, 2012e). Other potential avenues of dissemination included schools and academic institutions, faith communities, ethnic communities, low-income communities, and the AARP (GRC, 2012c, 2012e). They also mentioned that new technology could allow for crowdsourcing, which could take advantage of knowledge already in the community about potential actions as well as potential barriers and consequences (GRC, 2012b, 2012d, 2012g, 2012h). Involving the community in creating policies and

including explicit language in those policies about equity and affordability can also increase community buy-in for those policies (GRC, 2012e).

Community leaders already have influence in their communities and have motivation to improve standards of living and business opportunities in their communities (Conlin, 2011; GRC, 2012g, 2012h). Many may also have implemented smaller-scale projects similar to those that the city wants to try, or may have resources that the city might not—for example, the University of Washington has significant research resources that a partnership might allow the city to take advantage of (GRC, 2012b, 2012g, 2012h). One of the final recommendations of the GRC was to "create an alliance of unusual champions to serve as the new faces of climate change who are committed to helping the City implement the Climate Action Plan and to being early adopters of climate strategies" (GRC, 2012g, 2012h). They suggested that these champions come from a variety of backgrounds and interests, and be publically recognizable. The commission believed that these champions would help generate local support for climate policy (GRC, 2012d, 2012g, 2012h).

The 2013 CAP approaches community involvement from two angles. First, the city solicited input from "grassroots sustainability groups, environmental leaders, technical experts, businesses and community members to provide the City with creative ideas and recommendations" (OSE, 2013, p. C). Second, the city devoted a significant portion of the CAP to actions that citizens can take to help reduce their own carbon footprints and increase sustainability. Many of these recommendations are based on a consumption-based inventory that the city commissioned in partnership with King County and the Puget Sound Clean Air Agency, to look at "emissions from the raw

materials, manufacturing, transport, retail sale, use, and disposal over the life of the goods and services we buy, wherever those emissions occur" (OSE, 2013, p. 67). This can help determine the most effective ways to reduce emissions from the items we use.

> For example, over the lifecycle of a car, the emissions from driving it are the greatest; thus, buying a fuel efficient car is our best opportunity to reduce its lifecycle emissions. In contrast, the production stage in the lifecycle of food is the most emissions-intensive. Therefore, eating more fruits and vegetables and less meat and dairy is a great way for us to reduce our carbon footprints through our food choices (OSE, 2013, p. 68).

The plan identifies four areas where citizens can reduce their emissions (in the home, getting around, eating, and buying stuff) and gives suggestions for sustainable actions in each area (OSE, 2013). When creating the plan, the city solicited community input in several ways. It convened community groups to determine short-term actions the city could take toward carbon neutrality, it commissioned a proof-of-concept analysis to determine if carbon neutrality is a feasible goal, it took recommendations from Technical Advisory Groups (TAGs) made up of experts about ways to cost-effectively reduce emissions, it met with community and business leaders who made up the Green Ribbon Commission (GRC), and it received public comment through its website and through town hall meetings (OSE, 2013).

Working with other actors. International organizations did not come up at all in the 2012 GRC's meetings. The only mention in the GRC deliberations of learning from international actors came in the form of a review of British Columbia's carbon tax as a potential model for Seattle's (GRC, 2012h). There were similar brief mentions of other cities' climate programs in the group's deliberations but, again, there was no mention of an international organization facilitating communication, and no reference to other cities'

projects in the 2013 CAP (GRC, 2012d; OSE, 2013). The first Climate Action Plan mentioned connecting with regional, national, and international groups, with a strong emphasis on working with other actors like ICLEI and its Cities for Climate Protection Campaign (Seattle Mayor's Office, 2006). However, a search in city records for Cities for Climate Protection turns up no results later than 2000, and they are not mentioned in the 2012 GRC deliberations or the 2013 CAP. In the early policies where they are mentioned, they are primarily a source of grants for Seattle City Light emissions reduction projects (Pageler, 1997, 1998a, 1998b, 1999). Part of this omission can likely be put down to Seattle's perceived status as a climate leader. International organizations are primarily useful as disseminators of information. Because the policies Seattle is implementing are considered cutting-edge, there may not be very much information available from international organizations to help the city. The city used the Kyoto Protocol as its initial emissions reduction goal but, in 2011, it passed Resolution 31312, setting its own goal without an international benchmark (Conlin, 2011; OSE, 2013).

The 2012 GRC did not explicitly address partnerships with other cities. While there was emphasis on regional cooperation, and some mention of learning from other cities' actions, their conception of interaction with other cities focused more on how Seattle could be a role model for city-level climate policy (GRC, 2012a, 2012b; Lazarus et al., 2011). This is also reflected in the 2013 CAP, which does not mention getting ideas from other cities. There are several possible explanations for this. One, Seattle is so far out ahead that there are not a lot of cities for it to use as role models. Two, Seattle considers itself so far ahead that it does not bother looking for role models elsewhere. Three, there is insufficient infrastructure (e.g. networks) between cities to make sharing

information easy and efficient. The most likely explanation is a combination of the first and second options. Very few cities have made the kind of comprehensive policies or commitments to deep emissions cuts that Seattle has. The city also takes great pride in being at the forefront of municipal climate policy, to the extent of having an informally competitive relationship with the city of Portland, Oregon, where both cities try to outdo each other (O'Brien, 2013). While this competitive attitude can be good for fostering new policy growth, it could keep the city from using valuable information that might come from other cities.

While the city is not working closely with other cities or international organizations, policymakers recognize a need for support from regional, state, and, sometimes, national authorities. In many cases, the city needs state legislative support to set rates and taxes and to dedicate revenues to particular projects (GRC, 2012e). The GRC mentioned the necessity of a strategy to work with the state as well as the federal government (GRC, 2012b). The Seattle Climate Partnership is one way to work with large businesses and institutions (Seattle Mayor's Office, 2006). Dilemmas about road pricing and similar issues that require state implementation authority demonstrate an issue that cities have to deal with when developing policies—whether to concentrate only on actions that the city can take sole responsibility for, or to base some of their planning on regional actions that could have greater impact but that are out of a city's control (OSE, 2013). The city mentions two specific partnerships with outside entities: "Work with federal and academic research groups to downscale climate data for the watersheds supplying the city's water" and "Collaborate with Washington [S]tate, King County, neighboring cities, and impacted residents and businesses to create a coordinated

approach to shoreline management that enhances preparedness and increases the cost effectiveness of preparing for sea level rise" (OSE, 2013, p. 60).

