2009

A Baseline Greenhouse Gas Inventory for Oberlin: Stepping Up to the Challenge of Climate Neutrality

Nathaniel Flaschner Meyer
Oberlin College

A Baseline Greenhouse Gas Inventory for Oberlin: Stepping Up to the Challenge of Climate Neutrality

Nathaniel Flaschner Meyer

Honors Student '09
Oberlin College Environmental Studies Program

Advisors: John Petersen, Rumi Shammin
Honors Subcommittee Chairperson: Harlan Wilson

May 2009

TABLE OF CONTENTS:

EXECUTIVE SUMMARY

The climate crisis is perhaps the greatest challenge facing the world today. The international community has reached a strong consensus, supported by a diverse group of leaders and experts including scientists, economists, political figures, and religious leaders, that it is time for humanity to decisively take action. The vast scale of this problem necessitates collective engagement at all levels of governance. At the level of municipalities, there are unique opportunities for creative and effective action to reduce greenhouse gas (GHG) emissions that are not only crucial in the broader struggle to halt rising instability in the climate system, but that are also likely to be beneficial in a variety of ways to the communities enacting local climate initiatives. The fact is that climate legislation and increasing fossil fuel scarcity are likely to raise energy costs for cities and citizens. At the same time, recent activity on the national level suggests upcoming nationwide regulation of greenhouse gas emissions and increasing grant availability for sustainability projects. When these policies are set, communities that have already begun to make progress to reduce emissions will likely be at a competitive advantage with lower energy costs and a better chance of procuring funding. Furthermore, early action will garner regional and national attention as other communities begin to look for examples of success, which will lead to stronger regional ties and perhaps attract economic development. The City of Oberlin's municipal government can act in two important ways to address GHG emissions. First, it can adopt and enact policies and practices that minimize emissions associated with municipal operations. Second, the government can adopt and enact policies that encourage citizens and businesses to take actions on their own that minimize emissions. In Chapter 1, I review the problem of climate change and examine the role of local governments in addressing it.

Given the City and community of Oberlin's demonstrated commitment to environmental values and past history of leadership, the prospects are good for Oberlin to substantially reduce GHG emissions and become a bona fide climate action leader. Moving toward this goal, Oberlin became a member of the International Council for Local Environmental Initiatives (ICLEI) in February 2007. This study represents the City of Oberlin's first step in the five-milestone process that ICLEI communities commit to. These five milestones are:

1) Conduct a baseline emissions inventory
2) Adopt an emissions reduction target for a forecast year
3) Develop a local climate action plan ("CAP")
4) Implement policies and measures outlined in the CAP
5) Monitor and verify results.

The sequence of the ICLEI milestones is logical and important. Before actually developing and implementing formal policies to reduce emissions (milestones 2 through 5), it is imperative that the City do two things. First, inventories that quantify and identify the sources of GHG emissions for municipal operations and the community are necessary in order for City officials to strategically pursue and prioritize emissions reductions policies and to evaluate the effectiveness of these policies in reducing emissions. Second, in order to sustain a successful, long-term emissions reduction campaign, the City needs to establish an effective, sustainable, and institutionalized organizational structure for climate action, which will allow the ICLEI milestones to be systematically and cohesively achieved.

Accordingly, my research addressed the following primary questions. First, how many tons of annual GHG emissions are associated with the community of Oberlin and with Oberlin's municipal operations and what are their major sources? Second, what have other communities done to establish an organizational framework for the ICLEI process, and how might this inform Oberlin's options as it attempts to move toward accomplishing emissions reductions? To answer the first question, I conducted inventories of emissions associated with activities within city limits (hereafter referred to as the "community") and of emissions associated with municipal operations (hereafter referred to as the "City") for the years 2001 and 2007, using inventory methods and software developed by ICLEI (see Chapter 2). To answer the second question, I conducted interviews with officials from eight ICLEI cities around the US. This report contains brief descriptions of the eight case-studies (see first half of Chapter 3), as well as subsequent discussions of 1) how Oberlin might structure its framework for sustainable climate action in the future (see second half of Chapter 3) and 2) issues that are important to consider as the City approaches the next ICLEI milestones, such as criteria for setting a target and approaches to developing a Climate Action Plan (CAP; see Chapter 4). My goal has been to place the City of Oberlin in a better position to make decisions and begin proceeding through the rest of the ICLEI process.

Key Findings

Community-wide emissions inventories

- As a whole, the community (within city limits) emitted 178,400 and 174,400 tons of carbon dioxide equivalent (CO_2e) in the years 2001 and 2007, respectively.
- The community's per capita annual emissions were 22.2 and 20.9 tons CO_2e per resident, a moderate level compared to the other communities I examined.
- The commercial sector, including all businesses, Oberlin College properties, and City facilities within city limits, made up approximately 65% of total community-wide emissions.
- The commercial sector, excluding College and City facilities, emitted about 40% of total community-wide emissions.
- Emissions from the College made up approximately 20% of total community-wide emissions, with coal burned at the College's Combined Heat and Power (CHP) plant making up 10% of this total in 2007.
- The residential and transportation sectors each emitted approximately 15% of total community-wide emissions.
- The 2.3% drop in total community-wide emissions between the two inventory years should not be considered a reliable indicator of any sort of trend; data from only two years are insufficient to assess this. The measured difference is most likely attributable to 1) a 37% decrease in assessed natural gas consumption by the non-College, non-City commercial sector, and 2) the sale of renewable energy credits (RECs) within the community (to the College) in 2007, rather than outside the community (to Green Mountain Energy) prior to 2004.
- Emissions associated with electricity made up over half of community-wide emissions (55% in 2007).

- Given that such a high proportion of emissions resulted from electricity consumption, in order to substantially reduce emissions, the City and community of Oberlin will need to aggressively pursue electricity conservation measures and OMLPS will need to continue pursuing renewable electricity sources.
- An overall Climate Action Plan (CAP) should emphasize actions that maximize the combined reductions of municipal operations and community-wide energy consumption. Toward this end, it is in the Oberlin community's interest that OMLPS continue selling RECs to the College and to any other entities within the community that wish to reduce their climate footprint, as this practice simultaneously retains zero-emissions electricity in the Oberlin community (maintaining a lower emissions profile) and has the potential of generating substantial revenue for implementing innovative and effective sustainability programs that further reduce emissions along with providing other benefits.

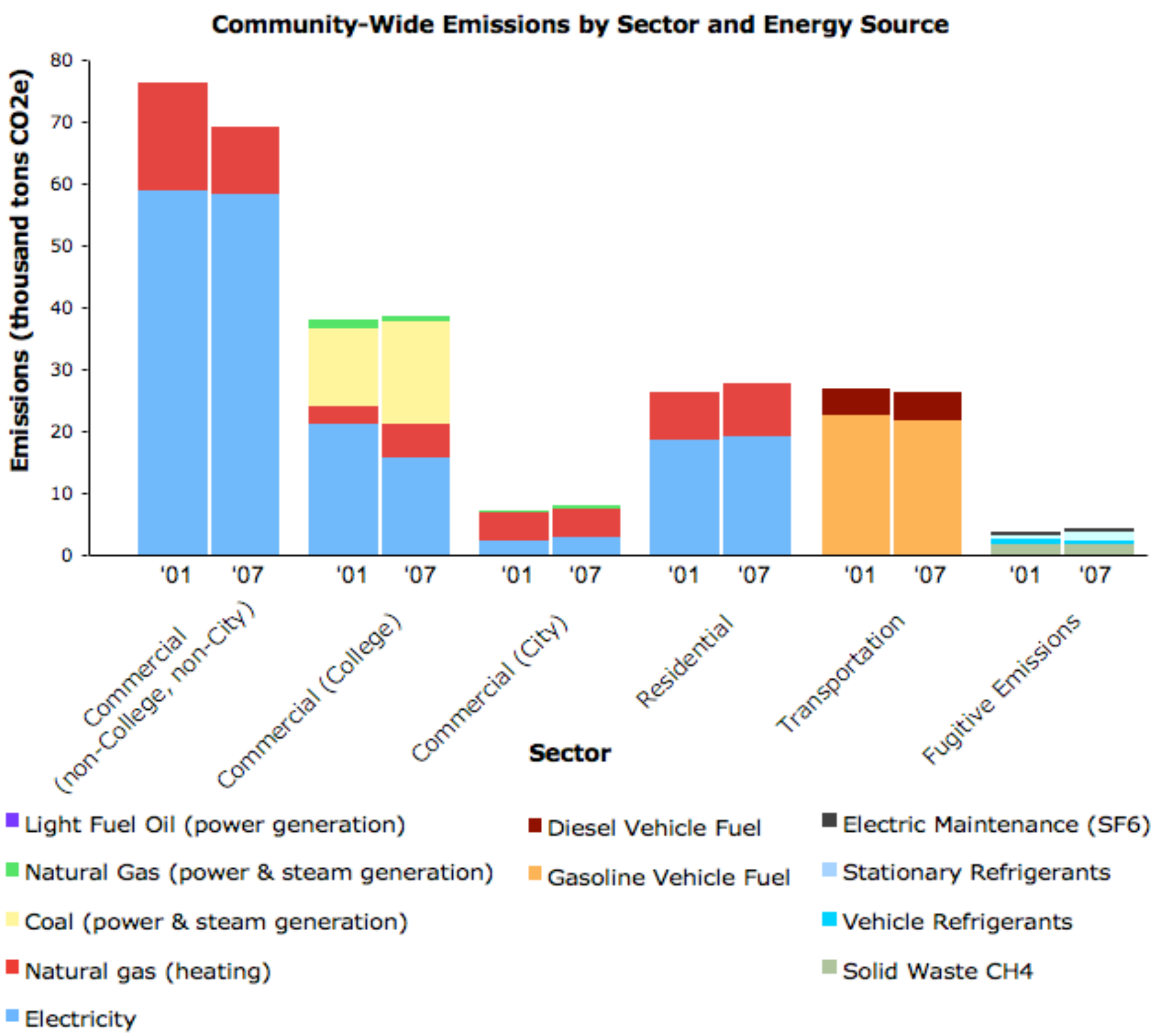


Figure 4. Total 2001 and 2007 community-wide emissions broken down by sector (bar pairs) and energy source (stacks with legend). Solid waste and miscellaneous fugitive emissions are stacked together.

Municipal operations emissions inventories

- The City of Oberlin's municipal operations were responsible for emitting 10,650 and 11,400 tons CO_2e in 2001 and 2007, respectively.
- Emissions associated with electricity and natural gas consumption each made up approximately 40% of City emissions.
- Buildings and facilities, excluding those associated with water and wastewater departments, were responsible for roughly half of the City's emissions.
- Water and wastewater buildings and facilities were responsible for approximately 30% of the City's emissions, and street and traffic lights between 8 and 9%.
- Emissions from the City's vehicle fleet and employee commuting were each responsible for less than 5% of the City's emissions.
- Although differences between the two years should be interpreted with caution, the measured 7.1% rise in City emissions between 2001 and 2007 was probably primarily the result of higher electricity and natural gas consumption by the City, attributable both to new facilities and increased consumption by existing buildings and facilities.
- In order to make both community-wide and municipal operations inventories easier in the future, the City should begin continuously collecting and archiving the necessary data as they become available.

Options for Oberlin's climate action framework

The results above provide the baseline assessment that should inform the development of a climate action plan (CAP) and that will be necessary for measuring future progress toward achieving emissions reductions goals for each sector and energy source. However, before a CAP can be developed, the City needs to decide how this entire process will be structured. The eight interviews I conducted lead to the conclusion that municipalities are employing a variety of organizational frameworks to pursue climate action, many of which share important similarities. In all cases, Cities have identified a municipal employee to act, at the very least, as a point person who actively coordinates the community's long-term climate action process. Additionally, most Cities have also assembled a committee, often called an "Energy Task Force," made up of community stakeholders, including resident volunteers, energy experts, professors, students, business owners, City employees, and other community leaders. The role of this Task Force has ranged from being an advisory board overseeing the work of employees and volunteers to being the entity that actually carries out the work of completing milestones.

While the establishment of both a City point person and a committee of stakeholders appears to be common, it is especially crucial for the City of Oberlin to decide what entity will be responsible for the "leg-work" involved in completing each ICLEI milestone. I have identified four main entities to which the primary responsibility of completing the ICLEI milestones might be assigned: a full-time City employee(s), a pre-existing City-chartered committee of volunteers and City employees, a newly created committee of community stakeholders (Energy Task Force), and/or a partnership between the City and a local non-profit organization. It is important to note that the distinction between these four options is not rigid and that many can be employed simultaneously, along with other strategies included in Chapter 3. If creating a new full-time position is not feasible, for example, the City could assign an existing staff member the responsibility of coordinating the ICLEI milestones, which would then be addressed primarily by a working committee or other entity. Many Cities have also distributed the responsibility of climate action among the various City departments, which may be effective but requires substantial communication and coordination. Furthermore, many Cities have incorporated climate action, and more specifically their ICLEI climate action plans, into their "Comprehensive" or "Master" Plans, which guide City priorities and decision-making. This has the advantage of ensuring that climate action planning is incorporated as a component of all decision-making processes.

The City should also continue to take advantage of Oberlin College and its students to aid in climate action planning, but should also understand the limitation of College assistance. For example, for the sake of continuity, consistency, and credibility, it is important for City officials or an officially designated body to take principle responsibility for overseeing the ICLEI milestones and future inventories. College faculty and students will be most useful in conducting specific and finite projects that advance the City's larger climate action process. My research is supporting evidence of this potential.

If the City decides on and creates a specific framework for climate action in Oberlin, this will greatly increase the likelihood of Oberlin sustaining a successful and cohesive campaign through ICLEI's milestone process and will make it much easier for the community to effectively pursue emissions reductions.

Regardless of the structure the City ultimately chooses to establish for climate action, it should seek out and nurture regional partnerships, something it has already begun doing through OMLPS. Given that Akron, Cleveland, and Cuyahoga County are all making progress in their ICLEI commitments, that the Green City Blue Lake Institute is compiling a regional inventory for Northeast Ohio, and that ICLEI membership throughout the Midwest is growing quickly, there are great opportunities for those involved with Oberlin's climate action to participate in regional cooperation and a broader, collective effort to fight climate change. Such partnerships are likely to be critical to Oberlin's own success in reducing emissions.

Setting an emissions target and creating a climate action plan

Once the City has established the framework within which ICLEI's milestones will be addressed, individuals and groups charged with this task will need to move forward by addressing the second and third milestones: setting an emissions reductions target and writing a climate action plan (CAP). It is beyond the scope of this report to make recommendations for a particular emissions target or specific emissions reductions measures for inclusion in the City's CAP, but in Chapter 4 I address some of the initial decisions and considerations those involved in the process will have to make.

The officials I interviewed identified several useful criteria that their municipalities used in setting targets. Many have adopted a long-term goal that is aligned with the recommendations of the Intergovernmental Panel on Climate Change (IPCC), namely an 80% reduction by 2050. Within this long-term vision, most have then established various interim targets as benchmarks. In setting such targets, there is a tradeoff. One option is to set very aggressive goals. This can spur creativity, establish a leadership position, and serve as motivation. But, if overly ambitious goals are not achieved, this can undermine momentum. Alternatively, setting very modest goals may guarantee attainment, but may do little to initiate or inspire creativity and new emissions reductions ideas. Decision-makers should additionally consider strategically choosing benchmark years for achieving targets that keep the community and municipal employees engaged, excited, and educated about the process and Oberlin's progress. Accordingly, Oberlin might consider making 2033, its 200th anniversary, a target year for an interim reduction goal.

As those responsible for formulating and implementing the City's climate action goals move on to writing a CAP, there are three main strategies for generating ideas that should be considered. First, initiatives already in place in Oberlin that will result in emissions reductions should be examined, improved, expanded, and included in the CAP. Second, CAPs from other municipalities should be carefully examined and those measures with the most potential for success in this community, based in part on information from Oberlin's inventories, should be included in Oberlin's CAP. Third, Oberlin should take advantage of ICLEI resources. For example, the Climate and Air Pollution Planning Assistant (CAPPA) can be used to help identify measures likely to be effective in Oberlin.

Throughout the process of writing and implementing a CAP, it will be important to weigh the advantages and disadvantages of pursuing those measures that are likely to lead to rapid and easy emissions reductions (i.e. low-hanging fruit), and those that are likely to ultimately result in the largest total emissions reductions over the lifetime of implementation (i.e. the largest fruit). Both should be addressed, but priorities will need to be set. Because electricity is the largest emissions source in the community, it is Oberlin's largest emissions fruit. Therefore, the City will sooner or later need to focus both on reducing the emissions resulting from each kilowatt of power used (carbon-intensity), and reducing consumption of electricity in the community through increased efficiency and behavioral change. Accordingly, the last chapter provides some background on Oberlin's electricity situation.

Finally, an important part of the ICLEI philosophy is that City government has a leadership role to play as the community acts on its commitment to address climate change. In Oberlin's case, there is also an important opportunity for collaboration between Oberlin City officials and Oberlin College. The City and College will both gain benefits by working together to prioritize climate action in their decision-making and operations. Success in achieving emissions reductions targets will serve to reinforce the community's dedication to this generation-defining challenge, and will also make it easier for the rest of the community to follow their lead.

CHAPTER I: LOCAL COMMUNITIES AND THE GLOBAL WARMING CHALLENGE

The current climate crisis is the challenge that defines this epoch in history. Leaders from all corners of society all over the world are converging on the conclusion that reducing emissions is an urgent and serious problem that humanity must decisively address. Scientists, economists, and political leaders have largely reached consensus regarding the need to reduce greenhouse gas emissions (IPCC, 2007; Stern, 2007; EPA 2009b), and now even religious leaders of faiths that have not been traditionally known for their environmental values are adding their voices to the worldwide plea for action (McCammack, 2007). Many generations from now, students, historians, politicians, natural scientists, social scientists, farmers, and other global citizens will thoroughly examine human activities since the industrial revolution and evaluate them in terms of climate change. World treaties and wars, economic peaks and troughs, and human rights triumphs and violations will all be duly noted, but the causes of and responses to global warming will likely headline the history books and be a prominent backdrop for all other historical events. Our climatic situation threatens to not only reap short-term destruction on our local and national economies, lifestyles, and livelihoods, but also to bring about a very different, lasting, and much less human-friendly global climate regime (Hansen *et al.*, 2006; Stern, 2007). Each day that passes without significant change to the world's carbon emissions status quo thus reduces our quality of life in the near and distant future. Conversely, however, each ton of carbon we avoid emitting today means another future resident of Earth that avoids climate refugee status, impoverishment, or death. Given the gravity of today's crisis, acknowledged by leaders and experts across the globe, it is imperative that all hands be on deck, from international governing bodies down to local city councils, in the push for climate mitigation while it still matters. Furthermore, while broad national and international initiatives and regulatory policies are crucial, it is as important for local communities to take action, where there are unique opportunities to use strategies that are less applicable at larger scales. In my research, I have focused on exploring climate action on the level of the municipality, both by completing the first step of inventorying Oberlin's emissions and by asking what other communities are doing and how this might inform members of the Oberlin community as they begin to fulfill their climate commitments.

The Climate Crisis

The existence of anthropogenic climate change is now a scientific certainty. Since its formation in 1988, the Intergovernmental Panel on Climate Change (IPCC), one of the world's most vigorously peer-reviewed scientific groups, has released numerous reports on the status of global climate. These reports, along with statements from virtually all relevant scientific bodies, have reflected what is now a strong consensus among climatologists, and the scientific community in general, that human activities are driving the observed changes (Oreskes, 2004). The IPCC (2007) has demonstrated that atmospheric concentrations of carbon dioxide, methane, and nitrous oxide, three of the most important greenhouse gases, are far higher than at any point in the last 650,000 years, primarily due to fossil fuel combustion and land use practices by humans. Since pre-industrial levels, carbon dioxide concentrations have risen approximately 100 parts per million (ppm) to 385 ppm in 2008 (Hansen *et al.*, 2008).

Consequently, air and ocean temperatures have risen, melting snow and ice have been widely observed, and sea level is not only rising, but at a faster rate than several decades ago. These results have led the IPCC to conclude that "warming of the climate system is unequivocal" (IPCC, 2007). The current global mean temperature is already near the maximum for the Holocene Era (encompassing approximately the last 10,000 years), having risen at a rate of about 0.2 degrees Celsius per decade for roughly the last three decades. Global temperature is now within one degree Celsius of the maximum temperature over the last million years (Hansen *et al.*, 2006). Despite these and other data, the frightening magnitude of our situation can be overlooked without difficulty, due in part to invisibility, scale, and a long time horizon that together make the implications of these numbers hard to internalize (Halford and Sheehan, 1991).

Even under scenarios more favorable than business-as-usual, the comfortable, stable climate system that has existed throughout much of human evolution will literally cease to exist (Hansen *et al.*, 2007). This is not an unfortunate turn of events, but rather a catastrophic threat to modern human ways of life. In his 2007 report, Sir Nicholas Stern (2007) modeled the projected economic consequences of climate change, estimating a 5 to 20% loss in global GDP, depending on various levels of warming. A two to three degree Celsius rise in global temperature—a realistic scenario given current emissions rates—would lead to declining global crop yields, expanded vector-borne disease ranges, collapse of fish stocks from ocean acidification, endangered water supplies, mass species extinctions, more frequent and intense severe weather events such as hurricanes, floods, and droughts, and higher risk of dangerous threshold events, such as ice sheet collapse. The resulting illness, death, damages, and forced migrations would have catastrophic impacts on the global economy and the lives of millions of people. What is frightening, given these consequences, is that even if greenhouse gas concentrations were somehow stabilized this year, the complexities and feedbacks in the global system apart from the direct greenhouse effect would result in many climate consequences continuing for centuries, such as warming temperatures and sea level rise (Scheffer *et al.*, 2006; Torn and Harte, 2006; IPCC, 2007). Perhaps more frightening than this, even, is that recent studies have shown that these effects are occurring at a much faster rate than recent models had predicted (Rahmstorf *et al.*, 2007).

The conclusions drawn by scientists and economists in recent years suggest that action to reduce global greenhouse gas emissions is long overdue, and that the climate crisis is becoming more urgent with each passing day. While science has been converging on the conclusions above for some time, the United States, one of the most powerful and influential nations on Earth and one that contributes over 20 percent of annual global greenhouse gas emissions, has been hesitant to respond (Marland *et al.*, 2008). The stated commitment of recent presidential administrations to addressing this issue has varied, but in each case, action has been largely limited to research and voluntary programs, with little else being done (Moser, 2007; Lutsey and Sperling, 2008). In the case of former President George W. Bush's two terms, the US stance initially questioned the science behind anthropogenic climate change and consistently relegated addressing it to the bottom of national priority lists. This contrasts markedly with the international community's collective attention to the issue, with 183 countries having ratified the Kyoto Protocol (UNFCCC, 2009). In his first several months in office, President Obama has demonstrated a strong commitment to fighting climate change, reflected most recently in the Environmental Protection Agency's report declaring greenhouse gases subject to regulation under the Clean Air Act (US EPA, 2009b).

It appears that public acceptance of this reality and commitment to act have grown considerably in recent years (Moser, 2007). The IPCC has been thrust into public consciousness (Haag, 2008) after the release of Al Gore's movie "An Inconvenient Truth" and the emergence of climate change in popular media coverage. Even groups from segments of American society that have not been traditionally associated with addressing climate change, such as the Christian conservative right, are proclaiming their support for aggressive measures to mitigate the problem (McCammack, 2007; Moser, 2007). Over 600 institutions of higher learning have become signatories of the American College and University Presidents Climate Commitment to carbon neutrality (ACUPCC, 2009), and 916 US municipal governments, representing over 27% of the country's resident population, have ratified the Kyoto Protocol through the US Conference of Mayors Climate Protection Agreement (US Census Bureau, 2009; US MCPA, 2009). President Obama, who explicitly acknowledges the severity of the climate crisis (White House, 2009), has now aligned the US with the attitudes of climate scientists and Kyoto signatory governments, and there seems to be coarse global acceptance of the existence, and to a lesser extent the urgency, of global warming. Given this apparent momentum, the next several years perhaps represent human civilization's greatest opportunity to take rapid and substantial steps to stave off the most calamitous climate shifts.

Engaging Local Governments and Communities

While the challenge is explicitly global in scale, its urgency and inextricable linkage with decisions made at all scales require that it be addressed at all levels of governance (Gupta *et al.*, 2007). Climate action can never be simply global because the cause of climate change is the aggregate of innumerable localized greenhouse gas releasing activities (Kates *et al.*, 1998). The crucial role of localities in mitigating climate change has frequently been left unaddressed by scholars (Koehn, 2008), but was stressed at the 1992 United Nations Conference on Environment and Development (Schreurs, 2008) and has been increasingly acknowledged as an essential level of climate policy (Betsill and Bulkeley, 2007). With the remarkable lack of national leadership over the past several decades (Moser, 2007), subnational entities in the US have begun stepping up to fill this hole and demonstrate their commitment to tackling climate change. Numerous studies have documented the worldwide acceleration of climate action by local governmental entities (e.g. Collier and Löfstedt, 1997; Bell, 2002; Allman *et al.*, 2004; Fleming and Webber, 2004; etc.). Schreurs (2008) reports that local governments are often interested in instating their own climate policies, and such initiatives have spread rapidly through international networks and as municipalities learn from the examples of others. Lutsey and Sperling (2008) report that numerous small-scale actions have been implemented in the US and that widespread localized initiatives represent the US's first real steps toward climate change mitigation.

In examining climate action from a local perspective, there are two angles to explore. First, from the perspective of an individual municipality, why does it make sense to address climate change explicitly in the context of other local concerns? Second, from humanity's perspective, why is local action likely to be effective at reducing emissions? There are a variety of reasons a City government might want to act decisively. Based on the interviews I conducted with eight City officials around the country, described in Chapter 3, it appears that saving money is one of the primary reasons municipalities choose to act. Not only do emissions reductions measures combat climate change, but many ultimately reduce costs for City governments and their community's residents and businesses, either in the short term by lowering energy costs, or in the long term by allowing Cities to take advantage of future opportunities. Indeed, in the current political climate, with carbon regulation and taxation schemes likely in the near future and funding for sustainability initiatives growing, those communities that make an early effort to reduce emissions, even with an initial cost, are likely not only to be less affected by costly taxes and regulation, but also to have a competitive advantage in procuring funding for emissions reductions projects. Already, many City officials have noted the growing number of grants available for energy efficiency and other related local projects. While some municipalities might be hesitant to move forward with new initiatives during an economic downturn, it may actually be a good time to start addressing emissions. Furthermore, acting now reduces a community's vulnerability to fluctuating energy prices. A Northampton City official explained that dependence on fossil fuels is a risky proposition, due to both the potential for carbon-pricing and the inherent uncertainty and volatility of prices, something many low-income taxpayers became all too aware of during last summer's spike in gasoline prices. Governments across the country appear to be beginning to understand the advantages of emissions reductions programs beyond the actual emissions. According to one official from Mission, Kansas, though roughly half of Mission's City Council denies the existence of climate change, all council-members tend to support measures outlined in their climate action plan because they make sense financially. Finally, beyond these considerations, a local government that insistently pursues sustainability initiatives is likely to garner attention as a leader in a growing movement, which will, in many cases, attract economic development and improve regional ties.

With the local benefits of reducing emissions clear, it is also important to consider the broader justification for approaching climate change at a small scale. Ultimately, the goal is to slow climatic changes that are dangerous to the planet and our hometowns. There are a variety of reasons to believe that a local approach is a useful one. Local municipalities have a much more direct influence than larger governmental entities over community emissions, through control of zoning, building codes, development, transportation, and waste management policies (Bell, 2002). Implementing local climate policy allows communities to craft municipality-specific strategies and utilize local knowledge and experience (Lutsey and Sperling, 2008). With these advantages municipalities tend to generate many creative ideas for climate policy, and at such a small scale, innovative policy experiments can be evaluated in terms of their effectiveness and the accompanying political responses (Lutsey and Sperling, 2008; Schreurs, 2008). As federal and international initiatives develop, there is likely to be multilevel synergy, where small- and large-scale policies are mutually reinforcing, and policymakers at one level benefit from the lessons learned by those at a different level (Koehn, 2008; Lutsey and Sperling, 2008).

The proximity of local policymakers allows them to interact closely with individual citizens and businesses in way that is difficult from state or federal offices (Bell, 2002). While such local ties can be problematic if polluting entities have a large political influence, Parker *et al.* (2003) show that local partnerships between city councils, neighboring municipalities, public and private utilities, homeowners, local businesses, universities, and NGOs improve local capacity for financing emissions reductions measures, gathering valuable information, and developing reputations and mutual trust among stakeholders, all of which contribute to successful climate action. The benefits of addressing climate change at the community level also extend beyond emissions reductions to the broader challenge of sustainability. A local approach is likely to result in synergistic policies that simultaneously improve fiscal responsibility, social justice, community health, and livability (Bell, 2002) and it also expands opportunities for community education, mobilization, and responding to public feedback (Schreurs, 2008).

Finally, decentralized climate action efforts can be framed in terms of local environmental issues that citizens already care deeply about. Many emissions reductions measures bear co-benefits, such as improved local health from reduced air pollution, that can be emphasized to garner widespread support for such measures (Betsill, 2001; Koehn, 2008). A local approach also makes it possible to leverage concerns about localized impacts of climate change (Bell, 2002). In Northern Ohio, higher temperatures and more intense rainfall are likely, potentially leading to agricultural damage and ironically, both depletion of groundwater aquifers and more severe flooding (CIER, 2008). It is more difficult to use the specific effects of climate change to generate support for national initiatives because these effects vary markedly across regions. This strategic 'bundling' of climate action with other important local issues can increase community buy-in and often means the difference between successful and ineffective implementation of emissions reductions measures.

It is important to acknowledge that in addition to the above advantages of local climate action, Lutsey and Sperling (2008) find that local climate initiatives could collectively have a major effect on national emissions. There are some disadvantages, such as patchwork regulation, overlapping enforcement, and the potential for emitters to migrate to less stringent municipalities, that merit concern. However, a human population that is serious about slowing climate change can hardly afford to wait for substantive national and international leadership, given the enormity of the crisis and the genuine promise of subnational municipalities in reducing emissions and generating ideas.

Oberlin as a Potential Climate Action Leader

The recent surge of local climate initiatives in the US is particularly noteworthy because it represents a voluntary push by municipalities without higher level mandates. This is often difficult to achieve given that on local agendas the multitude of immediate, day-to-day, locality-specific concerns can trump issues perceived as long-term and nebulous, like climate change (Bai, 2007). Furthermore, it is especially difficult to make changes on issues for which there are no top-down directives, as has largely been the case with emissions reductions. However, the community of Oberlin, encompassing both the City government and Oberlin College, has demonstrated its capacity for innovation and making voluntary, forward-thinking, and meaningful change in the face of entrenched local or supra-local status quo. In the case of emissions reductions, such forward-thinking will likely lead to tangible benefits for the Oberlin community.

Oberlin's central role in the US civil rights movement is the foremost historical example of Oberlin's voluntary courage and leadership. Many of the most notable events in this history have been compiled by the Oberlin Heritage Center (OHC, 2009). When the City was founded in 1833, Oberlin College was created as a co-educational institution, a rare occurrence during that time period, which led to the first four Bachelor's degrees awarded to US women in 1841. Oberlin went on to graduate one of the first women to keep her own surname, the first ordained female minister in the US, and later the first African-American female to receive a BA. Furthermore, in 1835, the College became the first institution of higher learning in the US to accept students without considering race. Shortly after mid-century, residents of the Oberlin community participated in the Oberlin-Wellington rescue, defying the Fugitive Slave laws by rescuing John Price, an escaped slave. This event earned Oberlin, a prominent stop on the Underground Railroad, widespread publicity (Bigglestone, 1981). Brandt (1990) has even suggested that the existence of an open, successful African-American community in Oberlin helped incite the Civil War. Today, Oberlin College is known not only as the first college to award diplomas to women and African Americans, but also for its inclusive attitude of acceptance and sensitivity toward people of all genders. It is evident that Oberlin has been a powerful force for societal change in the past, and this distinctive history has benefited the College and community by providing rich and unique educational and cultural opportunities and by attracting attention to Oberlin's progressive and forward-thinking citizenry.

From this rich history of civil rights leadership, the Oberlin community's identity as a leader has re-emerged recently in the context of another generation-defining challenge: climate change. Already, Oberlin has taken concrete steps that demonstrate its commitment to the goal of climate neutrality. In 2001, the City of Oberlin instated a policy measure explicitly requiring consideration of "sustainability" in all City actions (Beach, 2001) and sustainability was subsequently deemed the central theme of the City's 2004 Comprehensive Plan (Norenberg, pers. comm.). On 5 February 2007, City Council voted to become one of the first municipalities in Ohio to join the International Council on Leadership in Environmental Initiatives (ICLEI) Cities for Climate Protection (CCP) program (ICLEI, 2007; Dupee, pers. comm.). The next local election showed that concern about climate change had become an important issue for voters, as a new City Council was elected in part on this issue. In a controversial decision during the spring of 2008, City Council voted 4-3 to opt out of a 50-year contract with American Municipal Power-Ohio (AMP-OH) for shares in a new coal-fired power plant to be built in Southern Ohio (Dupee, pers. comm.). This contentious decision has left the community with many of its near-future electricity sources undetermined, and thus at risk of incurring higher short-term electricity costs. However, it has undoubtedly thrust Oberlin into a position that, while politically difficult, financially uncertain, and logistically problematic, creates unique opportunities for climate leadership.

In addition to the notable political activity around climate issues, there are myriad initiatives within Oberlin that have driven a growing awareness and demonstrate Oberlin's active environmental community. The City and College are exploring the feasibility of developing a green arts district in the heart of downtown Oberlin (Krislov, 2008; Orr, pers. comm.), the school district is considering consolidating into a new, carbon-neutral building (Schroth, pers. comm.), and the Providing Oberlin With Efficiency Responsibly (POWER) Fund is in its pilot year, providing energy efficiency retrofits to seven or eight qualifying low-income households (POWER, 2008; Braziunas, pers. comm.). Oberlin College's real-time energy monitoring project has been awarded grant funding for expansion into and beyond the Oberlin community (Petersen, pers. comm.), and the College's revolving loan Green EDGE Fund is finishing its first full academic year of work. Oberlin Municipal Light and Power (OMLPS) continues to provide free energy audits to local residents, Full Circle Fuels provides biodiesel and straight vegetable oil (SVO) engine retrofits and vehicle fuel downtown, and a variety of school and community garden projects exist or are being developed. The combination of recent climate-oriented political decisions, the bustling activity on local sustainability projects, and Oberlin College's national prominence as a "green" college reveal a community with enormous potential as a leader in what is now a national movement toward localized climate neutrality (Moser, 2007). While environmental regulation has often been alleged to hinder economic growth, there are now many examples both of governments that have economically benefited because of their environmental leadership (Scheurs, 2008) and of municipalities that have sharply reduced costs by saving energy and/or fuel (Bai, 2007). Additionally, given the challenges currently facing local businesses in the Oberlin area, climate change leadership, with the associated potential growth opportunities, is especially valuable.

The Role of Inventories and ICLEI's CCP Program

One important deficiency evident among the ubiquitous 'green' activity is the lack of a coherent framework from which current and future activities might gain an explicit common purpose. A comprehensive greenhouse gas inventory is necessary to situate these projects in the context of Oberlin's overall emissions profile and climate stewardship goals. In order to set these goals intelligently and develop and prioritize emissions reduction policies, it is necessary to have detailed emissions measurements. The existence of such a robust environmentally oriented community makes conducting such an inventory that much more valuable.

Perhaps the most important justification for conducting an inventory is the value of explicitly identifying and quantifying annual greenhouse gas emissions. The resulting detailed baseline can then be used to compare emissions inventories in future years. Without quantifying emissions, it is virtually impossible to evaluate the impact of implementing various emissions reductions measures. An inventory also provides important information about the distribution of emissions across various sectors, which in turn helps shape emissions reductions strategies that target the areas responsible for the largest portions of emissions, something that is much more difficult to do with state or national inventories (Kates *et al.*, 1998). Additionally, the process of conducting an inventory inherently recruits officials from each municipal department who become aware of the City's actions toward fulfilling its commitment and are thus less resistant to future initiatives and perhaps more likely to contribute ideas and expertise during the future planning and implementation phases of emissions reductions measures.

Having a concrete picture of a community's emissions also allows for two crucial steps in the process of addressing climate change locally: setting a target and creating a detailed plan. While conducting a two-year baseline inventory, 2001 and 2007 in this study, cannot identify a reliable pattern of increasing or decreasing emissions, it can provide a rough idea of how the community's emissions profile can change, making it somewhat easier to judge the aggressiveness and realism of potential reductions targets. A detailed inventory is also the foundation for a detailed climate action plan outlining specific measures the community will take to reduce emissions in each sector.

This logic is becoming standard practice throughout the world as citizens and elected officials struggle with the challenge of combating climate change in their communities. Lutsey and Sperling (2008) observe that a pattern has developed of subnational governments inventorying emissions, setting emissions reductions targets, and creating climate action plans. Along with several other organizations, ICLEI has played a prominent role in creating this pattern, and now has over 500 municipal members in the United States (Schreurs, 2008; ICLEI, 2009c). ICLEI's focal program, Cities for Climate Protection (CCP), assists municipal officials as they pursue climate neutrality for their municipal operations, their community as a whole, or both (Malick, pers. comm.). The CCP program is structured by five milestones (ICLEI, 2008b):

1. Conduct a baseline emissions inventory and optional forecast
2. Adopt an emissions reduction target for the forecast year
3. Develop a local climate action plan
4. Implement policies and measures
5. Monitor and verify results

Having become an ICLEI member in 2007, the City of Oberlin made the commitment to carry out these milestones, and with this study has now taken its first steps in the CCP program.

In the context of ICLEI and Oberlin's sustainability movement, this study was conducted to answer the following questions. How many tons of annual greenhouse gas emissions are associated with the community of Oberlin and with Oberlin's municipal operations and what are their major sources? What is a reasonable and realistic approach for the City of Oberlin to take in setting an emissions reduction target? What are the necessary next steps for Oberlin, how might Oberlin make its climate action process sustainable through an established framework, and what are some options as it moves toward developing a climate action plan? Both the City of Oberlin and Oberlin College have pledged to move toward climate neutrality. Addressing these questions shifts the community from simple statements of commitment toward concrete action, closing what Betsill and Bulkeley (2007) call the "stubborn gap between the rhetoric and reality of local climate policy."

CHAPTER 2: QUANTIFYING OBERLIN'S CARBON EMISSIONS

Introduction

ICLEI's first milestone consists of conducting a greenhouse gas inventory and an optional emissions forecast. The basic goal of this milestone is to establish a baseline emissions profile to which future inventories can be compared in order to evaluate the effect of emissions reductions measures implemented during the intervening period. In this chapter, I present the methods and results of Oberlin's first inventories, conducted from September 2008 through March 2009, which represent the City's first official step in ICLEI's Cities for Climate Protection (CCP) program. I conducted two separate sets of inventories: one quantifying GHG emissions associated with activities throughout the Oberlin community in 2001 and 2007, and the other quantifying emissions associated with municipal operations in 2001 and 2007.

Definitions of inventory boundaries and corresponding terms

The first task in conducting an inventory is to define its boundaries, within which emissions are tracked. For the community-wide inventories reported here, the boundary is Oberlin's geographic boundary, or city limits (see Appendix 1 for map). For the municipal operations inventories, the boundary is activities over which the City of Oberlin exerts operational control. There is some overlap between these two sets of inventories. A large portion of municipal operations occurs within the city limits, and is thus included in the community-wide inventories. However, several municipal facilities, such as the wastewater treatment plant, are located outside city limits and thus fall outside of the community-wide boundary. I use the capitalized term "City" to refer to Oberlin's municipal government and its employees—in other words, the entity that generates emissions covered in the municipal operations inventories. In Chapters 3 and 4, where I describe how climate action has occurred in other places, I similarly use the term "City" to refer to the municipal government of whatever locality is being discussed. "Community" refers to the entity covered in the community-wide inventories, specifically all people and entities located within city limits. I use "Oberlin" more generally, to refer to the wider group of people, institutions, and activities associated with this locality, which is not restricted to any geographic boundary or operational control. Both the City and community are encompassed in the term Oberlin.

What is an ICLEI inventory?

I conducted the inventories using ICLEI's Clean Air and Climate Protection (CACP) software, which ICLEI provides to all its members (ICLEI, 2008a; Manarolla, pers. comm.). ICLEI's Local Government Operations Protocol (LGOP), developed in partnership with the California Air Resources Board, the California Climate Action Registry, and the Climate Registry, provided detailed instructions for conducting the municipal operations inventories (CARB *et al.*, 2008). ICLEI's community-wide emissions inventory protocol is currently scheduled for release in summer 2009, and I consequently carried out the community-wide inventories based on the structure of the CACP software itself, with guidance from ICLEI

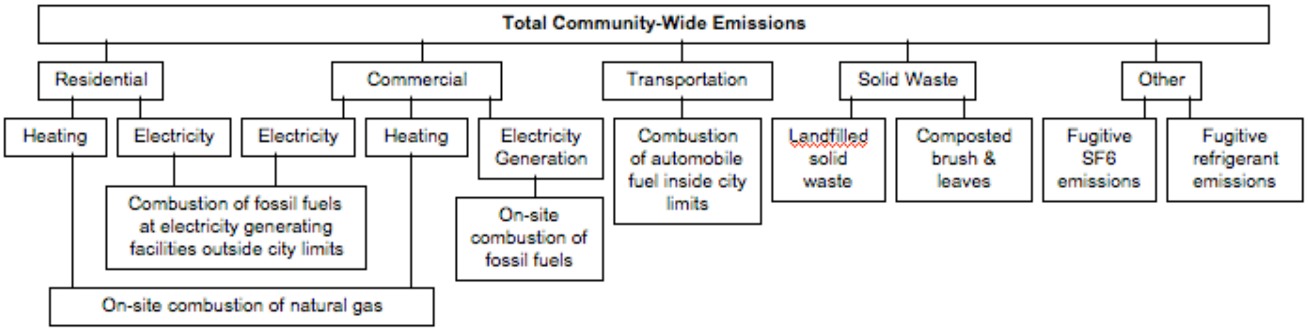


Figure 1: Constituent components of emissions attributable to activities within Oberlin's city limits and thus included in Oberlin's community-wide inventory.

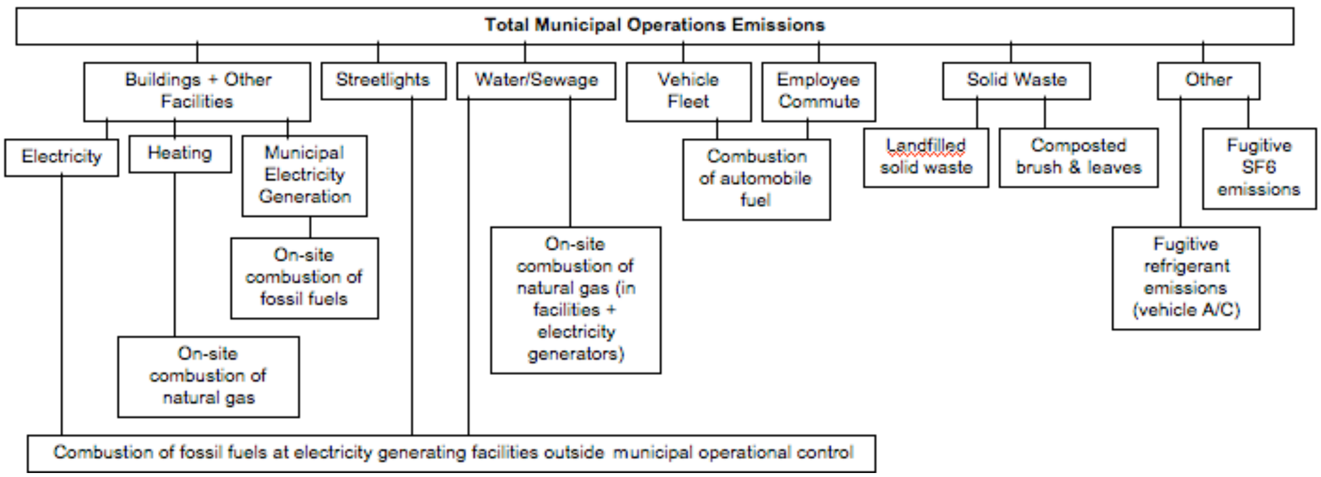


Figure 2: Constituent components of emissions attributable to activities under the control of Oberlin's municipal government and thus included in Oberlin's municipal operations inventory.

representatives and the LGOP. Figures 1 and 2, respectively, describe the emissions sources included in Oberlin's community-wide and municipal operations inventories. More detailed data collection methods can be found below.

Of the Kyoto Protocol's six internationally-recognized and regulated greenhouse gases (carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO_2), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)), I chose to focus these inventories primarily on CO_2 emissions, because they represented about 85% of all GHG emissions in the US in 2007 – about 94% of that from fossil fuel combustion (US EPA, 2009a). The CACP software and most other GHG accounting methodologies quantify emissions using CO_2-equivalents (CO_2e). Non-CO_2 gases can be converted to CO_2e using their internationally recognized global warming potential (GWP) factors. The GWP factor for a particular gas represents its ability to trap heat in the atmosphere, relative to the ability of CO_2 (CARB *et al.*, 2008). For example, CH_4 has a GWP of 21, indicating that one pound of CH_4 has the same warming effect as 21 pounds of CO_2. Reporting emissions in CO_2e allows inventories to easily incorporate emissions of any GHG. Emissions of many non-CO_2 GHGs are frequently considered fugitive emissions. Fugitive emissions are defined as those emissions that result from uncontrolled release rather than from an intentional process like combustion. In these inventories, I included fugitive emissions of CH_4 from decomposition of solid waste, HFCs from stationary and mobile refrigeration equipment, and SF_6 from electrical line maintenance. It should be noted that while the goal of these inventories was a comprehensive estimate of greenhouse gas emissions, the inventories do not represent precise greenhouse gas accounting, and in the case of CH_4, HFCs, and SF_6, these inventories are far from comprehensive. I did not explicitly address emissions of PFCs or N_2O. However, because CO_2 is the major GHG emitted in association with the City and community's activities, not accounting for all emissions of other GHGs likely has an insignificant effect on overall CO_2e emissions.