Formulating and implementing. The process of formulating the city's climate policy played out almost exactly as described in the literature. An expert body, the GRC, was commissioned to study the issues the city faces and to come up with recommendations, which have been and will be incorporated into the city's guiding climate policy documents. Both GRCs (but especially the 2012 one) worked to devise policies that could benefit the city in multiple ways. In contrast, the 2005 GRC was much more focused on benchmarks than the 2012 GRC, in part because its policies were based more on reducing greenhouse gas emissions, where progress is much easier to measure. While the 2012 GRC did discuss the importance of metrics as a way to ensure progress is actually being made and to communicate that progress to the public, they also felt that the 2005 GRC's focus on metrics had limited the scope of their recommendations.

The ways that Seattle has implemented climate policy and continues to do so are more or less consistent with the literature as well. It is taking aggressive measures to reduce emissions from city operations, enabling and encouraging private and community actors to reduce their own emissions, using infrastructure improvements to make emissions reduction actions such as transit improvements easier to implement, and regulating those areas in which it has jurisdiction (OSE, 2013).

Monitoring and accountability. Seattle's evaluations of its own policies also fits with what might be expected from the literature. Even though the city's policies are no longer focused narrowly on greenhouse gas reductions, inventories of emissions remain the (relatively) easiest way to measure and report progress on climate issues (OSE, 2005,

2009a). Other kinds of policy evaluation are more difficult to implement. The Office of Sustainability and the Environment has published periodic updates on climate policy progress; along with reduced emissions, these updates use metrics such as increased hours of bus service and miles of bike trail (OSE, 2008, 2009b, 2010, 2011c). However, outcomes are more difficult to measure. Increased hours of bus service are likely to lead to more riders, but the connection cannot be assumed. Seattle is not alone in its struggles to document its progress but, given how important measuring success is to continued policy support, it is crucial that the city make the results of its policies as clear as possible.

The 2012 GRC put a great deal of emphasis on assessment and transparency of climate projects, but it specifically declined to link its recommendations to specific, numeric greenhouse gas reduction goals, focusing on "doing what is right and identifying actions to improve Seattle, rather than meeting targets on greenhouse gas emissions" (GRC, 2012b, p. 2). In contrast, the first CAP included sections under each policy area about measuring progress; most of these metrics were emission-based, but there were others, including fuel use and non-car commuting (Seattle Mayor's Office, 2006). However, it still was very clear that verifiable progress and savings are crucial in maintaining buy-in for city climate policies from business owners as well as city residents, and linking reductions eventually back to greenhouse gas goals seems to be the best way to do this (GRC, 2012d, 2012e, 2012f). They also emphasized making the effects of climate policies visible to residents through case studies of particular neighborhoods, so people can understand the effects of the policies on their own lives

(GRC, 2012g). Accountability and assessment are also necessary to make sure that efforts do not wane in the long term (GRC, 2012g).

The 2013 CAP addresses the issue of evaluation and accountability. Each sector of the plan—transportation, land use, building energy, and waste—has its own set of indicators, with a target for each one (see Table 2). Greenhouse gas emissions are a major indicator, but they are not the only one. For transportation, for example, the city wants to reduce overall emissions, but it also wants to reduce vehicle miles traveled (VMT) by car, as well as increasing the number of people who ride the bus and increasing transit service hours. In land use, the city has set specific percentage goals for jobs and housing in urban villages, and plans to use metrics such as Walk Score[7] to help determine a neighborhood's efficiency. Metrics in building energy are dominated by emissions, but they also include a percentage goal for new buildings to meet the criteria for one of several green building certifications, such as LEED. For the category of waste, the city is measuring the percentage of waste diverted from landfills to recycling or composting, and the methane emissions from the waste that does go to landfills (OSE, 2013). The Office of Sustainability and Environment (OSE) has responsibility for monitoring the city's progress on the 2013 CAP's targets. It is expected to produce an annual report on implementation of the actions listed in the plan, biannual reports on progress made on the Climate Action Outcome Indicators listed in Table 2, and community greenhouse gas inventories every three years (the inventory for 2012 should be published late in 2013).

[7] Walk Scores are calculated by a third party using an algorithm that assigns points to an address based on the availability of a variety of amenities within a mile of that address, with closer amenities meriting higher scores. To score a neighborhood, the algorithm measures the score of each block and creates an average weighted by population density (Walk Score, 2013)

Table 2: Indicators of Success.[8]

SECTOR		INDICATOR	TARGET
TRANSPORTATION	Passenger	Passenger Vehicle Emissions (Million Tons CO_2e[9])	82% Reduction
		Vehicle Miles Travelled (VMTs)	20% Reduction by 2030*
		GHG Emissions Intensity of Travel (GHG Emissions per mile of Seattle Vehicles)	75% Reduction by 2030*
	Mode Share	Center City Commute Trip	Trend away from single occupant vehicles
		All Trips in Seattle	Trend away from single occupant vehicles
	Transit	Ridership	Increase in transit mode share and ridership
		Service	Increase in transit service hours and service levels on Seattle's Frequent Transit Service network
	Bicycling	Ridership	Triple the amount of bicycling from 2007 levels by 2017
	Safety	Crash Data	Eliminate serious injuries and fatalities on Seattle streets by 2030
LAND USE	Housing	Households (in Urban Centers/Villages)	45% of households
		Affordable Housing Units	Increase in households with incomes up to 80% of the Area Median Income (AMI) paying less than 30% of their income on rent/mortgage
	Jobs	Jobs (in Urban Centers/Villages)	85% of jobs
	Livability Components	Services within a Walk (WalkScore)	Meet a minimum WalkScore in all Urban Centers/Villages
		Open Space	Increased number of Urban Villages meeting open space goals
BUILDING ENERGY	Commercial Bldgs	Commercial Building Emissions (Million Tons CO_2e)	45% Reduction by 2030
		Energy Use (Trillion BTU)	10% Reduction in Energy Use by 2030*
	Residential Bldgs	Residential Building Emissions (Million Tons CO_2e)	32% Reduction by 2030
		Energy Use (Trillion BTU)	20% Reduction in Energy Use by 2030*
	Commercial & Residential (Combined)	Building Energy Emissions (Million Tons CO_2e)	39% Reduction by 2030
		GHG Intensity of Building Energy Use (Emissions/BTU)	25% Reduction by 2030*
	Multifamily Residential & Commercial Bldgs	Energy Use Intensity (EUI) of Existing Bldgs	Average EUI (kBtu/SF/year) for buildings greater than 20,000 sq ft: Decrease in average EUI Develop EUI target by 2020
		New Buildings, and Major Renovations, Meeting Green/Sustainability Standards	50% of permitted new construction projects achieve one of the following green building standards by 2025: Living Building Challenge, Built Green, LEED, Evergreen Sustainable Development Standard, or Passive House
WASTE	Recycling & Composting	Waste diverted from landfill to recycling and composting	70% Diversion Rate by 2022
	Collection, Processing, & Disposal	Methane emissions from landfill	50% Reduction in methane emissions by
TOTAL GHG EMISSIONS		Community Greenhouse Gas Inventory	58% Reduction by 2030*
*Target included in the Comprehensive Plan			

[8] Reproduced from Seattle's 2013 Climate Action Plan (OSE, 2013).