Emissions can be divided into three categories, or "scopes." Scope 1 emissions are direct emissions released inside the geographic or operational boundaries of the community or City being subjected to the inventory, from combustion of fossil fuels, fugitive emissions or chemical and physical processing. I chose not to pursue data on GHG emissions from the latter source, given that the chemical and physical processing of the only substantial industrial operation in Oberlin, a plug manufacturing plant, probably does not contribute significantly to Oberlin's overall emissions (McMillan, pers. comm.). Time permitting, future inventories should examine this and any other industrial processes occurring within inventory boundaries. Scope 2 emissions are indirect emissions released during the production of electricity, steam, heating, or cooling outside inventory boundaries. Scope 2 emissions are categorized separately because by definition, they are accounted for as Scope 1 by the entity that produces the electricity. For example, the OMLPS power plant burns light fuel oil and natural gas to produce electricity that is consumed mostly outside Oberlin city limits. The OMLPS plant's emissions are counted as Scope 1 in Oberlin's City and community inventories, but would also be counted as Scope 2 by any entity consuming electricity that was generated at the plant. Therefore, emissions can only be aggregated across entities within a single scope. Scope 3 emissions include any emissions that are not included in Scopes 1 and 2, such as those that occur outside the inventory boundary but result from activities within, including but not limited to emissions associated with extraction, processing, and transport of fuels and materials. The CH_4 emissions associated with decomposition of solid waste generated by Oberlin's community or municipal operations occur at the Allied Waste landfill, which is located outside the boundaries of both sets of inventories. Therefore, these emissions are considered Scope 3. Emissions from employee commuting, an activity outside the City's operational control but included in the municipal operations inventories, are the only other Scope 3 emissions I have addressed. For a brief discussion of other Scope 3 emissions, see "GHG emissions that are not accounted for in these inventories" at the end of this chapter.

Oberlin's inventory years and some caveats

The primary goal of these first ICLEI inventories is to establish baseline emissions profiles to which future inventories can be compared. Amy Malick, ICLEI's Midwest Regional Director, recommended that I conduct the inventories for two separate years, in order to begin addressing a secondary goal: establishing rough estimates of trends for City and community emissions. I chose the year 2001 because it appeared to be the earliest year for which the majority of data was available, although it became evident that some data were missing or otherwise problematic. I chose 2007 because it was the most recent year for which data were accessible. Readers should treat 2007 as the primary inventory year. I collected data from 2001 in order to provide an additional data point that allows for limited comparison, provides an additional baseline, and will facilitate more detailed trend analysis as data from more years become available in the future. With just two years, it is virtually impossible to detect reliable trends, due to typical annual variation that cannot be accounted for, such as that resulting from fluctuations in population, commercial sector composition, and heating and cooling degree-days. The latter two factors provide rough measures of potential demand for heating and cooling energy, respectively. Exercising caution when searching for trends is further warranted because of the uncertainty associated especially with the transportation and natural gas data. When comparing inventories from 2001 and 2007 for potential trends 2001-2007 trends should only be interpreted generally due to uncertainties primarily in natural gas and transportation estimates and annual variation left unaccounted for by the use of only two years.

Community-Wide Emissions: Data Collection Methods

Sector breakdown

The community-wide inventories are broken down into the following sectors, depicted in the second tier of the flowchart in Figure 1 (above) and described more specifically in Table 1 (below). The residential sector refers to all fuel and electricity use by households within city limits, with the exception of Oberlin College-owned on- and off-campus housing. The commercial sector refers to all fuel and electricity use in non-residential buildings and facilities within city limits, and includes all Oberlin College property, henceforth referred to as the "College,"[1] as well as City buildings and facilities located within city limits (but see "Natural gas" in this section for an additional caveat). I have also chosen to include Oberlin's few industrial entities in the commercial sector because this is how the OMLPS billing and accounting process has characterized them and because this approach avoids further complicating the community-wide inventories with additional calculations for a very small sector. In the results, in order to illustrate the specific contributions to the larger commercial sector from the City and College, I factor out and specify the associated emissions. The College and City 'sub-sectors' do not include the transportation, solid waste, or miscellaneous fugitive emissions associated with the College and City—only emissions from electricity and fossil fuel combustion in buildings and facilities (which is consistent with what is included in the aggregate commercial sector to which these sub-sectors belong). It is impossible to break transportation down into sub-sectors, due to the nature of the data. The Northeast Ohio Area Coordinating Agency's (NOACA) estimates include all vehicle travel within city limits and while both the College and City have data for fuel consumption by their respective vehicle fleets, it would have been prohibitively difficult to determine what portion of these consumption totals had occurred within city limits. The solid waste sector refers to fugitive CH_4 emissions from the decomposition of waste generated within city limits. Because the Allied Waste landfill is located outside city limits, these emissions are considered Scope 3. The 'other' sector refers to other miscellaneous fugitive emissions of GHGs unrelated to energy consumption. In this case, these include refrigerants released from vehicle air conditioning systems and stationary refrigeration systems as well as SF_6 released during maintenance of electricity lines. It would be possible to break down the solid waste and 'other' sectors into the contributions from the College and City,

[1] It should be noted that later in this report I use "College" to refer not only to College buildings and facilities but also to its administrators, staff, faculty, and students

but I chose not to in order to maintain consistency with the College and City sub-sectors as strictly part of the commercial sector (i.e. just electricity and fossil fuel).

It is important to acknowledge the existence of a separate inventory for the College, completed by the College's Sustainability Coordinator Nathan Engstrom in September 2008 (Engstrom, pers. comm.). While I used some data from the College's inventory in my calculations, I have not integrated the College's inventory, which was conducted using Clean Air-Cool Planet methodology, into these community-wide inventories. Instead, these inventories demonstrate the College's approximate contribution to the community's overall emissions. The College's inventory is more detailed and comprehensive with regard to College emissions, and because these make up such a substantial portion of the community's emissions, College staff should be included as the City discusses future climate action measures.

Energy source breakdowns

I also divide the community-wide emissions by energy source in two ways. First, I specify emissions resulting from electricity, natural gas (for heating), vehicle fuel, power and steam generation, and fugitive emissions. Vehicle fuel includes gasoline and diesel fuel. Power and steam generation includes natural gas and light fuel oil burned in the OMLPS plant to produce electricity as well as natural gas and coal burned at the College's Combined Heat and Power (CHP) plant to produce electricity and steam. Fugitive emissions include CH_4 from solid waste as well as the other three miscellaneous fugitive emissions in the 'other' sector. It should be noted that fugitive emissions are not technically an energy source, because no fuel is burned to generate energy.

Table 1. Constituents of each broad sector of the community-wide inventories.

Broad Sector	**Description**
Residential	Residential buildings (excluding College-owned on- and off-campus housing)
Commercial	All College buildings and facilities (including College-owned on- and off-campus housing and the CHP plant)
	All City buildings and facilities within city limits (note: this does not represent all municipal operations)
	All other non-residential buildings and facilities within city limits (including hospital, air traffic control center, schools, businesses, the community's small industrial sector, etc.)
Transportation	All vehicles traveling within city limits (includes vehicles owned by the College, the City, and residents, but only when operating within this boundary)
Solid Waste	Fugitive CH_4 emissions (includes solid waste generated within city limits and sent to the Allied Waste landfill as well as brush and leaves sent to the City's compost facility—both data sets include waste from the College and City)
Other	Miscellaneous fugitive emissions (includes refrigerants from vehicle A/C systems and roughly half of the community's stationary refrigeration systems, as well as SF_6 from OMLPS electricity line maintenance)

Table 2. OMLPS electricity mix broken down by fuel type. "*" Signifies a zero-emissions electricity source. Electricity from OMLPS's peaking power plant is considered zero-emissions to avoid double-counting, as its emissions are considered Scope 1 and are thus accounted for through direct on-site fossil fuel combustion.

	OMLPS (prior to REC sales)		Community		OMLPS (prior to REC sales)		College		Non-College Community	
Fuel Type	**2001 MWh**	**2001 %**	**2001 MWh**	**2001 %**	**2007 MWh**	**2007 %**	**2007 MWh**	**2007 %**	**2007 MWh**	**2007 %**
Coal	88,951	82.14	94,265	87.04	90,017	76.22	12,498	50.81	77,519	82.90
Hydro*	10,208	9.43	5,023	4.64	12,342	10.45	7,176	29.18	5,166	5.52
Nuclear*	5,294	4.89	5,844	5.40	7,814	6.62	1,085	4.41	6,729	7.20
Landfill*	1,724	1.59	862	0.80	4,916	4.16	3418	13.90	1,498	1.60
Natural Gas	1,036	0.96	1,158	1.07	2,001	1.69	278	1.13	1,723	1.84
Light Fuel Oil	1,051	0.97	1,113	1.03	961	0.81	133	0.54	828	0.89
Natural Gas (OMLPS)*	23	0.02	23	0.02	48	0.04	7	0.03	41	0.04
Light Fuel Oil (OMLPS)*	8	0.01	8	0.01	2	0.00	0	0.00	2	0.00
TOTAL	108,295	100.00	108,295	100.00	118,101	100.00	24,596	100.00	93,505	100.00
Carbon Intensity (lbs CO_2e per kWh)	2.05		2.18		1.92		1.28		2.08	

Electricity and renewable energy credits

All electricity consumed within Oberlin's city limits (and in nearby areas outside city limits) is provided by Oberlin Municipal Light and Power Supply (OMLPS), the City's municipally owned and operated electric utility. In order to calculate emissions from this electricity, it was necessary to determine 1) consumption within city limits by sector, and 2) the details of OMLPS's electricity 'mix'—the percentages of OMLPS electricity generated by various types of power plants (e.g. coal-fired, hydropower, etc.). The fact that Oberlin has a municipally owned and operated utility made acquiring these data much easier and more precise than it might have otherwise been, such as in the case of private utility companies. I obtained consumption data from OMLPS spreadsheets, which are broken down by customer class (residential, commercial, or municipal) and location (inside or outside city limits). The municipal customer class was not divided by location in the spreadsheets, and it was thus necessary to specifically request this additional piece of data from OMLPS staff. I obtained the College's electricity consumption from the College's Clean-Air Cool-Planet inventory spreadsheets, completed by Nathan Engstrom, the College's Sustainability Coordinator, in September 2008 (Engstrom, pers. comm.). These data allowed me to quantify emissions associated with electricity separately for the College, municipal operations within city limits, and the rest of the commercial sector.

Calculating the emissions associated with electricity consumption was a more complicated process. Table 2 shows the source breakdown of the OMLPS electricity mix for 2001 and 2007, acquired from AMP-OH by OMLPS Director Steve Dupee. The CACP software allows users to define their own electricity mix, which allowed me to incorporate OMLPS's specific breakdown into the inventories. However, before using this feature of the software, it was necessary to adjust the AMP-OH electricity source percentages, because they did not initially reflect the true carbon-intensity of the electricity consumed by OMLPS customers. Carbon-intensity refers to the amount of CO_2 emitted for each kWh consumed, which is determined by the fuel being burned to produce the electricity (e.g. coal-fired electricity has the highest carbon-intensity because burning coal releases more CO_2 per kilowatt than burning other fossil fuels). The first adjustment I made was in order to avoid double-counting emissions released by OMLPS's peaking power plant, which burns natural gas and light fuel oil. Because these emissions result from combustion within inventory boundaries, they are accounted for as Scope 1. Therefore, to avoid double-counting, it was necessary to assign zero emissions to the electricity produced at this plant and consumed by community residents, and to do this I needed to factor out the electricity generated at the OMLPS plant from the natural gas and light fuel oil portions of the total mix. OMLPS employee Bob Rogers provided data on the number of kilowatt-hours (kWh) generated from burning each of the two fuels used at the OMLPS plant. Using Dupee's assumption that OMLPS receives about 5% of the plant's electricity, we were able to make estimates of how many kWh in the OMLPS mix was generated annually at the OMLPS plant by each fuel type, which were subtracted from the overall natural gas and light fuel oil kWh totals provided by AMP-OH. These were then specified as separate zero-emissions electricity sources.

After accounting for this first issue, it was necessary to account for OMLPS's sale of renewable energy credits (RECs). Substantial portions of OMLPS electricity is generated by wind turbines, landfill gas, and hydropower plants, none of which result in net GHG emissions. Many entities around the country purchase RECs in order to be able to 'claim credit' for the associated zero-emissions electricity. OMLPS does not possess the RECs for its wind power, which comes from the Bowling Green wind project. Accordingly, I factored out wind power-associated zero-emissions kWh from the OMLPS mix in 2007 (OMLPS did not have any wind power in 2001). I then replaced those wind-kWh with kWh by source proportional to 2007 market mix percentages by energy source, found on AMP-OH documents provided by OMLPS. Next, it was necessary to account for REC sales of landfill gas and hydropower electricity.

In 2001, OMLPS was not aware of the revenue-generating opportunity a REC program would provide, given its electricity mix, but in 2002 Green Mountain Energy began purchasing RECs from OMLPS to obtain 'credit' for a portion of Oberlin's hydropower- and landfill gas-generated electricity. This occurred until 2004, when Oberlin College began purchasing these RECs. OMLPS receives money from REC sales in exchange for forfeiting the 'rights' to its renewable energy. Recently, this money, about $23,000 per year, has fed the City's Sustainability Reserve Fund, which has provided funding for a wind monitoring tower, the Full Circle Fuels biofuel and SVO station, and most recently Oberlin's POWER Fund (McMillan, pers. comm.). As a result of selling its RECs, a portion of the OMLPS mix that had been zero-emissions hydropower and landfill gas electricity, is effectively replaced by electricity with the carbon-intensity of the market mix. The fact that no RECs were sold in 2001 makes drawing comparisons between Scope 2 emissions in 2001 and later years difficult. To add consistency to these inventories and thus make comparisons with 2001 more meaningful, in my calculations I have assumed, contrary to reality, that OMLPS was selling its RECs in 2001. According to Dupee, if OMLPS had known, in 2001, that it was able to sell RECs, it likely would have done so in order to generate additional revenue to offset some electricity costs. Because OMLPS has sold RECs since 2002 and would have done so in 2001 if possible, it is reasonable to account for this in both inventory years, as it represents typical OMLPS practice.

In order to account for these REC sales in the electricity mixes I used in the CACP software, it was first necessary to determine how many kWh of RECs OMLPS sold for each of the two energy sources. OMLPS's contract for landfill gas electricity only allows it to sell RECs for half of its landfill gas electricity (although there were special circumstances in 2007 resulting in the sale of RECs for more than half of its landfill gas kWh). It is also only able to sell RECs from one of the multiple hydropower projects from which it receives electricity. Because OMLPS actually did sell RECs in 2007, I was able to obtain exact kWh numbers for RECs sold. For 2001, however, it was necessary to estimate the amount of RECs that would have been sold. I assumed that landfill gas REC sales in 2001 would have amounted to half of OMLPS's landfill gas kWh. Because the hydropower REC situation is complicated due to the existence of multiple projects and other issues, I estimated that OMLPS would have sold RECs for the same proportion of its total hydropower kWh as it did in 2007, and calculated the 2001 hydropower RECs by multiplying the total 2001 hydropower kWh by the proportion of 2007 REC-kWh to total 2007 hydropower kWh.

After determining the amount of electricity for which OMLPS sold its RECs in each year, I factored out those kWh from the existing OMLPS mix, assigning the REC-kWh to the entity that purchased it (Green Mountain Power or Oberlin College) and replacing them with kWh from sources proportional to the market mix percentages. I did not have data for the 2001 market mix, so I replaced the 2001 REC-kWh using the 2007 market mix as a proxy, under the assumption that it would be closer to the real 2001 market mix than assuming 100% coal-fired electricity.

In 2001, the hypothetical purchasing entity (Green Mountain Power) was not a member of the community, and therefore the REC-credited zero-emissions kWh could not be included anywhere in the 2001 community-wide inventory. However, in 2007, the College was the entity purchasing the RECs, which meant that while these zero-emissions kWh are factored out of electricity for non-College OMLPS customers, they remain in the community, credited to the College, and thus are accounted for in the 2007 community-wide inventory. Thus, from 2004 onward, the hydropower- and landfill-generated electricity for which OMLPS sold RECs has remained in the community. Accordingly, I created a separate 2007 mix specifically for Oberlin College's electricity use by crediting it with the zero-emissions kWh it purchased through RECs and then calculating the sources of the rest of the College's 2007 kWh consumption using the electricity mix for the rest of the community. Table 2 shows 2001 and 2007 electricity mixes for OMLPS before any REC sales, and also from the perspective of the consumers (i.e. after RECs were sold), along with respective carbon-intensities. I defined the electricity used in the CACP software's emissions as coming from the mixes after REC sales were accounted for. The software then calculates electricity carbon-intensities by incorporating default emissions coefficients (i.e. carbon-intensities) for electricity from each fuel source.

It should be noted that ICLEI recommends disregarding REC purchasing and other 'offset' or renewable electricity crediting schemes, because no system of accurately and credibly tracking ownership of renewable electricity has been established. However, I decided to deviate from ICLEI methodology and account for RECs in these inventories because it is important to acknowledge the legitimacy of the renewable electricity market and because from Oberlin's perspective, OMLPS's REC sales have a substantial impact on the effective carbon-intensity of its electricity. Furthermore, this makes the City and community's inventories more compatible with the College's inventory, which includes RECs and acknowledges money spent by the College (and not by other users) for the purpose of ensuring that its electricity is low-carbon.

It is important to note that the sale of RECs within the city limits does not change total community-wide emissions but simply alters the emissions baseline and subsequent quantification for each sector. If future inventory coordinators wish to revert to ICLEI's methodology of excluding RECs, for example in order to assist regional inventories using this methodology, it will not be difficult to adjust the inventories accordingly, using the CACP software. If retroactive recalculations are necessary, this requires nothing more than re-entering

Scope 2 data using coefficients from the pre-REC OMLPS electricity mix. As long as Oberlin's inventory methodologies are consistent, they will serve their primary purpose of accurately quantifying the effect of various emissions reduction measures and measuring Oberlin's emissions reduction progress.

Natural gas

It is important for readers to understand that the natural gas consumption data used in these inventories are not nearly as precise as the electricity data. While detailed electricity data were available from OMLPS, Columbia Gas of Ohio Inc. (CGO) was unwilling to release sector-specific data publicly (or privately to City officials). Instead, CGO External Affairs Specialist Amy Koncelik provided rough estimates for community-wide natural gas consumption, made initially by CGO employee Mark Balmert. Because sector-specific natural gas consumption data were unavailable, I estimated the sector breakdown in the following manner. Known 2001 and 2007 natural gas use by the OMLPS power plant, the College (both for the College's CHP plant and for direct building heating), and municipal facilities (see below) were subtracted from the 2001 and 2007 CGO community-wide totals and specified, leaving the amount of natural gas consumed by the remainder of the community (i.e. residential sector and non-College, non-municipal commercial sector). College Professor Rumi Shammin provided a 2005 estimate of residential consumption, which I then normalized for heating degree-days and population to produce residential consumption estimates for 2001 and 2007. I then subtracted these figures, specifying them for the residential sector, and attributed the remaining natural gas consumption to the non-College, non-municipal commercial sector.

Some of the calculations performed here introduce sources of error to natural gas consumption estimates. First of all, CGO's 2001 and 2007 community-wide estimates may not be very precise. I have assumed that these estimates include only buildings and facilities within city limits. While I specified this boundary to Koncelik when requesting the data, I cannot be certain that it was conveyed effectively to Balmert, who actually made the estimates. Additionally, Koncelik did not describe Balmert's estimation method.

The calculations for municipal natural gas consumption introduce two other minor sources of potential error in the sector breakdown for this fuel: imprecision in 2001 estimates, and an inventory boundary issue. CGO provided 2007 consumption data for the City's individual accounts, but could not produce records prior to late 2004. Therefore, I calculated facility-specific municipal natural gas consumption for 2001 by simply normalizing the 2007 data for heating degree-days for each account. This estimation method results in less accurate 2001 figures because differences in municipal consumption patterns and physical changes to facilities could not be accounted for without raw data. Additionally, in the 2001 and 2007 calculations performed to divide CGO's community-wide natural gas estimate by sector (described above), municipal consumption represents the aggregate normalized consumption from all individual municipal CGO accounts as well as consumption by the City's small electricity generators and the OMLPS power plant, which are not included in the CGO accounts provided, to my knowledge. These aggregate municipal figures used in my calculations represent a minor breach of the community-wide inventory boundary, because some municipal facilities are located outside city limits. However, I proceeded because 1) given some confusion regarding which CGO account numbers correspond to which City facilities, extracting individual municipal accounts occurring outside city limits was prohibitively difficult, 2) the effect is insignificant due to the small amount of City consumption, relative to the rest of the commercial sector, and 3) this figure was used only in dividing overall consumption by sector, without affecting overall community-wide natural gas emissions at all, which remain consistent with the CGO estimates and, presumably, the city limits boundary.

In future inventories, the City should attempt to obtain more disaggregated and accurate data from CGO, as well as data for years farther back in time from present. Perhaps Oberlin officials, knowing more about the contractual and legal relationship between the City and CGO, will be better able to leverage their position to obtain these data. If successful, this would greatly increase the accuracy of future community-wide inventories.

Transportation

Bill Davis and Eunah Kang from the Northeast Ohio Area Coordinating Agency (NOACA) generously provided VMT estimates for the community-wide transportation sector. As with other data, these estimates come with various sources of potential error. According to Davis, metropolitan planning organizations (MPOs), like NOACA, and departments of transportation (DOTs) approach traffic planning from a traffic congestion standpoint, and thus focus their attention on peak periods and workday commuting. The goal of their work is not to make accurate estimates that account for every automobile trip, and their VMT data are therefore less accurate than one might prefer for conducting GHG inventories. It seems likely that NOACA has underestimated annual VMT within Oberlin's city limits, but Davis did provide any opinion regarding the directionality of NOACA's error. Furthermore, several other factors specific to Oberlin are somewhat problematic. Oberlin is a "significant non-workplace destination" throughout the seven-day week and has an irregular boundary, both of which increase the potential for error using NOACA's modeling. The CACP software includes a VMT calculator that is meant to assist in calculating transportation emissions. However, according to Davis, reliable traffic counts for Oberlin roads do not exist, making it impossible to use the VMT calculator. Despite these caveats, Davis and Kang used NOACA's travel demand model to estimate daily vehicle-miles-traveled for the years 2000 and 2006. Given the inherent lack of precision in these estimates, we determined that they could reasonably be used as proxies for 2001 and 2007, respectively. If possible, future inventory coordinators should attempt to obtain more accurate data on emissions from the transportation sector, perhaps by facilitating dialogue between NOACA modelers and ICLEI inventory technicians.

Fugitive emissions from solid waste

Jeff Baumann, Oberlin Public Works Director, and Chris Jaquet, Allied Waste Industries Environmental Manger, provided data for community-wide solid waste collected by the City and transported to the nearby Allied Waste landfill (outside city limits). Baumann also provided the following estimate of waste composition, adjusted from Lorain County Solid Waste Management District's waste characterization: 30% paper products, 6% food waste, 3% plant debris, 12% wood/textiles, and 49% other. Additionally, he provided data on seasonal leaves and brush collection brought to Oberlin's composting facility at the City's wastewater treatment plant. I did not obtain composting estimates from George Jones Farm, which includes food waste from the Oberlin Student Cooperative Association (OSCA). Future inventories should attempt to account for this and other composting operations throughout the community. Recycling tonnage cannot be included in inventory module of the CACP software. Instead, recycling is considered an emissions reductions "measure" and is included in the analysis of measures the City has taken to reduce emissions, an analysis that was beyond the scope of these baseline inventories.

Other fugitive emissions

As discussed earlier, fugitive emissions include uncontrolled releases of GHGs, often non-energy gases such as refrigerants. I quantified the miscellaneous fugitive emissions included in the "Other" sector partly in order to be slightly more comprehensive, but more importantly to set a precedent of including non-carbon GHG emissions for future inventories. I did not include them in the specified sectors because I did not consistently pursue these data. Accordingly, this "Other" sector does not reflect exhaustive accounting of these types of emissions. Doug McMillan provided an estimate of SF_6 releases during maintenance of electrical lines by OMLPS based on their average annual purchase of one tank (35 pounds). Emissions of HFC-134a, the most commonly used refrigerant in vehicle A/C systems, were calculated using a literature-based average emissions rate per vehicle (Wallington *et al.*, 2008) and data on vehicles registered within city limits, provided by the Ohio Bureau of Motor Vehicles (Dearwester and Cook, pers. comm.). The estimate of stationary refrigerant emissions (emissions from refrigerators and other cooling equipment in buildings and facilities) is the least precise, provided by Doug McMillan in consultation with Monroe Heating, one of several HVAC maintenance companies that serve the Oberlin area. According to the owner of Monroe Heating, his company serves about half of the Oberlin community. I attempted to obtain accurate data for refrigerant emissions from the College, but was unsuccessful. Rocky Mountain Institute's 2020 Report was the source of HFC data used in Engstrom's College inventory (Heede and Swisher, 2002). However, I did not use the RMI figure because Marty Plato from the College's Facilities Department asserted adamantly that it was unrealistically high. Because fugitive refrigerant emissions almost certainly amount to only a small portion of the community's overall emissions, I chose not to further pursue data on these emissions and have therefore underestimated fugitive emissions. Future inventories would benefit from more precise and comprehensive accounting of these miscellaneous fugitive emissions, but achieving this should probably be a relatively low priority.

Per capita calculations

In order to calculate community-wide per capita emissions, I divided the community-wide emissions total for each year by US Census Bureau population estimates for Oberlin city limits for each year. I also report per capita emissions for the residential sector alone. Because the residential sector in these inventories does not include College-owned housing, I subtracted the number of College students living in College-owned housing, provided by the College's Office of Residential Education (Adams, pers. comm.), from the Census Bureau's population estimates for each year to find the population contributing to residential sector emissions. I then found per capita residential emissions by dividing total residential sector emissions by these population figures (6002 in 2001 and 5932 in 2007).

Community-Wide Emissions: Inventory Results

In this section, I present the results of the community-wide inventories for 2001 and 2007. Before doing so, it is necessary to acknowledge some general characteristics of Oberlin in these two years that influence emissions and should be kept in mind while interpreting the results. Community-wide emissions depend, in part, on the residential population, the growth of the commercial sector, and the demand for heating and cooling in buildings. Oberlin's city limits encompass an area of 4.4 square miles, within which the residential population was 8031 and 8330 in 2001 and 2007, respectively, an increase of 3.7% (US Census Bureau, 2009). Nevertheless, Oberlin's population has not changed significantly for some time, having peaked at 8,700 in 1970s and 80s (City of Oberlin, 2005). I was unable to obtain reliable data on the precise size of and change in the community's commercial sector over this period, but both Wendie Fleming, from the City of Oberlin's Planning and Development Department, and OMLPS's Doug McMillan have suggested that it has grown since 2001. According to the US Department of Commerce's National Climatic Data Center, in 2001 and 2007, respectively, Northeast Ohio had 5811 and 5984 heating degree-days (a 2.9% increase) and 563 and 703 cooling degree-days (a 24.9% increase) (NCDC, 2009). Presenting these data here provides context for the results that follow, and should be kept in mind as factors that influence consumption of natural gas and electricity.

Community-wide emissions by sector

In 2001 and 2007, the Oberlin community within city limits emitted a total of 178,427 and 174,393 tons CO_2e, respectively. This is a decrease of 2.3% over six years (note that this is a comparison between two years, not a reliable trend). Per capita annual GHG emissions for the two years were 22.2 and 20.9 tons CO_2e per resident. According to the US Energy Information Administration, per capita energy-related CO_2 emissions in the US were 21.8 tons per person in 2007 (US EIA, 2009a).

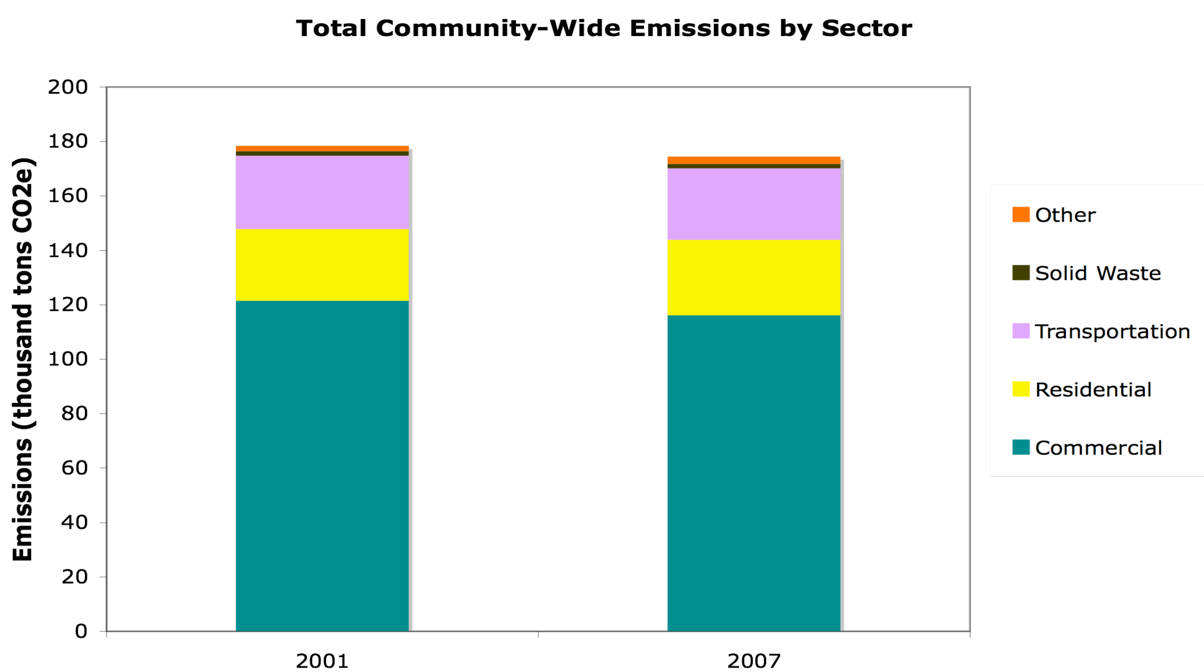


Figure 3. Total community-wide emissions for 2001 and 2007 broken down by broad sector.

Figure 3 shows that the proportional contributions to total community-wide emissions from each of the five broad inventory sectors (commercial, residential, transportation, solid waste, and other) were not very different between 2001 and 2007. The commercial sector, including the College and municipal operations within city limits, is responsible for the vast majority (68.1% in 2001 and 66.6% in 2007) of Oberlin's greenhouse gas emissions, followed by the residential (14.8 and 15.9%) and transportation (15.1 and 15.1%) sectors. The solid waste sector made up 0.9% of total emissions for both years, while the miscellaneous fugitive emissions (the 'other' sector) made up 1.1% and 1.5%, respectively. Considering only emissions from the residential sector (i.e. emissions associated with electricity and natural gas consumption in non-College residences), per capita annual residential emissions were 4.40 and 4.66 tons CO_2e per resident.

It is important to disaggregate the commercial sector in order to understand the contribution of the College and City to that sector's emissions. The College emits roughly one-fifth of community-wide emissions (21.3% in 2001 and 22.2% in 2007) and the City emits under 5% (4.1% and 4.7%). The rest of the commercial sector is responsible for approximately 40% of community-wide emissions (42.7% and 39.7%). Figure 4, on the next page, shows how both the individual sectors and specific energy sources contributed to community-wide emissions. It appears that the decrease in community-wide emissions between 2001 and 2007 was largely due to a substantial drop in natural gas consumption by the non-College non-City commercial sector (see "Community-wide energy consumption" below) and the incorporation of zero-emissions landfill gas and hydropower electricity from the sale of RECs to the College instead of to an entity outside the community. For a detailed breakdown of total emissions associated with municipal operations, see "Municipal Operations Emissions: Inventory Results."

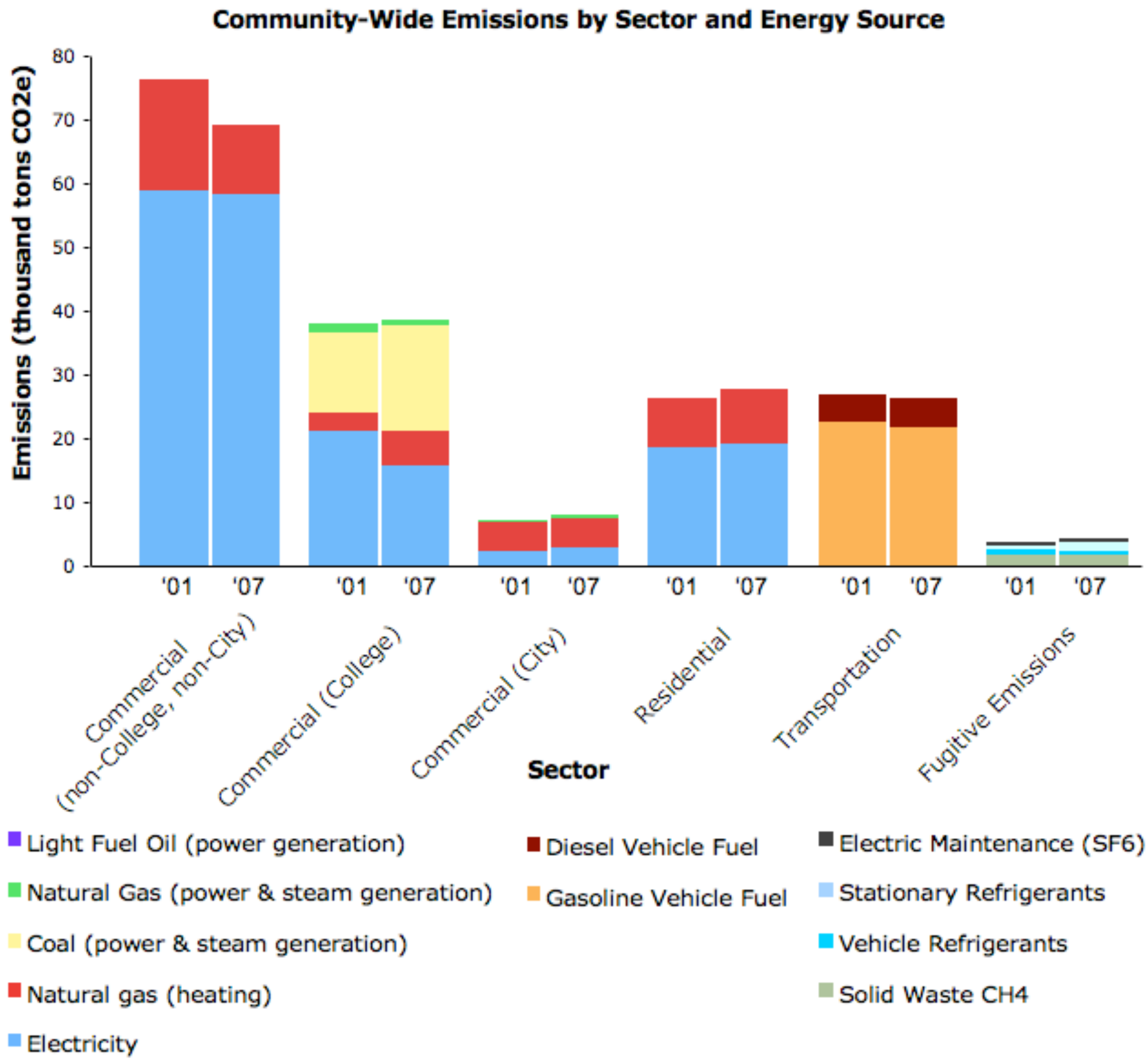


Figure 4. Total 2001 and 2007 community-wide emissions broken down by sector (bar pairs) and energy source (stacks with legend). Solid waste and miscellaneous fugitive emissions are stacked together.

Community-wide emissions by energy source

As might be expected in a part of the country so close to the Appalachian coalfields, over half of community-wide emissions are associated with electricity (56.6% and 55.2%). Coal is the most carbon-intense form of electricity generation, as discussed earlier, and because the majority of the community's electricity mix is coal, its electricity has a high carbon-intensity (refer to Table 2 in "Community-Wide Emissions: Data Collection Methods"). The remainder of community-wide emissions were generated by natural gas for heating (18.1 and 16.9%), vehicle fuel (15.1 and 15.1%), power and steam generation (8.1 and 10.4%), and fugitive emissions (2.0 and 2.4%). It is notable that in 2007, coal burned by the College's CHP plant was responsible for 9.5% of community-wide emissions, representing the largest single-facility source of emissions in the community and 43.0% of the College's 2007 emissions. It follows that if the College is seriously committed to reducing its climate footprint, removing or altering its CHP plant to eliminate coal combustion must be a central focus.

Table 3. Consumption by sector for years 2001 and 2007 and % change. The *italicized* rows represent aggregations and are therefore not additive with the other rows.

Sector	Emissions Source	2001	2007	% Change
Commercial (non-College, non-City)	Electricity (kWh)	53,943,105	55,864,798	3.6
College	Electricity (kWh)	19,405,232	24,595,705	26.7
Residential	Electricity (kWh)	16,919,451	18,387,741	8.7
City (within city limits)	Electricity (kWh)	2,166,508	2,713,302	25.2
Commercial Total	*Electricity (kWh)*	*75,514,845*	*83,173,805*	10.1
Total (inside city limits)	*Electricity (kWh)*	*92,434,296*	*101,561,546*	9.9
Commercial (non-College, non-City)	Natural Gas (mcf)	274,454	172,842	-37.0
Residential	Natural Gas (mcf)	125,429	133,972	6.8
City (all)	Natural Gas (mcf)	74,373	83,371	12.1
College Heating	Natural Gas (mcf)	43,708	86,695	98.3
College CHP Plant	Natural Gas (mcf)	22,036	13,120	-40.5
Commercial Total	*Natural Gas (mcf)*	*414,571*	*356,028*	*-14.1*
Total	*Natural Gas (mcf)*	*540,000*	*490,000*	*-9.3*
College CHP Plant	Coal (tons)	6,080	7,982	31.3
Transportation	Annual VMT	39,600,000	40,600,000	2.5
Solid Waste	Waste (tons)	4,384	4,277	-2.4
Leaves + Brush (tons)	Waste (tons)	413	377	-8.7

Community-wide energy consumption

The measured decrease in community-wide emissions must be understood in the context of the corresponding consumption patterns. Energy consumption data across community-wide sectors and sub-sectors for both inventory years are included in Table 3. The changes described here reflect a comparison between two specific years, not the general trends over the six-year period. Electricity consumption increased for all entities at all levels of aggregation. Community-wide natural gas consumption, according to informal Columbia Gas estimates, decreased substantially. This appears to have been a result of a substantial drop in natural gas consumption by the non-College, non-City commercial sector. Vehicle miles traveled went up slightly, according to NOACA estimates, but the US national average fuel efficiency increased slightly (US BTS, 2008), resulting in an actual decrease in emissions associated with community-wide transportation. Solid waste production decreased slightly. As discussed earlier, the data on miscellaneous fugitive emissions are incomplete, and thus these data are not included here because the comparison would not be very meaningful and because these emissions do not contribute substantially to overall community-wide emissions. Again, it should be acknowledged that the changes in the last column of Table 3 do not necessarily represent consumption trends, but rather show how consumption in 2001 and 2007 differ.

Community-wide natural gas consumption exhibited a 9.3% decrease comparing 2001 with 2007. To examine this, I normalized for changes in weather and population. Heating demand, measured by heating-degree days, was higher in 2007, and thus normalizing for this factor would result in an even larger decrease (11.9%). Oberlin's population also increased from 2001 to 2007, and normalizing further for this factor resulted in a decrease of 15.0%. Thus, the 9.3% drop in natural gas consumption is not due simply to changes in population or heating demand. It appears that it is mostly due to changes in the non-College non-City commercial sector, which showed a 37% decrease in natural gas consumption between 2001 and 2007.

According to OMLPS's Doug McMillan, such a considerable drop in consumption is suspicious (McMillan, pers. comm.). He noted that Missler's convenience store and Johnson's

Control closed, while other new commercial establishments, such as Walmart, were built. As described in the methods, there is some uncertainty in the accuracy of the CGO community-wide natural gas data. However, it is unlikely that this can explain such a substantial drop in consumption. The non-College non-City commercial sector must have somehow reduced its natural gas use, through improved heating equipment efficiency, weatherization, operational changes, or some other means. It may be that rising natural gas prices over this period were important incentives for commercial entities to reduce consumption (US EIA, 2009b). The sector-based analysis above shows that emissions from the non-College non-City commercial sector decreased between 2001 and 2007. This result is probably due primarily to the decreased natural gas consumption discussed here, as electricity consumption increased 3.6% and its associated carbon-intensity did not change substantially (see immediately below).

Electricity consumption, carbon-intensity, and implications of REC sales

While electricity consumption increased for all users, the community-wide emissions associated with electricity decreased by 4.7%. There are two reasons for this. First, the carbon-intensity of the electricity OMLPS procures, before selling RECs, has decreased from 2.05 to 1.92 pounds CO_2e (6.3%) (refer to Table 2). If one considers the sales of RECs, as I do in these inventories, then the effective drop in carbon-intensity for the community as a whole is more substantial. In 2001, with the assumption that RECs were sold outside Oberlin, the carbon-intensity of the community's electricity was 2.18. In 2007, the RECs were sold inside Oberlin, so the carbon-intensity remained the same as the OMLPS total, 1.92. So, by selling RECs inside the community instead of externally, OMLPS actually decreased the community electricity's carbon-intensity by 11.9% (2.18 to 1.92).

In 2007, because the RECs were sold to the College, the non-College community used electricity that did not include all OMLPS's landfill gas or hydropower kWh, a situation identical to that of the whole community in 2001. Therefore, from the perspective of non-College consumers, the carbon-intensity of electricity has changed little, from 2.18 to 2.08 (a 4.6% decrease). The carbon-intensity of electricity consumed by the College decreased substantially as a result of its REC purchases, from 2.18 to 1.28 (a 41.3% decrease). Its acquisition of this low-carbon electricity did not come at the expense of the rest of the Oberlin community, because it was reallocated from the prior REC purchaser, Green Mountain Power. For the College, the acquisition reduced the emissions associated with its electricity use, despite a substantial rise in its electricity consumption.

There are several implications of these developments. First of all, as discussed above, by selling its RECs to the College, OMLPS has effectively reduced the overall carbon-intensity of the Oberlin community's electricity. As long as the REC purchaser is within Oberlin city limits, the community will retain the emissions reduction associated with using this low-carbon electricity. Additionally, by selling the RECs, OMLPS generates revenue to fund a variety of valuable projects that can further reduce community-wide emissions. If the City wanted to ensure that it receives a larger portion of this low-carbon electricity, OMLPS could stop selling the RECs. This would surely reduce the emissions associated with municipal operations, but would not generate revenue for sustainability projects, and would thus be detrimental to progress on the larger community-wide scale.

It is in the interest of the City to do two things. First, OMLPS should continue to pursue renewable electricity until meeting a long-term objective of having an electricity mix made up entirely of "green" power sources. This will result in substantial emissions reductions, even if community-wide electricity consumption does not change. Second, OMLPS should sell the RECs for available low-carbon electricity in its mix to consumers within the city limits, such as the College and any other commercial institutions that wish to reduce their climate footprints. While this effectively increases City emissions, it does not change the arguably more important community-wide emissions profile and allows the City to implement innovative and effective sustainability programs that will further reduce emissions, benefit members of the community, demonstrate leadership, and draw attention to Oberlin's progress.

Municipal Operations Emissions: Data Collection Methods

As described at the beginning of this chapter, the municipal operations inventories quantify emissions associated with activities over which the City of Oberlin exerts control. Emissions are broken down into sectors differently than in the community-wide inventories in ICLEI's CACP software. Table 4 describes these sectors. The water and sewage sector includes electricity and natural gas consumed both by water and wastewater treatment processes and in the administrative buildings associated with these operations. I chose to include consumption by buildings associated with water and wastewater operations in that sector, as opposed to including this in the "buildings and facilities" sector, in order to better facilitate calculations of emissions associated with water consumption, being used for College Professor John Petersen's energy monitoring project, and because it would have been difficult to separate consumption by buildings from consumption by facilities. The miscellaneous fugitive emissions ('other') sector here includes the same SF_6 emissions included in the community-wide inventories because these releases occur under the jurisdiction of OMLPS and thus the City. This 'other' sector also includes refrigerant release from the air conditioning system in City vehicles, but unlike the community-wide inventories, does not include refrigerants released from stationary refrigeration systems. I did not pursue these data because 1) I was unable to identify a City employee who

Table 4. Constituents of each sector of the municipal operations inventories.

Sector	Description
Buildings and Facilities	All properties over which the City exerts operational control (excluding those included in other sectors below)
Water and Sewage	All City-operated buildings and facilities associated with water treatment and distribution (includes small electricity generator)
	All City-operated buildings and facilities associated with wastewater pumping and treatment (includes small electricity generator)
Street and Traffic Lights	All City-operated street and traffic lights
Vehicle Fleet	All City-operated vehicles
Employee Commute	Fuel consumed by City employees commuting to and from their City job (this is not limited to consumption within city limits)
Solid Waste	Fugitive CH4 emissions (includes solid waste generated by City employees or operations and sent to the Allied Waste landfill)
Other	Miscellaneous fugitive emissions (includes refrigerants from A/C systems in the City fleet and SF6 from OMLPS electricity line maintenance)

could provide me with the information, and 2) it was unlikely to represent a substantial portion of overall municipal operations emissions.

Electricity

Electricity consumption data for municipal facilities came from two sources at OMLPS. First, OMLPS spreadsheets provided aggregate totals for municipal electricity consumption for 2001 and 2007. Due to a change in accounting methods, the figure for aggregate municipal electricity consumption found in 2001 OMLPS spreadsheets did not include electricity consumed by the OMLPS power plant, while this consumption was included in the figure in 2007 spreadsheets. Therefore, for the 2001 municipal inventory, I added OMLPS power plant electricity consumption to the spreadsheet figure.