[9] CO_2e is a metric used to communicate the greenhouse effect of gases other than CO_2, so that they are easier to understand and compare.

The city plans to take these evaluations into account and modify the CAP accordingly, so that it can continue to respond effectively under changing climate and social conditions. In 2016, the city plans to revisit its goals for 2030 to ensure that they are still feasible and to develop a new set of short-term actions. One concern is that there currently are no data to track some of Seattle's metrics. For instance, there is no travel demand model yet available for the city to use to track the effectiveness of its transportation plan, and WalkScore data are not specific to the urban centers and urban villages around which the city is basing its land use plan (OSE, 2013).

Obstacles. Of the obstacles that the literature predicted, three were most troubling for Seattle—budget issues, a short timeframe for policies, and a lack of jurisdiction—while citizen opposition was another concern. Budget concerns were the most significant of these, especially in the face of ongoing economic issues. In recent years, the city has struggled even to finance ongoing maintenance of existing systems, much less invest in new projects and major infrastructure overhauls. The city has struggled with finding new sources of funding, as many potential revenue streams, such as parking taxes, congestion pricing, and carbon taxes, require state authorization. Policymakers feel that they have a strong grasp on what policies to implement, but without funding they will not be able to do so. Another obstacle from the literature was the necessarily short-term nature of many city policies. This did not appear in any official documents, but the 2012 Green Ribbon Commission did note that short-term crises often dominate policy discussions over long-term issues, making it difficult for elected officials to address more wide-ranging concerns. This is reflected in their ultimate recommendations, which include "Quick-Start Actions" that can be undertaken in the subsequent 1–3 years, alongside medium- and

long-term recommendations. The final predicted obstacle was a lack of jurisdiction. Along with being unable to institute measures to get funding without state authorization, the city is limited in the kinds of regulations it can implement. For instance, stricter fuel efficiency standards would go a long way in reducing the city's carbon footprint, but they are under state and federal control. The city can mandate standards for its own activities, but not for its residents or businesses (OSE, 2013). The city also faced some opposition from citizens, primarily focused on plans for increasing density.

Two obstacles from the literature did not appear to be as problematic as expected. The first was the idea that the lack of an institutional home for climate policy could make it difficult to implement. However, Seattle's climate policy has a home in the Office of Sustainability and the Environment, and it appears to have successfully spread out to other offices as well (for instance, the Parks Department has reduced fuel use significantly and has implemented strategies to reduce water use when irrigating public areas). The second obstacle that was not as significant as expected was determining boundaries for emissions. It is not that the city was able to easily determine which emissions to include in its inventories, but that policy shifts are making those inventories less relevant. In the past several years, Seattle has been moving away from a reduction-based climate policy to one that takes into account the many factors that go into making a city sustainable in the face of our ongoing climate crisis. Emissions are a part of this, but the overall policy is based on creating a complete city. It is possible that this holistic policy is in part a response to the difficulties inherent in basing the city's policies entirely on reducing greenhouse gas emissions, but the city is clearly committed to its urban villages strategy, suggesting that it is more than a response to a former strategy being too

hard (OSE, 2013). One could also suggest that this represents policy drift, where, in the course of making policies more palatable to the general public, they get shifted from their original intent until they no longer accomplish what they were meant to do. While this is certainly a concern, it is clear that the city is still committed both to reducing its emissions and to becoming fully sustainable in other ways.

Budget concerns are significant. Concerns and recommendations about funding took up almost as much of the 2012 GRC's time as coming up with the policy recommendations themselves. There were two main aspects to their conversation about funding the city's climate initiatives. The first revolved around how to get government funding for projects, and the second dealt with how to make these projects financially viable and attractive to local businesses.

Government funding is always a tricky issue, but became even more so in light of the nation's financial problems since 2008. Transportation funding, for example, has dropped 20% since 2006. The Bridging the Gap levy (BTG), a major source of funding for state transportation projects, is up for renewal in 2015. If BTG is not renewed, the Seattle Department of Transportation (SDOT) could lose a third of its funding (GRC, 2012e, 2012f). Even with BTG, "the City remains unable to fund most improvement projects identified in city-wide modal master plans or address all deferred maintenance" (GRC, 2012e, p. 23). The city is particularly concerned with developing local funding sources. Many possible sources of funding for transportation projects, such as taxes on off-street parking, variable congestion pricing, fees on new development to support alternative transportation, or a motor vehicle excise tax, require state legislative action (GRC, 2012e, 2012f, 2012h). The city can implement congestion pricing on city roads,

but the state legislature controls regional congestion pricing; the GRC believed that there was strong evidence that congestion pricing could work if implemented intelligently (GRC, 2012f, 2012g). Overall, restructuring taxes and incentives appeared to be the GRC's main mode of getting funding (GRC, 2012g, 2012h). Additionally, the GRC's recommendations could not be implemented without public and private investment (GRC, 2012h).

Another possible source of funding the group considered was a carbon tax, which could be "levied on CO_2 emissions from fossil fuels purchased for combustion in the state, and possibly on the carbon content of electricity imported from other states" (GRC, 2012h, p. 31). While a cap and trade system failed earlier in the state legislature, there may be some support for a carbon tax. However, barriers remain significant (GRC, 2012h). There were some concerns about implementing the carbon tax, since it is not city-specific but regional and also because it could be seen as both a funding mechanism and a way of reaching climate goals (GRC, 2012h).

The second aspect of the funding conversation revolved around highlighting savings from efficiency and, if necessary, creating incentives, to get business owners and leaders on-board with climate policy. The GRC noted that "bringing more unrestricted money to the table—especially in the residential context—leads to deeper investments in energy efficiency" (GRC, 2012d, p. 7). The advisors said that the city could use tools such as energy pricing, efficiency incentives, and financing tools to make projects such as building retrofits more attractive to builders, and that the source of funding could have a significant impact on the types of recommendations the group would make (GRC, 2012c,

2012f, 2012h). There was also a recommendation to integrate these funding needs with projects that already exist, so as to take advantage of their funding (GRC, 2012h).