In addition to the aggregate totals found in the spreadsheets, I decided to include specific consumption by City facilities, in order to provide information about which facilities were the largest consumers. Accordingly, I obtained monthly meter reading data from paper records at OMLPS, primarily for City facilities with substantial annual consumption (i.e. greater than 3,000 kWh). In some cases, I included facilities consuming less in order to have complete and accurate data for the groups included in Table 5, found in the results section below. However, the meter reading books from which I was able to gather data included readings from 2002 through 2008. The books containing 2001 data were prohibitively difficult to access, located in OMLPS storage. I thus decided to compile 2002 and 2007 data for specific municipal electricity accounts. The goal was not to use these data to calculate total municipal electricity consumption, which was already available in OMLPS spreadsheets, but rather to provide information on relative electricity consumption by various facilities. Therefore, I included 2002 account-specific data in the 2001 municipal inventory. In order to maintain the accuracy of Scope 2 emissions in the 2001 municipal inventory, I included an additional "fudge" entry in the CACP software that accounted for any difference between the sum of facility-specific 2002 consumption and the known aggregate 2001 consumption.

It should be noted, however, that even in 2007, the sum of facility-specific consumption exceeded the figure in OMLPS spreadsheets representing total 2007 municipal consumption. The only explanation can be some error in accounting methods, data-entry, or calculations. While OMLPS spreadsheets are carefully maintained, over the course of data collection I found one small error that OMLPS staff subsequently corrected. It could be that other errors exist that have yet to be detected. It is also possible that I was unaware of changes to OMLPS accounting practices between 2001 to 2007 beyond the one described above regarding the OMLPS power plant. Assuming no errors in my data collection and entry, a third possible explanation for this discrepancy is inaccurate estimation of electricity consumption by streetlights and traffic lights. These are the two facility-specific data points I included for which there are no meter reading data. Instead, Steve Dupee estimated these electricity consumption figures using the number of lights, wattage, and average operating hours per day. This results in an estimated consumption of 1000 kWh per light per year. If this estimate is found to be inaccurate, it might explain the discrepancy between 2007 aggregate and facility-specific data. Nevertheless, despite this error, the municipal inventories are still accurate with regard to the total annual municipal consumption obtained from OMLPS spreadsheets for the following reason. The extra "fudge" entry I included in the CACP software was originally meant to account for the difference between total municipal consumption and facility-specific consumption, resulting from low-consumption facilities for which I did not obtain specific meter reading data. However, the "fudge" entry also accounts for differences between aggregate data (found in OMLPS spreadsheets) and the sum of facility-specific data, which are due to the potential sources of error discussed here. For both years, this entry had to be negative in order to keep the inventories accurate.

The methods for determining the carbon-intensity of the electricity used in municipal operations are found in "Community-Wide Emissions: Data Collection Methods; Electricity."

Natural gas

I calculated aggregate natural gas consumption by the City by summing consumption data from the City's 12 CGO accounts and known consumption by electricity generators at the water and wastewater treatment plants and the OMLPS power plant. As discussed in the community-wide methods section, CGO could not provide specific data prior to 2004, so the 2001 consumption figures used in these inventories are simply 2007 data normalized for heating degree-days. Because a portion of the natural gas consumed by the water and wastewater sector is not for heating, the 2001 normalized estimate is not entirely appropriate. However, without raw data for 2001, it would have been difficult and time-consuming to obtain a more precise estimate for these facilities, which, in any case, would likely have had an insubstantial effect on total municipal natural gas consumption

Vehicle Fuel

I obtained data for fuel consumption by the City's vehicle fleet from a combination of sources due to the complexity of City accounting methods for this sector. The City's main diesel fuel tank was located at OMLPS until the summer of 2007, at which point the City's General Maintenance Division (GMD) built a central facility where all departments, except for the Fire Department, currently fuel their vehicles. Prior to the construction of the GMD facility, most diesel fuel was obtained from the OMLPS tank located at OMLPS and gasoline was purchased from local gas stations. OMLPS spreadsheets provided diesel fuel consumption from its tank for 2001 and the first half of 2007. The Fire Department has its own diesel tank. Fire Chief Dennis Kirin provided the Department's 2007 diesel use, but because his fuel tracking system was not implemented until 2003, he could not provide data for 2001 consumption. I therefore made a very rough estimate of 2001 Fire consumption by adjusting Chief Kirin's 2007 data for the change to the Fire s fleet (replacement of one diesel rescue vehicle with a gasoline vehicle) and then normalizing the data based on the number of fire calls received at the station. I obtained data for the City fleet's gasoline consumption in 2001 and the first half of 2007 from invoices provided by the City Finance Office's Beth Krosse. She also provided invoices for diesel fuel shipped directly to the water department (which had not been otherwise accounted for). Such invoices are kept on file for a limited period of time, and it should therefore be noted that the 2001 invoices used to obtain a portion of these data were discarded in January 2009. Dave Rucker, General Maintenance Division Supervisor, provided GMD facility data for diesel fuel and gasoline consumed beginning in May 2007. In order to make data collection for the City fleet's fuel consumption much easier in future municipal operations inventories, the City should begin continually compiling and consolidating the data from all City fueling stations. The new GMD fueling facility is likely to help make this simpler. The City also might consider consistently tracking fuel consumption and mileage for individual vehicles. Not only would this inform officials of which vehicles are consuming the most fuel (and thus releasing the most emissions and costing the City the most money), it would also alert officials of abrupt changes in individual vehicle fuel efficiency that should be addressed for a variety of reasons.

Because the City has not tracked employee commuting, it was virtually impossible to obtain data historical data on the associated emissions. Therefore, Eric Norenberg, City Manager, and Sharon Pearson, Administrative Assistant, administered a survey, included in Appendix 2, to all current employees when they collected their paychecks in late January 2009. Data were obtained for all employees except 10 part-time and less than 10 full-time employees. An additional six employees provided data that were too incomplete to include. Using the survey results, I calculated average consumption per City employee, for both gasoline and diesel fuel, which should be reasonably representative of typical employee commuting. I had no choice but to assume that City employee commuting patterns have not changed considerably over the last decade, and proceeded to use the 2009 averages to calculate fuel consumption from employee commuting for 2001 and 2007, based on total number of employees for those years. The City should begin compiling this data annually in order for future inventories to measure emissions from this sector more accurately.

Fugitive emissions from solid waste

The City does not currently quantify the amount of solid waste associated with its operations. Public Works Director Jeff Baumann provided a very rough estimate of these data, based on first-hand observations of municipal trash pick-up at City Hall. I chose not to pursue a more accurate estimate because this sector represents a very small portion of overall City emissions. Nevertheless, the City might consider measuring municipal solid waste generation in the future.

Other fugitive emissions

The methods for calculating SF_6 emissions from electrical line maintenance are described in the community-wide methods section, as are the methods for calculating refrigerant emissions from A/C equipment in the City fleet (the only difference is the number of vehicles).

Data collection challenges

One of the main challenges of conducting the municipal operations inventories was the lack of a centralized data source. Data collection and entry were therefore very time-consuming, because it was necessary to consult multiple departments multiple times in the course of requesting, receiving, and clarifying data. By implementing a policy of continuously entering and archiving data in a web- or network-based system, the City would make retroactive data collection and inventory updates far easier, greatly reducing the time necessary to complete a basic municipal operations emissions inventory. This would require creating the database, educating department heads about what data to include and how to upload them, and perhaps sending out periodic reminders at the times throughout the year when data generally become available. The flowchart in Figure 2 could help guide officials in the implementation of this process. Furthermore, any actions that can be taken to reduce manual data entry and convert to electronic record-keeping would be desirable, as this would reduce sources of error and the number of hours required for data collection. Implementing these improvements in City data logistics would not only improve the efficiency of future inventories and allow them to explore emissions in greater detail, but could also provide data to City officials making decisions unrelated to emissions or energy consumption.

Municipal Operations Emissions: Inventory Results

In this section, I present the results of the municipal operations inventories for 2001 and 2007. Again, the context within which these emissions took place should be acknowledged. As noted in the previous section, Oberlin's population, heating, and cooling degree-days were all higher in 2007 compared with 2001 (though only cooling degree-days were substantially higher). The City of Oberlin employed 147 people (98 full-time and 49 part-time or seasonal) at the end of 2001, and 166 (108 and 58) at the end of 2007, an increase of 12.9%. For reference, there were 170 employees (105 and 65) at the beginning of 2009. The City fleet grew by 24.4%, consisting of 78 vehicles in 2002 and 97 in 2007 (2001 vehicle fleet list was unavailable).

Municipal operations emissions by sector

Oberlin's municipal operations emitted a total of 10,654 and 11,414 tons CO_2e, respectively, in 2001 and 2007. This represents an increase of 7.1% over six years. Annual per capita municipal emissions (i.e. emissions from municipal operations per resident) were 1.3 and 1.4 tons CO_2e. The City emitted 108.7 and 105.7 tons CO_2 annually per full-time employee. While the municipal operations inventories included emissions from outside the city limits (as a result of the operational control boundary), a comparison between municipal and overall community emissions (within city limits) is still a useful measure. Municipal operations resulted in emissions amounting to 6.0% and 6.5% of community-wide emissions in 2001 and 2007, respectively.

The buildings and facilities sector was responsible for about half the City's emissions (49.0 and 50.0%), followed by water and sewage (30.8 and 30.2%), street and traffic lights (9.0 and 8.1%), vehicle fleet (4.2 and 4.7%), miscellaneous fugitive emissions (4.0 and 3.8%) and employee commute (2.9 and 3.0%). The City emitted 5.7 and 5.5 tons CO_2e annually per fleet vehicle, and from their annual commute City employees each emitted an average of 2.1 tons CO_2e (both years). Solid waste generated by the City represents a very small portion of its overall emissions profile (0.1%). The proportion of total municipal emissions associated with each sector appears to be remaining relatively constant. Figure 5, on the next page, shows the contribution of both the individual sectors and specific energy sources to municipal operations emissions for each year.

Municipal operations emissions by energy source

Emissions from electricity use made up 43.1 and 41.4% of it's the City's overall emissions, followed closely by natural gas consumption for heating (41.3 and 41.0%). The remaining 15-20% came from natural gas and light fuel oil burned, primarily at the OMLPS plant, to produce electricity (4.3 and 6.0%), gasoline (5.8 and 6.1%) and diesel (1.3 and 1.6%) fuel from the City fleet and employee commuting, and fugitive emissions (4.0 and 3.8%).

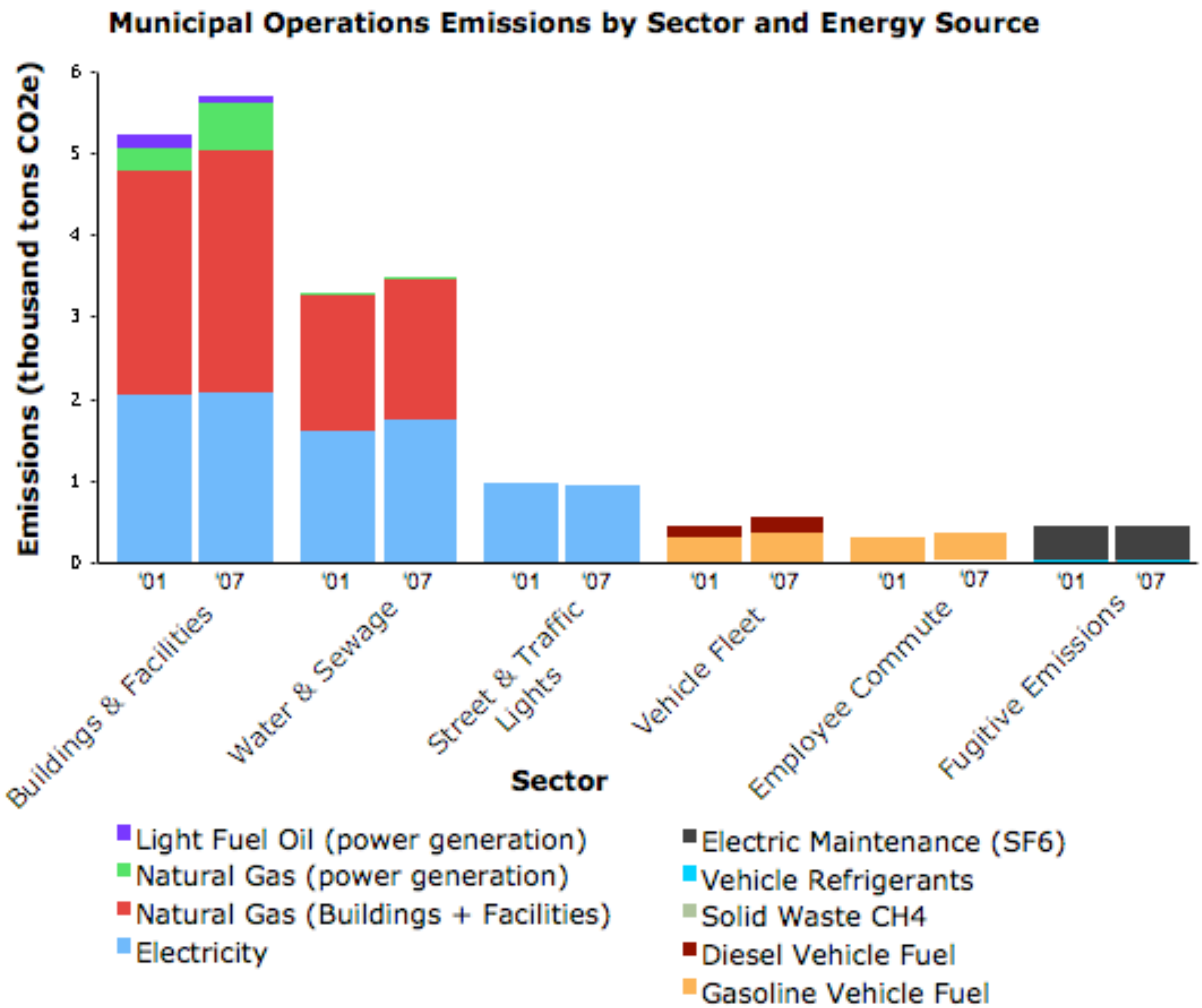


Figure 5. Total 2001 and 2007 municipal operations emissions broken down by sector (bar pairs) and energy source (stacks with legend). Solid waste and miscellaneous fugitive emissions are stacked together.

Table 5, on the next page, summarizes municipal consumption trends. For electricity and natural gas, City facilities are listed in order beginning with the highest 2007 consumer. Again, one should be very cautious attempting to infer the trend over the six-year period based on data from just two years. Instead, a direct comparison between the two specific years can be made. Municipal energy consumption was generally higher in 2007. This was true for electricity, natural gas, and vehicle fuel, the main contributors to City emissions. While some of the increase in electricity consumption was due to additional City facilities, examining individual building groups or facilities suggests that consumption was generally higher at each location. The increases in natural gas and employee vehicle fuel consumption shown in the table are strictly due to my normalization calculations, because there were no 2001 data for these energy sources. The increase in City fleet fuel consumption was due, at least in part, to the growth in the size of the fleet. This growth was strictly responsible for the increase in fugitive HFC emissions, due to a calculation method depending solely on number of vehicles.

Table 5. Municipal consumption by sector or facility for years 2001 (or 2002) and 2007, and % change. Rows in *italics* represent aggregations. The total electricity use is for 2001. See main text for explanation of the use of 2002 for facility-specific electricity data.

Sector/Facility	Emissions Source	2002	2007	% Change
OMLPS Power Plant	Electricity (kWh)	1,106,000	1,296,000	17.2%
Wastewater	Electricity (kWh)	1,019,985	1,134,801	11.3%
Streetlights	Electricity (kWh)	800,000	800,000	0.0%
Water Treatment/Distribution	Electricity (kWh)	447,366	510,280	14.1%
City Hall	Electricity (kWh)	312,800	334,800	7.0%
General Maintenance Division Dept	Electricity (kWh)	N/A	191,200	N/A
OMLPS Substations + Switchstations	Electricity (kWh)	156,084	152,269	-2.4%
OMLPS Buildings	Electricity (kWh)	119,270	111,371	-6.6%
Ballfield	Electricity (kWh)	N/A	86,000	N/A
Traffic Lights	Electricity (kWh)	78,000	85,000	9.0%
Utility/Finance Office	Electricity (kWh)	73,440	84,680	15.3%
Fire Dept.	Electricity (kWh)	51,406	63,146	22.8%
Cemetery Dept.	Electricity (kWh)	44,666	61,177	37.0%
		2001	**2007**	
Total Electricity Use (2001)	*Electricity (kWh)*	*4,205,819*	*4,514,609*	*7.3*
OMLPS Buildings	Natural Gas (mcf)	21,883	22,534	3.0%
Water Treatment/Distribution (incl. generator)	Natural Gas (mcf)	15,443	16,099	3.0%
Wastewater (incl. generator)	Natural Gas (mcf)	11,121	11,369	3.0%
City Hall	Natural Gas (mcf)	10,732	11,051	3.0%
Fire Dept.	Natural Gas (mcf)	4,830	4,974	3.0%
Utility/Finance Office	Natural Gas (mcf)	3,659	3,768	3.0%
Cemetery Dept.	Natural Gas (mcf)	2,387	2,458	3.0%
GMD Dept.	Natural Gas (mcf)	N/A	1,880	N/A
Total	*Natural Gas (mcf)*	*69,876*	*73,836*	*5.7%*
Vehicle Fleet	Diesel (US gal)	13,300	17,315	30.2%
Vehicle Fleet	Gasoline (US gal)	28,411	32,874	15.7%
Vehicle Fleet Fugitive Emissions	HFC-134a (gram)	8,199	10,515	28.2%
Employee Commute	Diesel (US gal)	247	279	12.9%
Employee Commute	Gasoline (US gal)	28,465	32,144	12.9%
Solid Waste	Waste (tons)	36	35	-2.8%

These Inventories Represent the Beginning of a Process

The inventories reported here represent my best attempt to account for community-wide and municipal operations emissions in Oberlin. However, it is important to recognize that this is the first attempt to conduct GHG inventories for the City and community. In the course of conducting these inventories, various challenges emerged with respect to data acquisition, data accuracy, and my lack of in-depth experience with and knowledge of City operations and community activities. As a result, although these results are defensible, it is likely that future inventory coordinators may identify inconsistencies and errors. ICLEI anticipates that the inventory process is inherently imperfect and that municipalities' ability to follow ICLEI's detailed methodology is evolving and therefore recommends that historical inventories be retroactively updated in order to maximize consistency across inventories, which is crucial for meaningfully measuring the effects of emissions reductions measures. I include these caveats not to diminish the perceived quality or value of these inventories, but rather to inform future readers and inventory coordinators.

It should also be noted that ICLEI released an improved 2009 version of its CACP software on 16 April 2009, which is available on the ICLEI-USA website for the City's designated ICLEI liaison, OMLPS's Steve Dupee, to download (ICLEI, 2009a). Because the new software has different sector breakdowns and is organized somewhat differently in other ways relative to the earlier version I used, switching to the new version may involve readjusting some of the calculations I have made for these inventories. However, according to the ICLEI website, transferring data from the software I used to the new software may take only a few hours. Furthermore, ICLEI plans to release a web-based data collection and inventory tool in 2009, which will likely function as a complement to the CACP inventory software. ICLEI representatives should be consulted for guidance regarding how to proceed with subsequent inventories in light of these developments. In any case, I provided OMLPS's Doug McMillan with an Excel spreadsheet containing all relevant data and calculations I used to produce the final results of my inventories, such that they will reproducible in the future.

Emissions Profiles of Other Cities

It is helpful to have an idea of the emissions profiles of other cities that have conducted inventories. My goal here is not to include a comprehensive list of results found in other cities or to explain in detail why specific inventories differ from Oberlin's, as this discussion would be lengthy and ultimately unhelpful. Instead, this brief section is intended to provide some context for interpreting the results above—to answer the question of what other communities look like. Specific comparisons are sometimes useful, but one must take care to acknowledge the myriad ways in which municipalities differ. It is more useful to examine the strategies other cities have used to enact climate action, which I discuss in the next chapter, and the specific measures other cities have successfully implemented to reduce emissions, which remain to be explored in depth as Oberlin develops a comprehensive climate action plan.

As Table 6 on the next page shows, there is much variation in per capita emissions as well as in the contribution from various sectors. Direct comparison between municipalities is difficult because the confounding factors are numerous. Population, area, and location are some of the most obvious factors. Specifically, location in the country has crucial implications both for heating and cooling needs as well as the availability of certain electricity and heating sources and advanced efficiency technology. For example, the New England cities in Table 6 appear to have lower per capita emissions, which is perhaps due partly to electricity that depends more on hydropower than coal, an uncommon situation in places like the Midwest. Beyond these factors, the dominance of a particular sector can have an important effect on a community's emissions profile. Some communities have developed around a strong industrial sector while others are primarily residential or perhaps characterized as regional hubs for commercial activity. These factors affect the amount, distribution, and type of energy used in the community. The location of communities relative to urban centers is also important. Some cities are located rurally while others are suburbs or urban centers themselves. This has implications for transportation patterns. If a busy commuter route runs through a community, or if its residents tend to commute to work outside the city limits, its transportation sector is likely to contribute more to its overall emissions. Transportation emissions swell further if a community is large enough to have an extensive mass transport system that runs regularly.

In addition to differences in the specific community characteristics, comparisons are also difficult to interpret because estimation methods can vary. This might be another factor

Table 6. Results from community-wide emissions inventories for the Oberlin and for the eight cities I contacted (see Chapter 3), including per capita emissions, total emissions, and the breakdown into residential, commercial, transportation, and waste sectors. Most cities specified their industrial sectors, which I have integrated into a single "commercial" sector in order to be consistent with the methods for Oberlin's community-wide inventory. The population and year refer to when the inventory was conducted. Notes: Aspen's population swells to 30,000 during its peak tourist season, so I have included an additional per capita calculation. Aspen's inventory combined residential, commercial, and industrial sectors to create a community-wide buildings and facilities sector for which a figure is included below.

						Sector			
City	**State**	**Population**	**Year**	**Per Capita Emissions**	**Total Emissions**	**Res %**	**Com %**	**Trans %**	**Waste %**
Brunswick	ME	21,806	2007-08	-	-	-	-		
Burlington	VT	38,531	2007	11.1	426,356	21.0	37.5	39.3	2.2
Brattleboro	VT	11,984	2000	16.3	195,520	19.0	28.0	45.0	8.0
Amherst	MA	34,874	1997	8.3	289,539	22.0	51.0	24.0	3.0
Northampton	MA	28,978	2000	12.8	372,363	28.4	45.5	26.5	-0.4
Mission	KS	9,746	2005	42.1	410,768	14.0	27.2	59.3	-0.5
Northfield	MN	17,992	2005	30.0	539,188	13.4	58.8	26.6	1.2
Aspen	CO	5,785 (30,000)	2004	145.4 (28.0)	840,875	32.5		66.1	1.4
Oberlin	OH	8,330	2007	20.9	174,393	15.9	66.6	15.1	0.9

contributing to Oberlin's relatively low transportation estimate. For example, Northfield's inventory used statewide transportation estimates scaled down simply using population, with the operating assumption that transportation patterns in Northfield and statewide were similar. Mission's inventory used data on traffic counts, road length, and road type to calculate vehicle-miles traveled (VMT). For Oberlin's inventory, an area MPO made the VMT estimates using its traffic models. Data obtained in certain ways are likely to consistently under- or overestimate, depending on the methods, and each method has its advantages and disadvantages. Furthermore, some inventories have not only performed calculations differently, but have included whole categories of emissions sources that other communities have not accounted for. For example, Aspen's City Council decided to take responsibility for round-trip airplane emissions from tourists traveling to Aspen resorts. This has had a very large effect on the community's emissions profile, rendering basic comparisons practically uninformative.