In the case of transportation, there are several options that could effectively reduce car use in the city, but without massive shifts in funding, they will not be implemented (GRC, 2012e, 2012f; OSE, 2013). The transportation section of Seattle's climate policy is the most expensive (GRC, 2012g). However, it does have the highest possibility for economic tools, such as parking fees and road pricing, that can help pay for the programs if the city can get authority to implement them (OSE, 2013).

Short-term policies get privileged. The GRC noted that they can think about longer-term policies because they are not running for office; in real-life scenarios, more immediate problems (including the potential negative impacts of climate policies) tend to dominate community discussions over long-term changes (GRC, 2012b, 2012d, 2012g). The 2013 CAP tries to address this problem by setting both short-term (implement by 2015) and long-term (implement by 2030) actions. The short-term actions are designed to pave the way for the longer-term actions. Many of them are research-oriented and involve determining the feasibility of long-term actions and developing plans to implement those actions. Others include working to secure funding for longer-term projects, or increasing efforts to disseminate information about new programs and opportunities to the community at large. Finally, there are some preliminary actions such as beginning to distribute smart meters and upgrade bicycle facilities (OSE, 2013). If the short-term actions can successfully set the stage for longer-term activities, the city may not be as limited as it might otherwise be.

Jurisdictional issues and city authority. In some areas, Seattle has a great deal of power but, in others, that power is exercised by county, state, and national entities. For instance, the GRC did not make any recommendations regarding industrial emissions, because those emissions are mostly outside the city's influence (GRC, 2012b). The city does have enough influence to "reduce VMT, develop alternative transportation modes, lower building energy use and emissions, develop district energy and electric vehicle infrastructure, and increase recycling, composting, and waste reduction," but its overall goals cannot be achieved without "federal and international action" (Lazarus et al., 2011, p. iv). In particular, increases in vehicle and appliance efficiency generally require action on the part of a large government, such as a country, or the state of California (Lazarus et al., 2011). The city also faces jurisdictional issues that make it difficult to implement its desired road pricing policies. While it can price roads within its borders, it does not have the authority to impose pricing systems that would affect regional traffic (GRC, 2012b, 2012e). Because the GRC's recommendations included many similar projects, it emphasized gaining regional and state support; it also recognized that market forces work better on a larger scale (GRC, 2012b, 2012c, 2012e). Finally, regional and state support may be required because the co-benefits of some policies are not visible on the city level, so the policies might have trouble getting local support (GRC, 2012e).

One of Seattle's most powerful tools is zoning. For instance, to implement its urban village strategy, the city can determine neighborhood boundaries and can determine what densities of residential and commercial activities are allowable there (DPD, 2005; Seattle Mayor's Office, 2006). The city can also expedite approval for projects using green techniques, making these more attractive to developers (OSE, 2010).

Another powerful tool is the energy code, which will be "at the core of the City's effort to reduce energy use and carbon emissions in new development" (GRC, 2012f; Seattle Mayor's Office, 2006). Again, where these codes are not yet in place, the city can use incentives to improve energy efficiency (GRC, 2012f). Land use codes can control both on- and off-street parking. Being flexible in the application of these codes can help developments with a transit focus get greenlit even if they don't have the number of parking spaces generally required (DPD, 2005). The city can also require bike parking to be included in developments (Seattle Mayor's Office, 2006). One wrinkle is that the city controls commercial energy codes, but not residential ones, which are set by the state (Seattle Mayor's Office, 2006).

In terms of transportation, the city's powers vary. It can determine whether it will allow expansion of roads, including regional arterials that pass through the city (DPD, 2005). It can also paint bike lanes on roads and otherwise make them more friendly to non-car uses (Seattle Mayor's Office, 2006). The overall goal is to create streets that are focused less on maximizing vehicle capacity and more on maximizing efficient movement of people and goods (OSE, 2011c). The city does not have direct control over public transit, which is provided by a variety of county and regional entities (Seattle Mayor's Office, 2006). This is problematic, especially in light of budget issues currently faced by King County Metro, the city's main provider of transit service (King County Metro, 2013). However, Seattle can work with these entities, make sure that its roads are as transit-friendly as possible, and in some cases even use city funding to buy more hours of bus service (DPD, 2005; OSE, 2009b; Seattle Mayor's Office, 2006). Seattle can educate citizens on more efficient driving and can encourage reductions in individual car

trips, but cannot mandate fuel efficiency standards except in its own fleet (Seattle Mayor's Office, 2006). Where road improvements are suggested, the city can refuse to allow those whose only purpose is to increase car traffic (DPD, 2005).

While there are some state requirements about utilities, mostly relating to minimum service requirements, the city has a great deal of influence, not only on the city-owned electric utility but on waste management and stormwater management as well (DPD, 2005; Seattle Mayor's Office, 2006). Ownership of Seattle City Light is particularly important, since electricity is a significant potential source of greenhouse gas emissions (Seattle Mayor's Office, 2006).

Opposition. While Seattle's population is generally supportive of adopting climate policies, certain aspects of some policies are meeting opposition. This is particularly true of the city's plan to continue increasing density rather than expanding its footprint. These density increases, in the form of loosening height restrictions in some multi-family neighborhoods and allowing micro-housing[10] in others have raised concerns from citizens who feel that the increased density will change the character of their neighborhoods, making them less safe, less appealing, and less green (Holden, 2013; Seattle Speaks Up, n.d.). For instance, the group Seattle Speaks Up is circulating a petition against changing height requirements in certain residential neighborhoods from 30 to 40 feet. Along with aesthetic and character arguments, citizens who oppose these increases feel that the buildings will crowd out valuable green space (Seattle Speaks Up, n.d.). There are also people who are concerned that new developments will contribute to loss of affordable housing, negatively affecting the city's poor residents (Holden, 2013).

[10] Very small living spaces, described as being "the size of a carport," with shared kitchens and other common areas (Holden, 2013).

City policies in context. Seattle's policies represent a mix of the four modes of government described by Corfee-Morlot et al. (2009)—direct, enabling, providing, and regulating. The city has taken significant direct actions in its own operations, reducing emissions from those activities by 77% since 1990 through programs such as maintaining Seattle City Light's carbon neutrality, increasing efficiency in city buildings, and replacing city vehicles with gas-electric hybrids (Papendick, 2011). The city takes an enabling approach by facilitating emissions reduction and other sustainable activities by other actors in a variety of policy areas. For instance, one of the city's transportation actions is to "work with Transportation Management Associations, property managers, employers, homeowners associations, and community groups to develop and market transit passes, car sharing and other programs that support travel options" (OSE, 2013, p. 9). In the area of housing and land use, the city plans to partner with property owners and developers to help them determine the most cost-effective ways to meet the city's sustainability goals. Finally, in the waste sector, the city wants to pursue partnerships with manufacturers and distributors that would lead to lifetime product stewardship, potentially reducing waste from consumption (OSE, 2013).