The brief discussion above is not an attempt to comprehensively review the many factors that influence where emissions come from in a given community. My goal is only to convey that while it is valuable to examine how Oberlin compares to cities around the country, without an in-depth understanding of each community as well as knowledge of its data collection and calculation methods, it will be difficult to draw concrete conclusions. Community comparisons may, however, be quite useful once more cities in this region have completed inventories. It is likely that they will have similar electricity mixes, climate, and technology, and, if collaboration occurs regarding inventories, will likely have similar inventory methods. Before drawing many conclusions from comparisons with communities in distant regions, the City of Oberlin should contact Cleveland, Akron, and other smaller Ohio communities to discuss how their emissions profiles compare with Oberlin's.

GHG emissions that are not accounted for in these inventories

While the inventories conducted in this study provide important insight into carbon emissions and their sources and represent a solid baseline from which to measure future progress, they leave many important aspects of GHG emissions unaddressed. Accounting for GHGs released from the combustion of fossil fuels to create Oberlin's electricity, heat its buildings, and move its vehicles only scratches the surface of a community's total climate footprint. The ICLEI accounting methods leave room for additional emissions in their Scope 3 emissions category, which includes emissions occurring outside inventory boundaries such as those associated with production and transportation of goods used inside city limits. However, inventories that have been conducted thus far by ICLEI members and others have tended to focus almost exclusively on Scope 1 and Scope 2 emissions, leaving out the "optional" Scope 3 emissions or evaluating them only in a cursory manner. However, it is certain that Scope 3 emissions represent a substantial portion, if the not the majority, of any city's total GHG emissions. Some experts have estimated that embodied emissions can make up over 50% of the emissions from higher-income households, for example (Shammin and Bullard, 2009). A closer look at activities occurring within Oberlin city limits (or under Oberlin's municipal control) reveals the "embodied carbon" Oberlin is additionally responsible for emitting.

Embodied carbon refers to emissions occurring throughout the full life cycle of a product. This includes emissions associated with resource extraction, transport, processing or manufacturing, subsequent transport, use (assembly, installation, or consumption), and disposal (deconstruction and decomposition). For example, the community-wide inventories I conducted count the amount of CO_2 the Oberlin College CHP plant releases as it burns coal. However, GHG emissions were also released from the mining process, the truck or train engines bringing the coal to cleaning and processing locations, the processing plant(s), the truck or train engines bringing the processed coal to Oberlin, from operations associated with the plant, and finally from truck or train engines transporting the waste ash to disposal locations. This chain can even be further expanded. There are associated GHGs released by construction equipment and vehicles designed for coal-related operations that would not exist if the college did not burn coal. There are also emissions embodied in the process and materials used to construct the CHP plant itself. A similar chain of emissions sources, although different in the details, is associated with literally every object and activity delivered to or conducted in Oberlin, from food to construction materials to recreational products to music concerts to soccer games. The inventories above account for none of the emissions associated with the full life cycle of these materials or activities. In addition to embodied carbon, there are other emissions sources that are left out because they fall outside the inventory boundary. For example, these community-wide inventories encompass only transportation emissions occurring on roads within city limits. However, Oberlin residents, traveling outside Oberlin, consume considerably more vehicle fuel than has been accounted for.

One of the reasons these more comprehensive emissions are often neglected is that they are difficult to directly account for. Additionally, including embodied carbon introduces methodological complexity that City officials might not have time to familiarize themselves with and incorporate into their inventories. Various methodologies exist for calculating life cycle carbon inventories, each producing a different understanding of associated emissions (Cutler, 2008). In some cases, these are straightforward. For example, the national average for the amount of embodied carbon in a gallon of gasoline is known, and gasoline consumption data can be converted to include embodied carbon by adding 26% of gasoline's carbon content (Shammin and Bullard, 2009). However, it is unlikely that City officials frequently pursue such in-depth inventories, in part because no standard accounting for embodied carbon has been set by ICLEI and because most municipalities have limited time and staffing.

Nevertheless, it is important for officials to keep embodied emissions in mind because even if they are absent from official inventories, they are important in considering the climate impacts of community activities and in developing a climate action plan. For example, the ICLEI inventories discussed above make no mention of the sources of food being consumed in Oberlin. However, a measure that encourages or incentivizes consumption of local food could have a very real impact on Oberlin's climate footprint, because it could reduce the emissions associated with transporting food to the mouths of Oberlin residents. It would not be possible to observe the effect of this measure in future inventories using the methods used in this study, but food policy, along with other issues concerning embodied emissions, should certainly be considered in any climate action plan. Professor Rumi Shammin, in Oberlin College's Environmental Studies Program, has developed a method of quantifying embodied carbon in various goods and services. Thus, the City can coordinate with the College to seek new and innovative ways of addressing embodied emissions, which could make Oberlin's future inventories unique among ICLEI members.

CHAPTER 3: WHO IS RESPONSIBLE FOR CLIMATE ACTION -- EXPERIENCE FROM OTHER COMMUNITIES

Introduction

The community-wide and municipal operations inventories I have conducted represent the City of Oberlin's completion of Milestone 1 in ICLEI's Cities for Climate Protection program. As described at the end of the first chapter, ICLEI's process is composed of five milestones through which cities progress in order to reduce GHG emissions. The primary value of the inventories is that they identify the sectors and energy sources most responsible for Oberlin's emissions and quantify these emissions. Only after sources of emissions have been identified and quantified can specific decisions be made regarding managing these emissions. Milestones 2 through 5 explicitly address emissions management, guiding cities to set emissions reductions targets, develop and implement a comprehensive climate action plan (CAP), and continually monitor progress toward a low-carbon community. Completing these next phases of the ICLEI process is the role of the city government working together with the community and is beyond the scope of this report. Nevertheless, the rest of the ICLEI milestones cannot be approached as a series of disjoint steps that are completed by disconnected entities. The City must identify and establish a person, group, or network of partnerships that is explicitly responsible for overseeing and sustaining forward progress through the cyclical ICLEI process. While the inventories I have conducted will inform specific decisions that are made in the near future, it is clearly useful for the City of Oberlin to first examine the organizational models provided by other ICLEI cities. Accordingly, this chapter is an attempt to gather information about how other municipalities have structured this broad approach and assigned responsibility for the ICLEI process. Here, I present case studies telling the stories of how climate action has been organized in eight ICLEI Cities. I use the term "climate action" to refer to the broad process of addressing a community's emissions, of which developing a climate action *plan* is just one step. These case studies inform the subsequent discussion of Oberlin's options for establishing a sustainable structure, the crucial step that will help Oberlin join the ranks of cities that have made substantial progress after demonstrating a genuine commitment to addressing climate change. Later, in the final chapter, I explore some decisions regarding specific milestones, namely setting a target and writing a CAP, which will need to be addressed once the City decides who is responsible for the process.

Methods

To gather information from other municipalities, I used a case study-based approach that used interview methods commonly employed in the Social Sciences and known formally as "theory-based or operational construct sampling" (Patton, 1990). ICLEI representative Brita Pagels provided a list of 60 municipalities that have publicly released their emissions reductions targets, indicating implicitly that they are farther along in ICLEI's milestone process than Oberlin in having developed a climate action plan. Since there are few examples available for cities with populations less than 10,000, I selected a subset of cities with populations most similar to Oberlin between 5,000 and 40,000 permanent residents. I tried to choose municipalities with small colleges or universities. Because none of the smaller towns on the list were located in the Midwest, I also selected Mission, Kansas and Northfield, Minnesota, both recommended by Pagels. After discovering that Bowdoin College students had been instrumental in the process that led to an ICLEI membership resolution, I chose to interview an official from Brunswick, Maine, as well. Because I aimed to solicit broad and open-ended responses from each contact, I chose to use the interview guide approach outlined by Patton (1990). Accordingly, I developed a list of questions for the interviewees that covered key information relevant to Oberlin's broad climate action approach as well as how it might go about addressing specific milestones, but during the interviews I did not replicate specific wording or order of questions and was not able to cover every question in all interviews. My interview guide questions can be found in Appendix 3, along with contact information for officials from the eight municipalities with whom I was able to speak, shown here in Table 7. I obtained contact information using ICLEI's online networking search, available to members (ICLEI, 2008c). All interviewees granted me permission to use their real names. Additionally, all expressed their willingness to discuss their climate action experiences further with Oberlin officials and community members in the future.

While I attempted to identify cities that might provide valuable information relevant to Oberlin's situation, a multitude of cities have conducted inventories and completed CAPs and thus gained experience that might be useful to Oberlin. Time limited the number of interviews I was able to conduct, and there are numerous other cities, similar to Oberlin in various ways, that members of the Oberlin community working on climate action might benefit from contacting. Ithaca, New York and Keene, New Hampshire have become models for cities in the Northeast, and could be examined, especially for instances of fruitful cooperation between a City and its institutions of higher learning. Additionally, Middlebury, Vermont, while not an ICLEI member, has a population of about 8,200 people and a small, top-tier liberal arts college with a 'green' reputation. I was unable to establish contact with Middlebury officials in time for this report, but this community is gaining attention as a leader in climate action. Additionally, Oberlin should also make an effort to reach out to cities across the Midwest, where ICLEI has experienced a strong surge in membership recently (Pagels, pers. comm.). While ICLEI members on the two coasts tend to be farther along in the process, most of the new Midwest members have yet to complete inventories. Not only would these cities benefit from Oberlin's experience and increased dialogue between Midwestern ICLEI members, but as they progress through the five milestones Oberlin can learn what strategies others are finding especially effective in this region of the country.

Table 7. Interviewee names, titles, cities, and interview dates.

City	State	Contact	Title	Date of Phone Interview (2009)
Brunswick	ME	Craig N. Worth	Deputy Public Works Director & Facilities Manager	31 March
Burlington	VT	Jennifer Green	Legacy Project Co-Coordinator	1 April
Brattleboro	VT	Paul Cameron	Director, Brattleboro Climate Protection Committee	2 April
Amherst	MA	Stephanie Ciccarello	Wetlands Administrator + Energy Task Force Coordinator	5 March
Northampton	MA	Christopher Mason	Energy and Sustainability Officer	31 March
Mission	KS	Josh Rauch	Management Intern	1 April
Northfield	MN	George Kinney	Co-Chair, Energy Task Force	11 April
Aspen	CO	Kim Peterson	Canary Initiative Project Manager	30 March

Eight Climate Action Case studies

Brunswick, Maine

Population (2007): 21,806   Land area: 46.8 square miles

Brunswick Deputy Public Works Director and Facilities Manager Craig Worth described the City of Brunswick as "feeling their way around right now," given that they only recently began work on their first inventory. Brunswick's government signed the US Mayor's Climate Protection Agreement and joined ICLEI after a successful campaign by Bowdoin College students, which has since fostered an ongoing City-College partnership. The agreement and ICLEI membership also served as a response to the Governor of Maine's statewide carbon challenge. In order to fulfill the ICLEI commitment, the City expanded the charter of its pre-existing Recycling Committee to include sustainability. The Committee, meeting one or two times a month, consists of Worth as the City's representative, public volunteers, and a representative from Bowdoin College. They are currently conducting a municipal operations inventory, with Worth spending between two and four hours per week collecting data and volunteers spending much more entering data and working with inventory spreadsheets.[2] They plan to expand the inventory into the community, but noted that obtaining electronic data from the statewide public utility has been difficult and that tracking residential emissions will be problematic due to the operation of many independent oil companies. The Committee, which still handles its original function, solid waste management, has an operating budget of a couple thousand dollars, funded by the City of Brunswick. The most notable aspect of Brunswick's situation is that upon joining ICLEI, climate action was assigned to a pre-existing committee, effectively institutionalizing the ICLEI milestones in a structure that had already functioned somewhat successfully. It is still unclear, however, how much progress the primarily volunteer committee will be able to make on its new sustainability charge. While it is possible that the committee is able to develop a detailed plan and work effectively to implement it, it is also possible that the committee has insufficient resources to make significant progress.

When Brunswick has its completed inventory, Worth anticipates addressing "low-hanging fruit" first, such as inefficient lighting systems and poor insulation. After observing subsequent emissions reductions, he hopes to develop confidence in the City's ability to reduce emissions. This will allow the Committee to justify setting target reductions. Also, Worth anticipates that evidence of these first measures' impact will help the Committee gain more influence in City discussions and operations. At such an early stage, Worth has not had the time or resources to actively engage the community-at-large beyond the committee's volunteers, but plans to pursue this after completing the municipal inventory.

Burlington, Vermont

Population (2007): 38,531   Land area: 10.6 square miles

In 1997, the City of Burlington became one of ICLEI's first members at the urging of its progressive Mayor. The city then proceeded to conduct a 1997 inventory before completing a

[2] Worth felt that ICLEI's CACP software was "not a great fit" for municipalities, and thus chose to use other spreadsheets.

CAP in 2000. According to Jennifer Green, Burlington's Legacy Project Co-Coordinator (see below), little has been done since then. However, Burlington's new Mayor has decided to revisit these documents, conduct a second inventory, and begin taking action.

When Burlington first joined ICLEI, it created a climate protection task force, consisting of City officials and representatives from local NGOs and large stakeholders, such as the University of Vermont (UVM) and the nonprofit Energy Investment Corporation. This task force conducted the Burlington's first inventory and wrote its CAP. Now, Burlington's new Mayor has taken a three-tiered approach for the City's second attempt to fulfill its ICLEI commitment. First, he pulled together a focus group of environmental experts that acts as a resource for City officials and community members trying to address emissions. Second, within the City government, the Mayor formed a regularly meeting municipal 'green team' to get department heads and other City staff involved and invested in the process. Finally, he created specific working groups for each sector, made up of community members and department heads (not just environmental specialists), each focusing on a specific community or government sector. Each of these sector-based working groups met three or four times before making recommendations to the City. The recommendations from these working groups were supplemented by submissions from the community-at-large through a webpage dedicated specifically to the CAP, on Burlington's website. After the working groups had finished making their recommendations and the City had formalized them into a CAP, the Mayor formed an official Committee for Energy and Environmental Coordination, made of up public citizens, that is charged with implementing the community element of the CAP, while the municipal green team addresses municipal operations. Burlington's solid reputation as a leader in sustainability suggests that its approach has been successful. It is, however, important to acknowledge that Burlington is a large city with substantial resources, a sizeable City staff, and a community that has had very strong 'green' tendencies for a long time. Creating such a large number of groups and committees may not be feasible for municipalities lacking a large population, many enthusiastic citizen volunteers, or a strong mayor. Nevertheless, the City's broad strategy of pursuing the advice of experts, stressing sustainability within the City staff, and focusing work sessions on specific sectors appears useful.

While the work groups brainstormed many of the ideas for the CAP, it is important to acknowledge who did the legwork of conducting the 2007 inventory and compiling the recommendations. These were Jennifer Green's responsibility. Green and an interested Planning and Zoning Department employee conducted the inventory over six months, working 10-15 hours per week on the inventory as well as the CAP and other related projects. Having already completed the 1997 inventory enabled Burlington to work on their CAP and second inventory simultaneously. According to Green, despite the advantage of having a municipal electric utility that can provide detailed data, one of the City's biggest challenges with regard to conducting inventories has been systematizing data collection, which will streamline the process such that future inventories require far less than six months of work.

Within the City structure, Green is part of a two-person team, assisted by an Americorps VISTA volunteer, that is responsible primarily for Burlington's master plan, called the Legacy Plan. The Legacy Plan is considered the "sustainability vision for the City." Burlington has affirmed the CAP's importance by embedding it into the Legacy Plan, which is often referred to during City planning decisions. Green mentioned that the best way of keeping the CAP visible and relevant is by maintaining the necessary political will beyond the term-limited Mayor's office, something that they are attempting to do by incorporating it into the Legacy Plan. Based on many of my discussions, it seems that it is common practice for cities to update their comprehensive plans to satisfy state requirements and then leave them untouched until the subsequent update. The practice of actively consulting such plans, which could include CAP measures and recommendations, may be an effective strategy for maintaining awareness of and attention to emissions reduction goals and commitments.

Burlington has publicized its climate action progress by having City staff appear on local news shows and by holding press releases. Most citizens had no idea that the City had created a CAP in 2000. The more recent CAP project gained visibility in the community-at-large when community members were included in the work groups and when the Mayor held a meeting to announce Burlington's target, which was attended by over 80 people. Burlington also created the 10% Challenge, where residents and businesses track their energy consumption and emissions and make a reduction pledge online

Green's primary advice for Oberlin is that the City builds climate action into the way it does business, which will help overcome staff turnover. Specifically, she recommends that Oberlin's first step be creating a body that comes up with recommendations, a measure that might be authorized by the City Manager or City Council. Because Burlington has had success with sector-specific teams of community members and City staff generating ideas, Green suggests this framework, where sector leaders, perhaps chosen from City staff, would gather each working group. Broadly speaking, Green laid out the following potential path for Oberlin. First, someone puts forth a climate action resolution. The City then recognizes the validity of its inventory data, examines other CAPs, and publicly announces a goal at a community event with media coverage. Once the goal is set, Green suggested that Oberlin adopt annual reduction targets, conduct cost-benefit analyses on various recommendations, and develop a detailed implementation plan. While some of these steps might be challenging in a place so much smaller than Burlington, Green stands behind this approach based on the successes she has witnessed. Burlington is a perfect example of how a City can integrate various strategies into how it approaches climate action. It also suggests an important lesson in that a decade went by without any substantive follow-up to the initial inventory and CAP, primarily due to a lack of political will. Burlington's experience shows why it is so important to create a long-term, well-rooted climate action framework such that ICLEI milestones are continuously addressed, regardless of changes in the political environment.

Brattleboro, Vermont

Population (2007): 11,984 Land area: 32.0 square miles

Brattleboro's select-board passed a resolution to join ICLEI's CCP program after Paul Cameron, a resident, became interested in global warming in 2001 and sent a letter to members of the City's select-board. One select-person was very interested, and the two teamed up to write the resolution and get it passed. Cameron then spent one summer conducting Brattleboro's inventory with the help of ICLEI software and technical support, which he subsequently reported to the select-board after ICLEI had reviewed his process and results. He and the select-person then brainstormed members of the community they felt should be involved in climate action and sent them letters through the City Manager's office. After receiving a positive response, they created a task force made up of Cameron, the select-person, and citizens who were either very interested, had some expertise, or were community leaders (such as business owners, nonprofit heads, and resident college professors). The City Planning Department provided a workspace, and the task force spent the next year writing a CAP that included reduction targets and identified 35 specific emissions reductions measures, borrowing heavily from other CAPs. The select-board was very supportive and approved the CAP. This approval process went smoothly in part due to Cameron's partnership with the select-person, but also because the CAP did not include any explicit costs to which the select-board might have had to agree. Furthermore, unlike Burlington, Brattleboro did not integrate its CAP into the City's master plan. However, a Vermont natural resource group recently approached the City asking for participation in a pilot project where it would write and pass a strong energy section in the City plan, for which periodic updates are mandated. As a result of this new project, Cameron is now updating the 2001 CAP.

After the original CAP was accepted, Cameron, a private citizen, formed a nonprofit organization to carry out the City's climate action initiatives. This model for CAP development and implementation is very interesting and appears to be somewhat unique. Under certain circumstances, a quasi-governmental, nonprofit organization employing community members is a promising structure for climate action. The City of Brattleboro provides his workspace and half his budget. He obtains the other half predominantly through grants, such as those available through state energy offices, and private donations, for which he has established a solid base of donors by sending out fundraising letters twice per year. Primarily through performance contracts and a biodiesel conversion for its vehicle fleet, Cameron estimates that the City has come close to reaching its municipal target of 20% by 2010 (although they have not completed their second inventory to verify his estimate).

In Brattleboro, public outreach has been a challenge. While there is a high level of citizen interest, indicated by the presence of numerous groups working on sustainability issues, the difficulty has been bringing people together under one umbrella, a situation quite similar to Oberlin's. To stimulate community awareness, he has written many articles in the local paper and recently borrowed Burlington's 10% Challenge program (see Burlington case study). Cameron was surprised to find that while he was hoping for this program to have success in the residential sector, he was most successful by directly targeting businesses. This was a positive result, but did not generate the widespread awareness he would have preferred. He attributes this partly to the fact that people have short memories, have a lot going on in their lives, and that in order to be active climate advocates, they need constant reminders. Cameron acknowledges that he has not had the staffing, money, or time necessary to publicize his organization's climate work as much as he would like. He has chosen a project-based approach to climate action, in order to avoid lengthy community discussions in favor of moving forward with obvious emissions reductions projects. To do this, he has had to sacrifice initiatives that might have increased community engagement. While some communities employ focus groups and actively pursue community input, Cameron has preferred to use his time getting things done.

Nevertheless, he emphasized the importance of organizing a group of volunteers to carry on climate action work. Without an active person or group for the City to go to, he argues, sustained progress is difficult. Most cities have numerous staff and/or citizen committees, so if there is sufficient interest in Oberlin, Cameron suggests that it might not be difficult to add one more. To motivate municipalities to create such climate action teams, Cameron stresses the fact that these projects save money, something the federal government has recognized and to which it has consequently responded by provided funding and jobs in this area. He also mentioned the value of connecting regionally. In Vermont, 30 to 40 small towns have organized themselves into a climate action network to coordinate efforts. Most have not conducted inventories or developed formal CAPs, but momentum can be built by connecting with other municipalities that are making progress.

Amherst, Massachusetts

Population (2007): 34,275   Land area: 27.7 square miles

Amherst's select-board passed a resolution to join ICLEI in 2000, and subsequently created an energy task force charged with reducing GHG emissions. Initially, this task force consisted of over twenty people, including residents, facilities representatives from each of Amherst's three colleges and universities, members of local environmental organizations, a select-person, and Stephanie Ciccarello from the City's Conservation Department, with whom I spoke. Before shrinking to five or six regularly contributing members, the energy task force, which meets once each month, conducted an inventory of the year 1997 and completed its CAP in 2005. Initially, the City hired graduate student interns to conduct most of the work. At one point, an intern departed without a replacement and the City needed someone to step up. Ciccarello, then working as Amherst's wetlands administrator, volunteered to take on the responsibility, and procured a $7500 per year grant for five years from a local utility company to work eight hours per week on Amherst's climate action projects. The City has continued to hire graduate interns, paid and overseen by Ciccarello, who work regular hours in a workspace provided by the City.