The city also plans to implement a number of strategies around the services that it provides and regulations that it can enforce. For instance, the city cannot directly control how transit service is provided, but it can ensure that the streets it builds are friendly to increased transit service (DPD, 2005; OSE, 2011c, 2013). The city can also enable residents to be more sustainable by providing information; for example, it can educate people on what items are recyclable and compostable, and it plans to create a grading system for construction waste so that it can be reused more easily. Another approach is to

choose not to provide services in a certain area; in the transportation sector, for example, the city can choose not to focus on providing parking, in order to reduce the attractiveness of driving for errands. Regulatory actions are also part of the city's plan, in areas where it has authority. For example, as a complement to its approach of providing information about what kinds of waste are recyclable or compostable, it can also ban those types of waste from conventional garbage. It can also institute building codes that require a certain level of energy efficiency in new and remodeled buildings (OSE, 2013).

Another aspect of the city's climate approach is information-gathering. Along with information about how policies are working, discussed above, the city needs information on what policies to implement and how to make them effective. For example, the vast majority of the city's adaptation actions in the 2013 CAP are information-gathering. The city needs information on "how climate change impacts, such as changes in temperature, precipitation, and sea level could affect City infrastructure, operations, facilities, and services, including human health with special attention to vulnerable communities" (OSE, 2013). Since adaptation is a relatively new addition to the city's climate policy, there is not as much information available about possible impacts and approaches. Additionally, a number of the city's actions in other areas, including transportation and land use, involve studying possible policy strategies and their effectiveness (OSE, 2013).

Reasons for addressing the issue. Seattle's experience shows that cities are taking action on climate change, despite arguments that these actions do not make economic sense, since cities may not see immediate benefits from reducing their own emissions. However, this viewpoint is based on an almost entirely emissions-based

conception of climate policy, while Seattle and many other cities are taking a more holistic approach. While the city certainly does want to reduce its emissions, this is not the only reason for it to create these policies. Instead, a review of city documents suggests that Seattle is addressing this issue because it feels threatened by potential effects of climate change and because it sees other benefits that could come from climate policies. Its efforts were supported by a city history of addressing environmental issues and by the championship of individual policymakers who were committed to creating climate policy. Perhaps surprisingly, while the city's earlier efforts were in part motivated by the United States' refusal to sign on to the Kyoto Protocol, contemporary climate policy in the city does not appear to be strongly influenced by a lack of action on the federal level. In the introduction to the 2013 CAP, where the city lays out its motivations for creating climate policy, there is no mention of failure on the federal level; instead, all of the focus is on the threats and opportunities facing the city (OSE, 2013).

Seattle's political leaders recognize that the city faces significant threats from climate change. Immediate threats to Seattle include sea level rise, evident both in normal circumstances and in increased intensity of incidents such as storm surges, as well as heat events and other extreme weather (GRC, 2012a, 2012e, 2012f, 2012h; OSE, 2013). By 2050, the sea level is expected to rise up to 19 inches, flooding beach property and low-lying neighborhoods, with extreme events leading to water levels up to 38 inches above a "normal" high tide (OSE, 2013). There is also a threat that weather events the city currently deals with, such as storms, will change in frequency and intensity (GRC, 2012a, 2012f; OSE, 2013). Water supplies, which are the basis of Seattle's cheap, carbon neutral electricity, are projected to be disrupted by changes in hydrological cycles in the Cascade

Range (GRC, 2012a; OSE, 2013; Seattle Mayor's Office, 2006). These changes could also affect urban streams and their inhabitants, while other natural systems could be affected by changes in temperature and migrating pests and diseases (GRC, 2012a, 2012f; OSE, 2013). Seattle also faces many of the threats that other cities do by virtue of their large and concentrated populations, including heat stress and respiratory diseases, as well as potential disruption of food supplies (GRC, 2012h; OSE, 2013).

Seattle's response to climate change is not all based on avoiding threats, however. The city's policymakers and their advisors also recognize that there can be significant benefits to the city from implementing policies that help either to mitigate or to adapt to climate change (and, further, that emphasizing these benefits could help to bypass much of the divisive, partisan rhetoric around climate policy) (GRC, 2012b; O'Brien, 2013). The GRC specifically recommended looking at policies that can be paired with other issues, to help prove that climate policies don't necessarily have to compete with other policies for limited resources but can rather help lead to the same goals (Conlin, 2011; GRC, 2012b, 2012c, 2012g, 2012h). Benefits that the GRC wanted to emphasize to citizens included having more time at home, building careers rather than jobs, and improving public health and wellbeing; this would help to show that climate goals are not exclusive to the city's other goals, including economic growth and social equity (GRC, 2012e, 2012g; OSE, 2013; Seattle Mayor's Office, 2006; Sheeran, 2011). In fact, advisors believe there is evidence that climate policies can help to spur economic growth, both by increasing efficiency and by creating an attractive place for green industries to locate (DPD, 2005; GRC, 2012g; Seattle Mayor's Office, 2006; Sheeran, 2011).

Other co-benefits the GRC listed included improved health from reduced air pollution, reduced energy costs and new jobs through efficiency upgrades to buildings, more complete, connected neighborhoods, and the opportunities that could come with being perceived as a climate leader (Conlin, 2011; GRC, 2012c, 2012g, 2012h; OSE, 2013). Decreased spending on car-based transportation can also help stimulate the local economy (OSE, 2013). As the GRC put it, "[t]o avoid missed opportunities, **climate strategies should never be designed as purely emission reduction efforts** but instead should also **be crafted to build a vibrant, prosperous and equitable city**" (GRC, 2012g, p. 12, emphasis in original). The city hopes that by using climate policies to improve quality of life, it will attract much of the Puget Sound region's projected future economic growth, meaning that there does not have to be a choice between environmental protection and prosperity (DPD, 2005; Seattle Mayor's Office, 2006; Sheeran, 2011). The literature reviewed for this study suggested that the desire to be seen as a climate policy leader could be a strong motivator for cities when creating policies. It does not appear as one of Seattle's primary motivations, but multiple policy documents mentioned that creating a city friendly to green technology and emerging green industries could help drive economic growth (GRC, 2012a; OSE, 2013).