In setting their targets and developing their CAP, Amherst focused on compiling measures that had already been initiated throughout the community, such as UMass-Amherst's conversion to a co-generation plant leading to a 10% emissions reduction, and was consequently able to set a very aggressive target of 35% by 2009. They are currently finishing an inventory for 2006, which will illustrate what progress the City has made. If Amherst demonstrates such substantial emissions reductions over such a short time, Oberlin City officials should consider contacting Ciccarello for more specific information about which of their CAP measures were most successful. Since the energy task force's inception, in addition to implementing specific projects, it has supported various ordinances, including an anti-idling law and greener building codes, and has shaped City policy indirectly through its recommendations.

Northampton, Massachusetts

Population (2007): 28,411   Land area: 34.5 square miles

Northampton joined ICLEI in 2000 and soon after hired an intern to conduct a 2000 inventory. Until recently, however, the City had taken no explicit action regarding the development of a CAP. In 2007, Northampton began the required process of updating its comprehensive plan. Christopher Mason, the City's current Energy and Sustainability Officer, explained how the City went about this process. It is common practice, he said, for cities to release a plan, let it gather dust for 10 years, and then reopen it and realize that some great ideas had been forgotten or neglected. In developing a new plan, Northampton's Mayor requested everyone's input, and decided to aim it explicitly at sustainability, calling it the Sustainable Northampton Comprehensive Plan. This document included a section that was essentially an integrated CAP, with various measures the City should take to reduce emissions. Because the Mayor was behind this, every department was required to identify how they would address the actions spelled out in the document. With its release in 2008, it created an Energy and Sustainability Commission, headed by an Energy and Sustainability Officer housed in the Central Services (i.e. Building and Maintenance) Department. The Commission, which meets once per month, is made up of the City's Directors of Central Services, Public Works, and Planning and Development, the City's Building Commissioner, two City Councilors, a representative from the local vocational high school, and four community members appointed and confirmed by the Mayor and City Council, respectively. This body is responsible for ensuring that the City follows through with the actions outlined in its Comprehensive Plan. Mason emphasizes the importance of involving top City officials as well as community members because it increases buy-in from different parts of the community.

Interestingly, Northampton has had an energy officer periodically since the 1980s. The position was initially contracted out before it became a permanent 10 and then 15 hour-per-week position. As Northampton's current Energy and Sustainability Officer, Mason works 30 hours per week with benefits, and is tasked with "increasing efficiency, accelerating the City's adoption of renewable energy, guarding and mitigating the effects of fluctuating energy supply and demand, guarding against the effects of climate change, and reducing carbon emissions for all sectors."

To afford Mason's position, Northampton has taken advantage of an innovative State of Massachusetts program through which citizens can choose to purchase renewable energy through their power utility. For every extra dollar spent on renewable energy, the City receives a dollar from the State to spend on efficiency and other energy reduction projects. Northampton raises approximately $200,000 annually through this program, some of which pays Mason's salary. This is helpful because as it is, Mason spends much of his time searching for funding. If one wants to get things done, he argues, one has to find money, and Mason tries to identify programs that are funded by state, private, or federal aid, or that pay for themselves. From this approach he has taken advantage of performance contracting, which is budget neutral, managed to procure several small photovoltaic panels free of charge for the City, and helped Northampton participate in regional energy efficiency programs. According to Mason, ICLEI can be very helpful in helping small communities find funding. Recently, it hosted a conference call for members providing instructions and tips for utilizing funding earmarked in the recent federal stimulus package.

Mason's advice for Oberlin emphasized the need to procure funding. He recommended that whoever is responsible for climate action find relevant list-serves and request notifications of funding opportunities from ICLEI. He also mentioned that in his experience, he has dealt extensively "with everyone on everything" in the City. Any energy-related City position, he asserts, should be based in the Mayor or City Manager's office because of the position's importance and potentially wide-ranging influence.

Mission, Kansas

Population (2007): 9,743   Land area: 2.5 square miles

In Mission, growing concern about climate change among its citizens and City Councilors, including a Councilor working for the EPA, led to the City's ICLEI membership and subsequent climate action. In summer 2007, numerous City officials from Mission and the surrounding Kansas City region attended a sustainability retreat hosted in Shadow Cliff, Colorado. Following the successful retreat, the City organized a sustainability task force that served as the impetus for Mission's inventory, which was completed in 2008, and CAP, which is due in May 2009. The task force is co-chaired by two City Councilors, and otherwise consists of community members appointed by the mayor, who are either residents or people who own businesses and/or work in Mission. When the task force was formed, it created a calendar of monthly meetings, and scheduled due dates for the inventory (one year later) and CAP (up to one year after the inventory) along with monthly goals. Because most of task force members had other full-time jobs, instead of doing most of the laborious data collection, the task force functioned as a kind of steering committee, directing City staff with which they met one or two times per month. The City contracted the inventory itself to a consultant, Black and Veetch, which collected community-wide data, operated the ICLEI software, and generated reports, with City officials providing municipal data. When it was completed, Black and Veetch passed the inventory along to the task force, which subsequently submitted it to City Council. City employees are now compiling the CAP with the direction provided by input and feedback from the task force and community-at-large. The measures being included in Mission's CAP were mostly generated using ICLEI's Climate and Air Pollution Planning Assistant (CAPPA) tool, described later. The task force voted on each of the roughly 100 projects CAPPA 'recommended,' and the top 20 to 25 results became the core of the City's CAP.

Josh Rauch, whom I interviewed, is a University of Kansas graduate student in Management working as an Administrative Intern for the City of Mission through his department's internship program. He has worked part time for the last year, and will be full-time for a year starting in June. He has drafted most of the CAP, working back and forth on edits with the task force. Mission has no Sustainability Coordinator—instead, many City officials are supportive of climate action. One of Mission's city planners even organized Mission's participation in a regional commute challenge, where the City earned points by tracking carpooling, biking, and walking. According to Rauch, many City employees are sustainability-minded and the City is trying to reach a point where sustainability is not segregated from 'normal' City processes. In Rauch's opinion, if the City were to hire a specific employee to deal with these issues, it would seem like nobody else has to worry about it, which is the opposite of what Mission is aiming for. As a result of Mission's approach, sustainability has become a line item in the general administrative fund's budget. This has allowed Mission to build a community garden, hire Black and Veetch to conduct the inventory ($40,000), and pay for Staff sustainability education (such as the Colorado retreat expenses, which were covered partly by a Black and Veetch sponsorship).

For Oberlin, Rauch recommended the formation of a committee similar to Mission's task force, with representatives from all interested parties, including, for example, residents, students, businesspeople, and City officials. In order to be successful, the committee needs to be provided with a detailed work plan specifying target dates by which certain projects, such as the CAP, will be done, as well as month-by-month benchmarks. Rauch explained that one of the challenges for Mission has been a lack of 'manpower' within the City, which has a small staff made up of only 12 City Hall administrators, of which he is one. In order to accomplish climate action projects in such circumstances, it is necessary to have both a functioning task force as well as leaders who can create the political capital necessary to reach sustainability goals. He also warned that while Oberlin College introduces the opportunity for very interesting projects, any Oberlin residents that have had trouble with the College-community relationship might struggle to accept College-generated ideas. It is thus important that shared goals are made explicit, to avoid unproductive power struggles.

Rauch emphasized the way Mission has tried to integrate climate concerns into the way the City conducts its business. He mentioned that sustainability is often conceptualized as yet another responsibility with associated initiatives that are added to an already "full plate." However, Rauch and other Mission employees view sustainability as a lens through which officials should look to improve the ways things are already done. Rauch encouraged this approach in Oberlin, where sustainability goals should be considered, along with other concerns, each time the City makes decisions.

Northfield, Minnesota

Population (2007): 19,331   Land area: 7.0 square miles

An environmentally conscious community-at-large was behind Northfield's first climate action. Northfield has had an environmental quality commission since the mid 1970s, but awareness that is specifically focused on climate change arrived recently. In 2003, a group of community members formed a nonprofit organization to search for renewable energy sources. A couple years later, Carleton College built a 1.65-megawatt wind turbine, which spurred St. Olaf College to erect an identical one. A spike in the community's climate consciousness followed, which led to informal discussions among City officials, residents, and local businesspeople, during which people began to conclude that the City should continue down this path. These occasional meetings eventually produced a resolution that was passed by City Council creating an energy task force.

The task force was set up as a subcommittee of Northfield's Environmental Quality Commission, and although it had no staffing or budget, was considered equivalent in stature to the City's 18 other volunteer boards and commissions (such as the hospital, library, and fund-dispersal groups). Using an application process the City created the 7-member task force, which included two technically oriented people, one skilled writer, and a professional facilitator, among others. The task force was charged with 1) exploring what Northfield can do to increase energy conservation and improve the ways energy is used, 2) evaluating the possibility of creating a municipal utility or special energy district, 3) setting an emissions reductions target and date, and 4) creating a CAP.

The task force resolution that had passed in early June 2007 was set to expire on May 31, 2008, so the group began meeting every two weeks, frequently in the evening, with each member completing small "homework" assignments between meetings. They set up a GoogleGroups account to facilitate communication, and as deadlines approached moved to weekly meetings. Over the course of the year, one member dropped out and several others became more or less inactive, leaving four people toiling to fulfill the task force's responsibilities. To accomplish its tasks in the short time frame City Council had provided, they set up a resource team that functioned as an expert panel, consisting of residents and people from Northfield's colleges, businesses, and industries. In addition to multiple meetings with the resource team, the task force held two public meetings, which were quite exciting due to the diversity of community members that attended, according to George Kinney, the former task force co-chair with whom I spoke. Additionally, Kinney scheduled a work session with City Council to decide on a target, and this meeting that he had anticipated lasting ten minutes became an intense hour-long discussion, because the Councilors were so interested and engaged in the process. They eventually decided on a "Carbon-free by 2033" target, which was included as one of the task force's recommendations in the final CAP document it submitted to Council in May 2008. The

City Council accepted all the recommendations, but did not actually vote on anything, instead issuing many remarks thanking the task force for their efforts and congratulating them on their product. Interestingly, Kinney remarked that ICLEI and other municipalities have marveled in disbelief when he insisted that a volunteer energy task force created Northfield's CAP, which apparently seems as well-constructed as those submitted by consulting firms. Kinney is proud of this, and Northfield appears to be an example of a strictly volunteer committee producing a high-quality CAP. He encourages Oberlin to "steal" items from Northfield's CAP and others, as that approach is how his task force generated many of its ideas. Some cities have voluntarily uploaded their CAPs to ICLEI's website, where they are accessible to members. Additionally, CAPs are usually available for download from City websites.

Despite their impressive CAP, Kinney reports that Northfield has not yet acted on any of the task force's recommendations, largely as a result of political upheaval that occurred during the task force's year of existence. Northfield's 2008 Mayor is facing felony charges for trying to convince City staff to file favorable reports regarding a liquor store proposal on land of which he had partial ownership. As a result, the City's politics were in an uproar in the middle of the energy task force's presentations to City Council. After the corruption incident, four of five new Councilors were elected. As City Council tries to reestablish its goals and identity and sort out the corruption issues, the City's climate action progress has halted. Kinney has stayed in touch with the current Mayor and several City Councilors, who are aware that the former task force is energized and excited to continue working. They have tried to set up a permanent energy board, but have been unable to garner attention from City Council, which is focused on dealing with the political strife. These untimely challenges have also come as the City lays off staff due to the economic recession. Consequently, no City official has had sufficient time to dedicate to climate action. The task force is currently pursuing a State of Minnesota grant to hire an energy coordinator position.

Aspen, Colorado

Population (2007): 5,785 (up to 30,000 at peak tourist season) *Land area: 3.5 square miles*

The City of Aspen explicitly began its climate action campaign in 2004 by creating the Canary Initiative, now part of the City's Public Works Department. Initially, a City attorney decided that it was important to put Aspen, a city with a strong environmental ethic, 'on the map' for doing something meaningful about climate change. The Canary Initiative, which now employs three City staff members, works on the ICLEI milestones as well as numerous other sustainability projects throughout Aspen. When Aspen committed to climate action, this became a line item in the City's budget, under both the utilities and general funds. In 2004, the Canary Initiative hired a carbon inventory firm, Climate Mitigation Services (CMS) to conduct its first inventory, which occurred before ICLEI had developed a well-defined protocol. This first inventory involved 300 hours of consultant time in addition to Canary staff work.

Canary staff then created their CAP with input from the Aspen Global Warming Alliance, an existing advisory board of local NGOs and businesses. This was a set of non-binding recommendations accepted by City Council. While the non-binding CAP measures must be translated to ordinance language and voted on before becoming law, Aspen must nevertheless take the CAP and corresponding GHG emissions reductions seriously as a result of its participation in the Chicago Climate Exchange. This means that if Aspen cannot meet its targets, the City is obligated to purchase carbon credits through an offset market.

Aspen is currently working on the areas of the CAP where officials have most influence, such as City operations, municipal electricity, developing a partnership with the local transit authority, and increasing public awareness. Since roughly 60% of Aspen homes are second residences, which tend to be larger and energy-intensive, Aspen is reaching out to these homeowners to encourage energy efficiency and conservation behavior. In the municipal sector, Canary staff have had considerable success, reducing emissions from municipal operations by 23.7% over just three years. CMS, the inventory consultant, is now working with Canary staff to help them learn inventory methodology as they conduct a second inventory.

Kim Peterson, the Canary Initiative's Project Manager, identified cost as one of the challenges of these contracted inventories, which is one of the reasons that Canary staff is learning how to conduct the inventories—an in-house inventory would be far less expensive. Another challenge for Aspen has been addressing air travel. Aspen's city council made the decision to take responsibility for airplane emissions from Aspen's own airport and from tourists flying into a nearby airport with Aspen as their destination. Given the intense regulation of airports, there is little the City can do, but Peterson appreciates the value of having such a major source of emissions on the City Council's radar. Engaging citizens has also been a challenge. While they are not very directly involved in the Canary Initiative itself, according to Peterson, they are certainly aware of it. The Canary logo is on City buses and its hybrid police vehicles. City employees have also ensured that climate action receives media attention and have taken out advertisements in local papers. To facilitate further community engagement, Aspen partnered with ICLEI to host a Climate Conversation on Earth Day 2009.

In our discussion about Oberlin's situation having just completed a baseline inventory, Peterson offered several pieces of advice. She stressed that climate action should be somebody's job and that without this basic structure, it is easy for people to "let it go." Nevertheless, she mentioned that Oberlin does not necessarily need a 'Canary Initiative.' Instead, it is enough if one or two people on the City staff are willing to have this be part of their job. Without someone in the City working explicitly on sustainability projects, she argues that institutional memory disappears. Her opinion, when I mentioned the potential of Oberlin students, was that semester or yearlong people are not enough. Peterson also underscored the need to find someone, either within or outside of City government, who can act as a local champion for this work, as it is unlikely to be successful without a person or group pushing the City forward. Nevertheless, she finds that the process is not too difficult, especially given the fact that there is an essentially prescribed process that many cities have followed with the help of ICLEI.

Options for a Sustainable Climate Action Framework in Oberlin

The case studies above suggest a variety of options and strategies for structuring the long-term process of climate action that the City of Oberlin should consider. The goal of this chapter is not to suggest that any of these communities provides a clear template for Oberlin, but rather to provide the City with a range of ideas regarding how Oberlin might structure its own approach such that the momentum generated by these inventories leads to a sustainable and ongoing GHG reduction campaign. These options are summarized in the following list:

Four General Approaches

- Assign responsibility of climate action planning and implementation to a pre-existing City-chartered committee of volunteers and City employees (Brunswick)
- Create a new task force including various stakeholders, such as city employees, residents, College representatives, and businesses, responsible for conducting the inventories and planning and implementing a CAP (e.g. Burlington, Amherst, Northampton, Mission, Northfield)
- Develop a parallel public-NGO partnership through which climate action planning and implementation is accomplished (Brattleboro)
- Assign the responsibility of conducting inventories and climate action planning and implementation to City employee(s) (Burlington, Amherst, Northampton, Aspen)

Additional Strategies

- Incorporate the CAP into the City's master plan and master planning process (Burlington, Brattleboro, Northampton)
- Form a team of City employees, including department heads, that meets regularly to ensure that sustainability issues are being addressed in City operations (Burlington, Northampton)
- Create short-term, sector-specific work groups made up of and led by community members or city employees, each focused on making recommendations for a single sector (Burlington)
- Gather a committee of experts to act as an advisory board to those involved in planning and implementation (Burlington, Aspen)
- Base the City employee responsible for climate action out of the Mayor's or City Manager's office to provide greater influence and centrality in larger City structure (Northampton)
- Send City employees to educational sustainability retreats to generate ideas, enthusiasm, and dedication (Mission)
- Hire a contractor to conduct inventories (Mission, Aspen)
- Employ short-term interns to conduct inventories and/or research CAP measures (Amherst, Northampton, Mission, Oberlin)
- Establish a clear work plan, schedule, and process for consistently reviewing accomplishments during climate action planning and implementation (Mission)
- Actively publicize the climate action plan and actions to implement the plan through press releases, a climate action webpage, and public events to enlist public engagement, solicit input, and build support (Burlington, Northfield, Aspen)
- Join a regional climate action network to coordinate efforts, facilitate idea sharing and collectively lobby for regional initiatives (Brattleboro)

Funding Options

- Include climate action planning and implementation initiatives in the City budget (Brunswick, Brattleboro, Mission, Aspen)
- Obtain funding by pursuing grants from state offices or programs and private foundations and businesses (Brattleboro, Amherst, Northampton)
- Raise money by requesting private donations from local residents and businesses (Brattleboro)
- Rely on committed volunteers working without funding (Northfield)

Before taking any concrete steps, the City of Oberlin should examine and evaluate the approaches that other cities have taken to provide an organizational framework for sustained climate action, some of which are presented here. The framework the City ultimately decides to put in place should reflect consideration of various objectives. This framework should 1) institutionalize the process such that the City continues proceeding through the ICLEI process without necessitating specific mandates to do so, 2) maintain continuity by building on prior work, 3) have the necessary authority to ensure that implementation occurs, 4) engage all components of government, 5) maximally engage the community, 6) take advantage of Oberlin's unique resources, such as its top-tier College, 7) facilitate communication between all entities, 8) support continuous data collection, and 9) be oriented toward well-defined goals. Keeping these objectives in mind in examining what other communities have done should help the City decide what structure will be most effective as Oberlin moves forward.

The role of City officials

One of the crucial choices the City must make is whether or not, and to what extent, it should assign the responsibility of proceeding with climate action to one or several City employees. There are three basic and ongoing tasks involved in climate work: researching emissions reductions measures and writing or revising the CAP, implementing the measures that are formalized in the CAP, and continually collecting data and conducting periodic inventories. In some cases, City governments have hired a new employee or, in Aspen's case a group of employees, whose job description is defined by these three tasks. In other cases, governing officials and top administrators have mandated that all City staff be proactive and incorporate an energy reductions approach to all city business, opting to distribute the responsibility of reducing emissions across all departments. Many of these Cities assign the inventory to an individual staff member, intern, or contractor and then collectively develop the CAP and implement measures as a City staff. In still other cases, existing City employees have taken on a part-time role overseeing climate action, often leaving the majority of the work involved in all three tasks for dedicated and passionate community volunteers or hired interns. Weighing these options for Oberlin involves an evaluation of budgetary constraints and potential funding mechanisms, the level of individual and collective interest among City staff, and the level of interest and likelihood of dedication among community members.

Hiring a Sustainability Coordinator or Energy Manager position under the City Manager or Public Works Departments provides the advantage of having an explicit go-to person employed by the City, whose responsibility is to ensure that the City fulfills its commitments by reducing emissions. This would likely lead to solid institutionalization and continuity, as it would essentially be someone's job to push forward in the ICLEI process. However, choosing this option risks that other employees might not internalize emissions reductions considerations in their decisions and operations, given that the responsibility lies explicitly with another staff member, although this internalization is not certain to occur in the absence of a specific climate action staff member, either. There is also potential for the climate action position to lead to defensive or territorial reactions from other departments. The effect of hiring a specific sustainability employee likely depends a great deal on the personality and characteristics of that employee as well as the culture existing within the government. If departments are open to frequent communication and cooperation, a sustainability staff member can act as a resource person and sounding board, facilitating the development of new ideas and collective action. In this case, the introduction of a Sustainability Coordinator position could lead to a broader, government-wide approach in which climate action is well integrated into all city processes.

How the City conceptualizes the broad task of climate action

This final point suggests a dialectic concerning how a City staff engages in climate action. If a single person is charged with sustainability, that person might be more effective at getting certain projects completed. However, if a City can manage to make sustainability the focus of its master plan, and if that plan is situated prominently in City planning and operations and correspondingly stressed by City Council and/or a City Manager, then it is perhaps more likely to be tackled seriously by all parties.

Cities vary with regard to how climate action is embedded in City planning, some conceptualizing the development and implementation of a CAP as an integral and indistinguishable aspect of their City's approach to all issues, and others considering the ICLEI process as more of a sustainability to-do list. Many have incorporated CAPs into master plans, which frequently identify "sustainability" as their broadly defined focus (as does Oberlin's 2004 plan). Mission's Josh Rauch suggests that people tend to think of the CAP and other ICLEI milestones as tasks consisting of a concrete development stage, the creation of a budget and timeline, reaching benchmarks, and accomplishing goals. While this framework can be helpful in certain circumstances, in his opinion, the ICLEI milestones act more as a lens through which officials examine municipal operations and community activities to improve the way everything is done. This is reflected in the way Mission has approached climate action by making it the responsibility of all city officials. Others have spent the majority of their time completing distinct projects within the ICLEI process. Brattleboro's climate action has not been a broad City-wide campaign, but rather a series of individual projects that have been accomplished without special attention paid to facilitating buy-in across City staff.

City-nonprofit partnership

Perhaps part of the reason for Brattleboro's project-oriented approach is its unique organizational model. Paul Cameron, an interested and competent citizen has partnered with the City to form a nonprofit organization to accomplish climate action goals for the City and community, funded in part by the City's general budget and housed in City offices. This is obviously contingent on there being a community member interested and available to take on this substantial responsibility and workload. However, it certainly holds promise. The organization's director would be able to spend time pursuing funding for climate action initiatives, something City officials might not have time to do. As long as this person remains included and consulted in City decisions and discussions, this approach could represent a long-term institutionalized structure that provides continuity and integration with City processes while taking advantage of an external, community-based, nonprofit structure, perhaps steered by a diverse committee of stakeholders. Oberlin should seriously consider this approach, especially if establishing a full-time City position proves difficult.