The three biggest factors that have influenced Seattle's commitment to addressing climate change are the city's history and identity as a place closely connected with its natural environment, its past environmentally-oriented actions, the policy championship of Mayor Greg Nickels, and a general dissatisfaction with policy as it was being made at higher levels of government. Seattle's natural environment has been part of its identity since the city was founded, and environmental stewardship is one of the four core values

laid out in the city's Comprehensive Plan (DPD, 2005; GRC, 2012a). OSE mentions Seattle's history in the introduction to the 2013 CAP, saying:

> Seattle has been a world leader in climate action for many years. For example, in 2000 Seattle became the first city in the nation to adopt a green building goal for all new municipal facilities, and in 2001 the City created a LEED incentive program for private projects. In 2005, after decades of investment in conservation and renewable energy, Seattle City Light was the nation's first large electric utility to become carbon neutral. That same year, Mayor Nickels, concerned about federal inaction on climate change, launched the Mayor's Climate Protection Initiative and challenged U.S. mayors to do what the federal government would not: meet the GHG emission reduction targets of the Kyoto Protocol—7% below 1990 levels by 2012. More than 1,000 mayors representing nearly 89 million Americans joined Seattle in making the pledge to take climate action.
>
> In 2006, Seattle was one of the first cities in the nation to adopt a Climate Action Plan (CAP). The 2006 CAP laid out a strategy to meet the Kyoto target and identified short-terms actions the City should take to achieve that goal. To date, fifteen of the eighteen areas of action identified in the 2006 CAP have been implemented or are in the process of implementation. (In late 2013, the Seattle Office of Sustainability & Environment expects to release the 2012 GHG Emissions Inventory for the Community of Seattle, which will tell us whether Seattle met the Kyoto goal in 2012.) (OSE, 2013, p. 2)

The city's natural beauty is a point of pride for its residents, leading to an increased desire to protect it (DPD, 2005; O'Brien, 2013). Advisors also want the city to build on its widely recognized history as a "model in climate protection" (Seattle Mayor's Office, 2006, p. 20). One key advantage is that Seattle already has a carbon-neutral electricity supply, as well as "a strong foundation of existing emissions reducing activities in the transportation, buildings, and waste sectors" (Lazarus et al., 2011, p. iii). However, it can still be difficult to build community support for climate policy; advisors suggest using

case studies of past climate strategies to publicize the ways they have helped create more "livable communities" (GRC, 2012a, 2012d, 2012g). Seattle's environmental ethos is so strong that even conservative politicians who want to get elected in the city have to have pro-environment views (O'Brien, 2013).

A culture of climate awareness. The GRC placed a great deal of emphasis both on understanding the cultural values that citizens hold and on creating a culture in Seattle of efficiency and sustainability. They believed that it was important to understand the outcomes that people and businesses care most about in order to keep them invested in climate policy (GRC, 2012c, 2012g, 2012h). There was a consistent theme of making environmental protection part of "who we are" as Seattleites (GRC, 2012c, 2012g). When there is cultural support, people will often take environmental action without mandates, and they may be more supportive of mandates where they are required. Protecting the environment becomes a matter of civic pride (GRC, 2012c). A significant part of this involves making the climate impacts of people's actions visible; one example is real-time, publically-accessible information about energy use in the built environment (GRC, 2012d, 2012f). The goal is to help people see that, rather than being opposed to other goals, climate policies are in line with the "city's overall goals of shared prosperity, social equity, and environmental sustainability" (GRC, 2012d, 2012g, 2012h). The GRC wants to build a strong connection between the city and its residents, and base that connection on environmental health (GRC, 2012d, 2012e, 2012g). Basing the Climate Action Plan on a compelling story could help people get behind it (GRC, 2012e).

One strategy for creating a culture of climate protection was using case studies and other examples to "illustrate the connection between community goals and climate

action" (GRC, 2012e, 2012h). This can help people step back and see the big picture, so that they may be less likely to be angry about aspects of climate policy that inconvenience them (GRC, 2012e). Another is to avoid top-down strategies that can make people feel disconnected from the climate policy process by giving citizens a chance to participate in the climate policy process (GRC, 2012e, 2012h). The 2012 GRC also emphasized talking to the public about co-benefits, because reducing greenhouse gas emissions is not something that necessarily catches the public imagination and, in fact, may be something they are tired of hearing about (GRC, 2012e). Generally, public officials should be consistent in their messaging and use narratives that are designed to connect with people. They should also work to link climate impacts to specific, familiar events, such as Seafair, a large and well-attended festival held every year (GRC, 2012g). There is already a culture of environmental protection in Seattle; the idea is to support and expand on that (GRC, 2012g, 2012h).

Whether this strategy has been or will be successful is difficult to measure or project. There is certainly a "green" culture in Seattle (O'Brien, 2013), but there is not always a connection between what people believe and what they do, or what they want their city government to do. This is evident in the debates over micro-housing and similar density-increasing measures—many citizens are not convinced that these measures are necessary or that they could actually contribute to a more sustainable city (Holden, 2013; Seattle Speaks Up, n.d.). The city will have to make the connection between climate policy and other policies clear, and be sure to communicate the potential co-benefits of addressing climate change.

An interdisciplinary approach. One of the themes in Seattle's climate policy is the need for integrated and interdisciplinary action. In the 2013 CAP, the city states:

> Climate change is not a stand- alone issue separate from the other issues cities face. It is rooted in land use, transportation, and building energy patterns that have evolved over generations. Similarly, the solutions to climate change are not stand-alone, and are part of Seattle's work to reorient land use patterns, transportation infrastructure, and building energy systems to build vibrant communities. Therefore, the 2013 CAP provides a coordinated strategy and long-term vision for action that cuts across City functions. (OSE, 2013, p. 4)

A comprehensive strategy helps to "maximize the efficacy of planning efforts and to maximize co-benefits such as fostering healthy communities, natural systems, social equity, and shared prosperity" (GRC, 2012e, p. 17). By approaching problems from several angles, the city can achieve many goals simultaneously, not only in terms of addressing climate concerns but in terms of increasing quality of life in the city (GRC, 2012a, 2012f). This can be seen in the urban village strategy, where land use, building codes, and transportation planning all come together to create more complete, robust climate policy that also addresses community goals such as safety and public health (DPD, 2005; GRC, 2012a, 2012h). This approach recognizes that city systems, much like environmental ones, are complex and interdependent, and that the best policies will recognize and address this (GRC, 2012a, 2012h). For example, the urban village strategy of increasing housing density will only work if it is coordinated with transit action, so that the neighborhoods do not become unusably congested (OSE, 2013). One of the main goals of the 2013 CAP is to "[provide] a planning and monitoring framework for achieving climate change goals… [and] consideration of emissions reduction potential across the range of City plans" (OSE, 2013, p. 5). The city's comprehensive plan

emphasizes the idea that environmental stewardship is linked to the city's other core values of shared prosperity and social equity (DPD, 2005).

The city's approach could also be seen as interdisciplinary in terms of policy approaches. As discussed earlier, most of the literature on the subject of municipal climate policy differentiates between adaptation and mitigation strategies, suggesting that it is a matter of choosing one or the other. In contrast, Seattle is devoting resources to both approaches, with a quarter of the 2013 CAP addressing adaptation and the Comprehensive Plan's goals split almost evenly between mitigation and adaptation (DPD, 2005; OSE, 2013). This is a relatively new development, as the 2006 CAP only mentions adaptation in relation to potential changes in hydrology in the Cascades (Seattle Mayor's Office, 2006). In fact, many of Seattle's policies can work for both mitigation and adaptation; addressing both goals together may enhance the effectiveness of the desired policies. For example, trees that are planted in the city to offset greenhouse gas emissions can also help reduce the effects of higher temperatures as the climate changes. Small, flexible, renewable energy projects will help insulate the city against potential instability in its hydropower supply as precipitation becomes less predictable.

Thinking Locally and a Multi-Scale Approach

Seattle's climate policy shows characteristics that the literature suggests are to be expected from a situation where the federal government has largely declined to offer any leadership. The city's climate policies are not closely connected to federal climate policies because there are no federal policies to connect to. While this lack of national action is no longer a primary driver of Seattle's climate commitment, it does influence what policies the city can enact and how they can be implemented.

Advantages of acting locally. Seattle's climate policies demonstrate several ways in which cities are well suited to tackle global climate change. For example, the city's urban village program is an example of how cities can tailor their climate response all the way down to the neighborhood level, accounting for demographic and cultural variations that could prevent larger-scale policies from being totally effective. The city has also put a great deal of emphasis on citizen input, something that would be difficult to implement effectively on a regional, state, or national level. Seattle also shows that cities can accomplish a great deal in areas where they have authority, such as building codes. Using these, as well as controlling how roads in the city develop, Seattle can shape development to be as climate-friendly as possible.

Disincentives to acting locally. These documents also point to some of the distinct disadvantages of working at the local scale without support from other levels of government. The city faces significant limitations in how it can raise funds, especially through road pricing and other transportation-related economic policies that it believes would not only reduce driving but also provide a lot of money for other programs. The city is also planning to perform a great deal of research that might be better addressed at the state or national level; for instance, the city is planning to work with other groups to determine possible effects of sea level rise on Puget Sound. Given the size of the area and the number of jurisdictions it intersects, it would likely be more efficient for this project to be undertaken at a higher level of government. The city needs this information, and if it is not coming from anywhere else, the city will have to gather it, but its resources would be better used elsewhere. While there is clearly a wide range of areas where a city-level approach is best, there are some that would benefit more from a wider lens.

A multi-scale approach. The GRC briefly mentioned that the city's projects could serve as pilot projects for national climate policy; for example, there are not many examples of congestion pricing in the US (GRC, 2012d, 2012e, 2012f; Seattle Mayor's Office, 2006). The city can also demonstrate a market for green technologies such as more efficient vehicles and appliances (GRC, 2012e; Lazarus et al., 2011; Seattle Mayor's Office, 2006). Seattle has the resources and infrastructure to attract climate innovation and act as a national proving ground (GRC, 2012a). The documents in this study offered no evidence that Seattle's policies have been used as templates for policies, either in other cities or at the national level, to date. The city's policymakers, however, are hopeful that demonstrated successes will encourage others to implement similar programs. One program that shows promise is the city's collaboration with the US Department of Energy, where the city is acting as one of the department's pilot locations for a program designed to increase electric car use by installing charging infrastructure at convenient locations. This lack of evidence for dissemination may be because the policies are relatively new, or it may be because the documents used in this research were strictly focused on Seattle and therefore unlikely to address other areas' climate policies.

Seattle's climate policy offers clear evidence that top-down international agreements are not necessary to address climate change. The city is voluntarily addressing the issue, based on threats that it perceives to itself. It has demonstrated its ability to work with regional, state, and private actors to address the problem without support from the federal government or from a binding international climate agreement.

4. Conclusion

This research began with the question of whether Seattle's climate policy demonstrates that cities are an effective place to make climate policy. Seattle clearly does not represent a "typical" case—its climate policy is more established than that of many other cities. While it remains to be seen whether its emissions reductions will successfully meet the goals it set under the Kyoto Protocol, the success it has already achieved and its commitment to ramping up climate policy in the future give cause for optimism. Its integrated plans are ambitious but, if successful, they will be more effective than a series of unrelated policies, which might have ended up working against each other. These policies also acknowledge that a city needs to be treated as a whole; that the lives of the people who work and live within the city's borders overlap with all city departments, so policy decisions should understand how those interactions can be supported and perhaps even used to reinforce policy.

This thesis began with a review of past research about municipal climate policy. In order to understand the larger policy context, this review began with research that investigated how local, regional, national, and international governments work together and separately in an increasingly global world where national governments are no longer the primary conduit for information between countries. A key concept in this body of research is the idea of governance, which positions the national level of government as only one of many actors on the international policy stage. The review of past research then shifted to focus more closely on the political processes through which climate policy devolves from the national to the local level in a sometimes-informal process that fills in the gaps in national level policy. As part of this discussion, research was reviewed that

investigated the reasons that cities might see benefits to themselves to addressing climate policy that would overcome expected economic obstacles, as well as conditions within city governments that would make them more likely both to initiate climate policy and to have that policy stay in place. This and other research was then used to describe the advantages and disadvantages of addressing climate change at the city level. Local governments can inspire more trust in citizens and can focus policies to precisely the sources of greenhouse gas emissions, but they may lack authority in key areas, particularly relating to raising revenue. Therefore, past research suggests that a multi-scale policy, where the weaknesses of each level of government are complemented by the strengths of the other levels.

The review of past research then turned to the process of making climate policy at the city level. An important component of this is the process by which city governments frame climate change so that it becomes relevant to city residents. The literature then described the multiple roles that cities can play when creating climate policy, from providing information on ways to voluntarily reduce emissions to increasing the efficiency of city operations to imposing building codes requiring climate-friendly construction and operations. Past research also stressed the need to evaluate policy and communicate its successes and failures, not only to ensure that the policies are effective but also to maintain citizen buy-in through transparency. Next, this section reviewed what research there is on whether climate policies that cities have already put in place have succeeded or failed. In many cases, city policies are quite new, so this area would provide fertile ground for further research. Research about the focus on adaptation in city policies was reviewed next. This was given special attention because so much of the policy

conversation is still focused on reducing greenhouse gas emissions rather than on adapting to the climate change we are already committed to. City policies in this area may signal a larger shift in focus in global climate policy. Finally, this section described what little literature there is on Seattle itself. While some researchers used it as an example, and one delved into a highly theoretical analysis of its climate policy process, there was nothing available about the city's climate policy program.

To help fill this gap, this thesis then turned to Seattle's climate policy. Using a case study approach, city documents were reviewed, including emissions inventories, city policies such as its Climate Action Plans and its Comprehensive Plan, notes from the commission convened to create the Climate Action Plans, and City Council resolutions. First, the emissions inventories were determined to be comparable and to show that Seattle has made significant reductions in its greenhouse gas emissions, reducing them 7% below 1990 levels by 2008. Next, information from the documents, as well as from an interview with a member of the City Council, were used to create an overview of Seattle's policies and determine whether the city's experience shows that making climate policy at the local level is an effective use of policy and other resources. In most instances, Seattle's experiences matched what was predicted by the literature—for instance, its reasons for addressing climate change included feeling threatened and seeing economic opportunities—although there were some differences, especially in the city's lack of participation in the transnational networks that some of the previous research suggested could be very important to a city's climate policy process. The most important characteristic of Seattle's policy, however, was its integrated and interdisciplinary approach. Climate policy and environmental protection are tightly woven into every

aspect of the city's Comprehensive Plan, and nearly every city department is involved in implementing or tracking these policies in some way.

Finally, this investigation of Seattle's experience highlighted the advantages and disadvantages of local-level climate policy, ultimately concluding that no single scale of government can address climate change on its own. Seattle is able to make policy down to the neighborhood level, responding to unique conditions and concerns in a way that would be impossible for a higher level government. It is also accessible to a diverse range of citizens, giving them more of a voice than they might have at higher levels of government. On the other hand, the city faces some significant obstacles stemming from its lack of jurisdiction in key areas—it needs state help to implement a comprehensive road pricing plan, and reducing emissions from motor vehicles depends as much on fuel efficiency standards, set by the federal government, as it does on reducing the number of miles traveled. Without support from regional, state, and federal actors, the city will not be able to fully realize its emissions reduction potential. These advantages and disadvantages demonstrate that only a multi-scale approach to global climate policy, with cities as key participants, will be able to truly address the threat of climate change.

As Seattle demonstrates, cities are addressing climate change on their own, with little or no support from higher levels of government. As the global population becomes increasingly urbanized, cities will become ever more important players on the international policy stage. This thesis provides an important addition to existing literature by demonstrating the need for an integrated global climate policy that recognizes the policy potential of every level of government. Especially in the face of uninspiring international policy performance, policymakers and researchers alike must explore every

avenue that offers some hope of averting a global crisis. The importance of cities in this approach also suggests a key area for further research—continued monitoring of the successes and failures of local-level climate policy. Not only will this help to ensure that cities are using their resources efficiently and effectively, but it could also provide insight into how those local policies could be scaled up to higher levels of government, and what pitfalls to avoid if they are implemented at a larger scale. The more thoroughly we understand the role that cities play in global climate policy, the greater our chances are of building a robust, powerful global regime that can truly address the coming climate crisis.

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Appendix: Parameters of Seattle's GHG Inventory[11]

Transportation Sector

Road transportation. Road transportation includes the emissions from passenger, commercial, and transit vehicles. Emissions are based on an estimate of vehicle miles traveled (VMT) on streets and highways within the city limits.

Marine transportation. Marine transportation includes fuel used by boat traffic in the waters in and around Seattle. Boat traffic includes pleasure craft, Washington State Ferries, cruise ships, cargo vessels, and other commercial boat traffic, such as tugboats.

Rail transportation. Rail transportation includes the rail activity associated with the Port of Seattle.

Air transportation. Air transportation includes take-offs and landings at the King County Airport and Seattle's share of flights out of Sea-Tac Airport. Seattle's share of Sea-Tac traffic (29%) is determined by a passenger survey administered by the Port of Seattle. Though emissions from the flights taken by these passengers do not occur within the city limits, the Mayor's Green Ribbon Commission decided to include emissions associated with air travel by Seattle's residents and businesses.

Building Sector

Residential buildings. Residential building emissions are from single-family homes, apartment buildings, and other residential buildings in the City of Seattle. The vast majority of the building emissions are generated by the energy used for home heating, appliances, and hot water, but the emissions reported here also include fuel used for landscaping equipment like lawnmowers.

Commercial buildings. Commercial building emissions are from the energy consumed by businesses, office buildings, and institutional facilities (like government buildings and schools). Like residential building emissions, the majority of these emissions are generated by lighting, space heating, and hot water. Many downtown buildings are heated by steam generated by Seattle Steam Company, and the emissions associated with steam heat are reported on a separate line item. Commercial buildings also include emissions from small equipment associated with commercial operations.

Industrial Sector

Industrial operations. Industrial operations include emissions from energy consumed by industrial facilities located in the City of Seattle. Unlike residential and commercial emissions, industrial operations are dominated by emissions from energy used to fuel

[11] Summarized from the 2008 Community Greenhouse Gas Inventory (OSE, 2009a)

manufacturing or other industrial equipment, rather than space heating and hot water. Industrial operations also include fuel use and greenhouse gas emissions from construction equipment, material handling, HVAC equipment, and other associated off-road machinery.

Industrial processes. Industrial processes include greenhouse gases that are emitted directly from production of cement and steel, as well as the emissions from fugitive gases from electric switchgear equipment. With two cement plants in the City of Seattle, cement production is a significant contributor to the city's greenhouse gas emissions. Emissions from burning coal and tire-derived fuel for cement operations are included in the processes table below.

Waste Sector.

Closed landfills. Landfills continue to emit methane long after they have been closed, although emissions levels drop significantly over time. There are a number of closed landfills in Seattle, and the community inventory includes estimates of their methane emissions.

Wastewater treatment. King County operates a large wastewater treatment plant, West Point, located adjacent to Discovery Park within the Seattle city limits. Wastewater treatment emits methane and nitrous oxide.