Establishing an Energy Task Force (ETF)

One of the most common institutional structures employed to pursue climate action in the cities I examined, no matter how municipal involvement was otherwise structured, is an Energy

Task Force (ETF) made up of city officials, public volunteers, community stake-holders and business people, and often college representatives. This can be manifested in a variety of ways, and the explicit roles of these groups can vary. In some cities, the ETF (or similar entity) acts as an advisory panel, made up of experts who can then be consulted by City officials as they move forward. In this formulation, the ETF does not actually do the work of writing plans, procuring funding, and implementing projects, which are the responsibility of the City staff. However, in other cases, the ETF is not a board of sustainability experts, but rather a work group of interested people, from all corners of the community, who generate ideas and write up the climate action plan. Membership in such committees seems to wane over time, but despite this decrease in participation, ETFs of this nature have produced some of the most widely referenced and well-known CAPs, such as Northfield's. Finally, several committees could be created in place of a single ETF, each acting as a focus group to address a specific aspect of climate action, such as transportation, renewable electricity, community outreach, building efficiency, etc. City staff members or particularly active and knowledgeable community members could lead these groups. In Oberlin, there are myriad volunteer organizations and programs, many of them environmentally oriented or sustainability-related. What Oberlin currently lacks is an umbrella framework that can link what are now diffuse and seemingly unrelated endeavors, something Cameron has identified as one of the main challenges in Brattleboro, where there is reasonably high citizen interest. It is evident that Oberlin is a community of very active citizens, and if the City can manage to connect everything that is happening in the College and wider community to a central framework, namely Oberlin's CAP, in a productive way, there is great potential for climate action synergy.

If an ETF system is decided on, it will be necessary to determine what authority it has that will allow its work to be integrated into City policy development and eventually implemented. The degree of authority seems to vary among cities. Some ETFs are made up primarily of City officials, giving them some level of de facto authority. In other cases, the ETF is a volunteer group acting as a kind of City commission. The degree to which ETFs help actually enact policy and implement projects depends, at least in part, on its relationship to the City. If its members come together on their own and successfully push for formalization, the dynamic may be quite different than if the City had assembled the group or issued the initial mandate. Whether or not the ETF simply makes recommendations or is more integral to the City planning process depends on the characteristics of the specific municipality. No matter how the ETF is developed and manifested, frequent and substantive communication with the City is crucial.

Brunswick's unique strategy of assigning climate action endeavors to a pre-existing City-chartered committee is very relevant to this discussion of ETF roles. As the case study describes, Brunswick expanded the charter of its Recycling Committee to include conducting a GHG inventory. While Brunswick has not had its climate action approach formalized for long enough to sufficiently judge the effectiveness of its strategy, it appears to have some merit. First, it takes advantage of the fact that committee members have likely already developed a working relationship with City, having been operating at least adequately for some time. It also acknowledges that those members interested enough to volunteer on a recycling committee are also the members of the community that would be likely to participate in a broader climate action movement. While it may be that assigning the ICLEI tasks to a pre-existing group is actually an evasion of the more difficult task of assembling an ETF, the potential merits are worth considering.

A potential tradeoff between community engagement and efficiency

There are numerous challenges associated with an ETF composed of numerous community members. Mission's Rauch noted that ETFs have to be small enough to allow work to get done. He suggested that if committees get too large, exceedingly lengthy discussions might result, and the committees may struggle to actually pursue tangible emissions reductions activities. It is not difficult to imagine this happening in Oberlin, where opinions are strong and ideas are plentiful. There appear to be various philosophies regarding community engagement in climate action. Brattleboro's Cameron chose not to spend much time reaching out to community members for input because he was already aware of obvious measures that could be implemented, and felt that starting work toward those measures was most important. However, Mason, of Northampton, pointed out that community engagement is crucial because when he brings recommendations to those responsible for implementation in the City, his proposals have substantial weight because they were generated, at least in part, by the community. If the community is very engaged, it becomes apparent that the whole community, not just the Sustainability Officer, is asking for things to be done. This suggests a tradeoff between efficient progress and solicitation of community participation. Initially identifying motivated leaders who are then responsible for pulling together work groups might lead to efficient work without entirely sacrificing community engagement, especially if goals are well-defined and benchmarks clearly established.

Taking advantage of students as interns

An obvious strategy that I have not yet addressed is taking advantage of the resources Oberlin College provides. Indeed, my project is an example of how interested College students may be able to help the City move forward. Following my work, the City could continue to 'hire' interns responsible for completing aspects of the ICLEI process. This approach can be effective when City officials are willing to work closely with interns and share ideas, and has the advantage of being a low-cost option. Prof. Shammin, for example, has expressed interest in creating assignments or projects for students in his "Energy and Society" course that are explicitly related to making climate action recommendations, conducting and updating inventories for the City, or forecasting emissions. Similar to the framework under which my project was conducted, College students could receive credit for helping the City move forward.

While the College has great potential, there are, however, serious challenges associated with relying on Oberlin College and its students, which many of the interviewees pointed out. First, students doing semester or yearlong projects are likely to spend a substantial portion of their time learning what has been done in the past, gaining a working understanding of the structure of City and community operations and activities, and developing relationships with City staff and community members. While this is important for the students' education, it may not be the most efficient or effective way of going about climate action from the City or community's perspective. Second, there is a high rate of turnover. Students' interests and priorities change quickly, and most are only temporary Oberlin residents. This turnover might make it difficult to avoid repetition or disconnectedness concerning student projects, although a partnership between City officials and tenured College faculty or the College's Office of Environmental Sustainability could certainly provide some continuity for student projects. Student interns have been successful at conducting and updating inventories, but it appears that few cities have relied on interns beyond the first milestone. Oberlin College students, in the context of the College and City's goal of developing a long-term, synergistic relationship, could make especially productive contributions to the City's climate action process, but this strategy would require some larger structure. They are likely to be most useful for targeted and finite projects rather than for larger components of climate action analysis, planning, and implementation, which require continuity in oversight and methodology or involve authority.

A City official as point person

One common theme through all eight case studies was the existence of a City staff member that acted, at the very least, as a point person for climate action work. If the City of Oberlin decides to rely on student interns and community members, other Cities' approaches suggest that it should still assign a staff point person to be in charge of coordinating continuous data collection and the CAP development and implementation. This job could range from being integrated as a portion of an existing position to a full-time position, depending at least in part on the presence and competence of community volunteers and students who are interested in doing meaningful and perhaps time-consuming work. With such interest, the City staff member could identify useful projects or advise volunteers and students in their work, and then integrate the products of that work into a dynamic and evolving ICLEI process. Ultimately, the City of Oberlin will have to determine where on this continuum is best, based on budgetary, logistical, time availability, and human resources concerns. Whatever it chooses, there must be some mechanism within the City for maintaining continuity and building on prior work.

Regional Partnerships

In addition to establishing a concrete, organizational framework to sustain the ICLEI process in Oberlin, most interviewees emphasized the benefits of developing partnerships throughout the region. Such regional connections are especially important in small towns that might lack the independence or resources required to comprehensively research emissions-reducing measures and implement them unilaterally. This is particularly relevant when considering transportation initiatives and in some cases regional electricity or heating plans. The community of Oberlin will not, for example, be able to single-handedly make improvements to its mass transit system that would minimize driving to and from Cleveland. However, if Oberlin can reach out to nearby cities and develop a coalition that demands improvements, success is much more likely. Aspen's county, for example, recently hired an energy manager tasked with reducing countywide energy consumption, whose salary is paid with the savings his work generates. Such a position could not have been established without the support of multiple municipalities. Given that Akron has completed an inventory and will be releasing its CAP this year, Cleveland and Cuyahoga County have each begun conducting inventories, and the Green City Blue Lake Institute is compiling an inventory for Northeast Ohio, there is great opportunity for regional cooperation in this part of Ohio.

This is not to say that the City of Oberlin has not already connected with other communities. In fact, OMLPS procures Oberlin's electricity through AMP-OH, an organization made up of 85 municipal power utilities in the region. OMLPS is participating not only in new renewable energy ventures through this broad partnership, but is also exploring energy conservation measures. OMLPS is increasingly pursuing Demand Side Management (DSM) programs through partnerships with energy companies and contractors. This kind of collaboration is crucial to reducing the emissions both in Oberlin and at larger scales, and should be enthusiastically encouraged. OMLPS should continue to seek these partnerships, and having already established connections with other municipalities through AMP-OH, could help facilitate further cross-community collaboration in other City departments. More generally, City employees in all departments should be alert for opportunities to connect with nearby communities and establish a culture of cooperation and idea sharing that will be valuable to all entities as they struggle to reduce emissions and meet other challenges.

CHAPTER 4: MOVING FORWARD TOWARD AN EMISSIONS REDUCTION TARGET AND CLIMATE ACTION PLAN (CAP)

Once the City of Oberlin has decided on and formalized an organizational structure that assigns responsibility for meeting the City's ICLEI commitments, it will be time to begin working toward accomplishing the rest of the five milestones. The City's first tasks are to decide on a series of emissions reduction targets and write a detailed climate action plan. Attempting to accomplish these tasks without first ensuring that the broader climate action process has a sustainable framework would be irresponsible. However, it makes sense to move quickly in order to take advantage of the momentum and general awareness generated by these inventories and the rest of this report. In this final chapter, I address the next two ICLEI milestones by discussing some of the associated decisions and deliberation that will need to be carried out by the individual or body ultimately designated to be responsible for this work.

Deciding on Oberlin's Emissions Reductions Target

A crucial part of the ICLEI process is the emissions reduction target(s), which will act as the goal for Oberlin's subsequent CAP. Table 8 shows the targets set by the seven cities I interviewed that have completed inventories. In some cases, these targets were declared after the completion of an inventory but prior to the beginning of work on a CAP. In others, the targets were included in the CAP, with its individual recommendations explained in terms of how they would help achieve that target. The City of Oberlin can make the decision about when and how to declare its emissions reductions target(s), but before doing so needs to determine how it will decide where to aim.

City	State	Inventory Year	Inventory Finished	Ideal Inventory Frequency	CAP Year	Target
Brunswick	ME	2007-08 (Fiscal Year)	in progress	-	-	-
Burlington	VT	1997 2007	2000 in progress	every 3 years	2000 in progress	80% by 2050 (1%/yr until 2020, 2%/yr until 2050)
Brattleboro	VT	2000 ?	2002 in progress	-	2003	Community: 10% by 2010 Municipal: 20% by 2010
Amherst	MA	1997 2006	2001 2009	every 3 years	2005	Community-wide: 35% by 2009
Northampton	MA	2000	2001	every 10+ years	2008 (Comprehensive Plan)	Municipal: 80% by 2050 (8% by 2010, 20% by 2017, 30% by 2020)
Mission	KS	2005	2008	every 2-5 years	in progress	20% by 2020
Northfield	MN	2005	2008	annually	2008	15% by 2015, 100% by 2033
Aspen	CO	2004 2007	2006 2009 (nearly complete)	every 3 years	2005	30% by 2020, 80% by 2050

Table 8. ICLEI milestone progress and emissions reductions targets from contact cities. Targets are relative to baseline inventory years and apply to both community-wide and municipal operations emissions, unless otherwise noted. The "Ideal Inventory Frequency" reflects interviewees' hopes and/or recommendations for how often to conduct inventories.

Criteria for setting an emissions-reduction target

The officials I interviewed described several criteria their cities have used in making this decision. Most have aligned their targets with the IPCC's recommendations, setting long-term targets of 80% reductions below their respective inventory year by 2050. Most of these cities went further, setting interim targets, such as 30% by 2020. Burlington's CAP broke down the 80% target into annual reductions of 1% until 2020, and then 2% until 2050. Regardless of how interim goals were specified, emissions reductions targets are frequently explained by what international experts claim needs to be done to stabilize levels of atmospheric carbon. The state of Minnesota has set its 80% by 2050 statewide target based on this science, and Northfield's ETF had to decide whether or not it made sense to go beyond this target. They decided to be as aggressive as possible, choosing a target that is perhaps the most stringent in the country: "carbon-free by '33." Northfield has garnered much national attention as a result, despite a notable lack of post-CAP progress.

Another strategy, employed explicitly by Amherst, was to look at emission reductions that were "already in the pipeline" and then set the target at a level the City was confident it would be able to reach. This may not have been a difficult decision for Amherst, as their target happens to have been the most aggressive of the eight cities I contacted. However, Ciccarello explained that Amherst chose that target because it knew of projects already in place that would reduce emissions, and she did not mention the international scientific community or the IPCC. Nevertheless, if existing initiatives had not led to an estimate of substantial reductions, Amherst might have set its target using very different criteria.

Some cities appear to be hesitant to set targets without evidence that achieving them is at least conceivable. Mission chose 20% by 2020 (compared with 30% set by nearby Kansas City), because given Mission's dependence on the surrounding municipalities, it may not have a strong influence on its own emissions, the largest portion of which come from the transportation sector. Nevertheless, even though their target was included in the CAP, Mission's Josh Rauch mentioned that if every strategy in their CAP were implemented, these would still only amount to 25% reductions. The rest would have to come from increased availability of green electricity and the creation and expansion of regional initiatives. Rauch explained that while it did not match Kansas City's 30% target, Mission still wanted to "shoot for the moon" and risk missing, because then it would likely achieve maximum emissions reductions. Brattleboro took a similar approach, setting a target that seemed achievable but challenging, according to Cameron. While some cities chose targets without exhaustive forecasting, others determined targets specifically based on anticipated reductions associated with proposed measures in their CAP and recommendations from staff involved in the CAP process. ICLEI's CACP software allows its operators to forecast emissions profiles for future target years. I did not make forecasts because I was focused on making the inventories as accurate and comprehensive as possible and because I felt City officials would be able to do this more accurately themselves with ICLEI assistance. However, now that the inventories are complete, the City should consider using the CACP software and ICLEI support to make business-as-usual forecasts for reference in the CAP.

The most common criterion used, mentioned by all eight interviewees, was a survey of targets set by other cities around the region and country. Most cities seem to have converged at least in the long-term on the IPCC target, and have interim targets that differ in minor ways, based on individual circumstances and the status and nature of respective CAPs.

A critical assessment of target-setting

It should be noted that Christopher Mason, of Northampton, questioned the importance of the specific target. He believes that because there is so much to be done, one needs to keep working "flat out as hard as you can" without paying too much attention to the goal or results of an inventory. Accordingly, he recommended that Northampton's second inventory be conducted no sooner than 10 years after the first. His opinion probably represents a perspective at one end of a continuum, with ICLEI's recommendation for annual updates being at the other. Most cities appear to have acknowledged both the importance of setting a target, either for pragmatic or symbolic reasons, as well as the value of an inventory to measure progress. While many have not been able to conduct inventories as frequently as they would like, most aim for updates at least every three years. Mason is not opposed to this framework, but rather prefers to stress the urgency of climate action, and for him, the magnitude of this challenge requires that time is used as efficiently as possible to "get things done."

Who sets the target?

There was some variation in what person or body actually set the target. In Burlington, their progressive mayor set the target himself at a public presentation attended by over 80 community members. The other extreme, perhaps, was when the aggressive target chosen by Northfield's ETF was embedded in the CAP presented to their city council. The council accepted their report, but never voted on officially setting a target (or formally adopting the CAP). In most cases, however, the staff or volunteers responsible for doing most of the climate action work have made recommendations regarding setting a target to a City Council, which has then ultimately made the decision.

Making the target year meaningful

Some cities have also aimed to make the target year a meaningful one. In Amherst, for example, their target year of 2009 coincides with the City's 250th anniversary. If Amherst is proven successful at reaching its target reductions, then this accomplishment can be featured as part of the City's anniversary festivities. Oberlin might consider making 2033, the City of Oberlin's 200th anniversary, one of its interim target years, or in an aggressive scenario, its 80% reduction target year. This target would not only put Oberlin on par with Northfield and its famous "Carbon-free by '33" jingle, but would make an already historic and celebratory year even more momentous. Furthermore, this kind of strategy is likely to keep community members and municipal employees engaged, excited, and educated about the process and Oberlin's progress.

Conclusion

Oberlin should weigh the advantages and disadvantages of these criteria and the various associated targets as it makes a decision. Being aggressive can demonstrate dedication to reducing emissions and an understanding of the enormity of climate change, but while such demanding targets can be motivating, they also risk being dismissed as unrealistic. Setting a target based strictly on reasonably certain 'pipeline' reductions could generate momentum when the city announces it has achieved an interim goal, but may fail to foster the creativity, hard work, and broader perspectives that lead to further reductions and ongoing action. Ultimately, decision-makers must consider the specific characteristics of the City government, politics, staff, and community temperament. An aggressive target of 80% by 2050, with corresponding interim goals that are tailored to individual municipalities' situations, seems to be emerging as a trend for both local and supralocal entities.

Considerations for Milestone 3: Oberlin's Climate Action Plan (CAP)

Once the City has determined what person, group, or groups are responsible for moving Oberlin forward in its broad climate action campaign, the next step for this entity, in addition to setting a target, is to develop a detailed CAP, fulfilling Milestone 3 of Oberlin's ICLEI commitment. My goal in this section is not to compile a list of suggestions for specific items to include in a CAP, but rather to use the conversations I had with officials from other cities to provide some general guidelines for how those responsible for climate action in Oberlin might approach the task of writing a CAP. Also, because the inventories identified electricity as the most important source of emissions in the community, I also briefly discuss this energy source specifically.

Incorporating costs

Minimizing costs is probably one of the highest priorities in municipal governments, and in order for a CAP to hold weight with officials in the City of Oberlin, it will be necessary to include detailed cost-benefit analyses. While ICLEI's CACP software is capable of incorporating energy costs, I did not include these expenditures in the inventories conducted for this study. Generally speaking, reducing consumption of fossil fuels, and thus emissions, saves money. However, municipalities often prefer to have concrete savings figures informing their decisions. Oberlin should consider revising the inventory to include costs, as many other inventories do. Toward this end, in addition to the CACP software, ICLEI offers members another tool that is designed specifically to help city officials generate and evaluate ideas for a CAP based on predicted emissions and cost savings and initial implementation costs. The Climate and Air Pollution Planning Assistant (CAPPA) is a web- and/or Excel-based library of emission reductions strategies based on input from ICLEI communities (ICLEI, 2009b). It allows officials to use inventory data and assumptions customized to a specific municipality to identify potential CAP measures. Each of these results comes with implementation examples from other communities and CAPPA includes tools that allow users to estimate specific emissions and cost reductions as well as anticipated performance for each measure. Mission relied heavily on CAPPA in developing its CAP, and while it can be difficult to customize for small communities like Oberlin, it is certainly a valuable tool that can be used as a starting point to generate ideas.

Prioritization in CAPs

When it comes to actually writing and implementing the CAP, cities appear to be weighing two broad, non-exclusive strategies: pursuing the low-hanging fruit and pursuing the largest fruit. The first strategy consists of identifying measures that are likely to be relatively easy, have relatively low implementation costs, lead to results quickly, and over which the City has most influence. Prioritizing these measures may develop early momentum as low-hanging fruit emissions are quickly reduced. The second strategy consists of identifying the sectors that contribute most to a community's overall emissions and working on measures that will reduce these major emissions sources. While this approach is likely to be more challenging and take more time, it has the advantage of addressing areas that need the most work, and has potential for greater payback.

Mason described the tradeoff between these two strategies well. In Northampton, he is currently targeting the residential sector because Massachusetts has great subsidy programs that are applicable to the residential sector. However, Northampton's commercial sector is a much larger emitter, and accordingly the City needs to start addressing this portion of the community. As he prioritizes projects, Mason struggles with the importance of aiming at the bigger targets where climate action is so important while also taking advantage of areas that are easier to address. In most cases progress on both fronts is possible, but as municipal governments with tight budgets well understand, priorities have to be set, and this extends to CAP development and implementation.

Some examples of specific CAP measures

There are now many CAPs across the country, and a comprehensive list of CAP projects would be very long. Nevertheless, it is important to have a general idea of the kinds of things that tend to be included. It should be noted that I did not review numerous CAP documents, but am rather using information from interviews in this section. CAPs include a range of both small-scale and broader approaches. Many are comprised of measures like insulating buildings, replacing inefficient lighting with CFL- or LED-based systems, replacing old water pumps with more efficient ones, converting vehicles to run on biofuel, or replacing police cruisers with hybrid cars or bicycles. Many municipalities have hired performance contractors to accomplish these kinds of projects for municipal buildings and operations. In addition to specific implementation projects, CAPs can include policy recommendations, such as building code improvements, no-idling ordinances, and open space zoning, as well as innovative and often controversial ideas such as establishing a four-day work week to simultaneously and significantly reduce emissions resulting from heating, lighting, appliance use, and commuting. CAP measures can have broader targets, often with community engagement components. To encourage efficiency improvements across sectors, some cities have held energy-saving workshops for residents and business owners, trained volunteers to install efficient equipment in homes and talk to residents about energy efficiency, or challenged community members to reduce emissions through programs like Burlington and Brattleboro's 10% Challenge. In Northampton, a local organization forms school-based green teams of administrators, educators, maintenance staff, parents, and students, who identify and complete projects that are related to the City's CAP or comprehensive plan, which City officials then publicize. Activities like tree plantings and community gardening can also bring residents together to talk about sustainability. Although an inventory-based strategy for developing a CAP is likely to designate certain measures for certain sectors or even specific establishments, often CAP measures can be applied or encouraged across residential, commercial-industrial, and municipal sectors. Finally, many of the measures included above are examples of notable successes mentioned during the interviews, and implementation will likely go much more smoothly if Oberlin City officials pursue the advice of others who have experience with the measure at hand.

Addressing Oberlin's electricity sources

Because over half of Oberlin's GHG emissions are associated with electricity, it makes sense to include a somewhat more in-depth discussion of this emissions source. To reduce overall emissions, numerous measures like those above need to be included. However, if Oberlin wants to become a low-carbon community, sooner or later its coal-based electricity mix will need to be addressed (refer back to Table 2). OMLPS Director Steve Dupee provided a detailed explanation of the development of Oberlin's current electricity mix and associated challenges (Dupee, pers. comm.). In the Spring of 2008, after a heated, community-wide debate, Oberlin City Council voted to withdraw its participation from AMP-OH's plans to construct a new coal-fired electricity generation plant, called AMP-GS, thus foregoing partial ownership in the facility. The AMP-GS plant will replace AMP-OH's Gorsuch coal station, which currently provides a substantial portion of Oberlin's coal-fired electricity. In addition to replacing Gorsuch's production, the new plant will provide additional baseload power for a portion of AMP-OH's municipal power utilities, many of which have been struggling to procure affordable, reliable, and reasonably long-term electricity contracts after Ohio's electric industry was deregulated in the late 1990s. As a result of Oberlin's decision to withdraw from the new contract, the source of the 75% of Oberlin's electricity, beginning in 2013, has become uncertain. Accordingly, OMLPS has begun to explore Oberlin's options.

Oberlin is fortunate to have OMLPS, according to many of the representatives I contacted, who were emphatic about the advantages afforded to cities with municipal power utilities. These utilities report not to investors, but rather to elected City officials. They tend to advocate for the interests of residents, and are likely to support, and in many cases initiate, programs that reduce energy consumption.

In addition to helping residents reduce energy consumption through its free energy audits and other programs, OMLPS has been an active advocate for sustainable and renewable power sources, even before the AMP-GS decision. According to OMLPS Director Steve Dupee, Oberlin is already "ahead of the curve" with regard to renewable electricity. Ohio has a statewide renewable portfolio requirement of 25% by 2025, which is split into 12.5% traditional renewables (such as solar, wind, hydropower, biomass, and landfill) and 12.5% advanced technologies (such as clean coal with carbon capture and sequestration and advanced nuclear). While municipal utilities are exempt from these requirements, Oberlin already plans to have 25% traditional renewables by 2014. In addition to the approximately 15% of its electricity currently provided by hydropower and the nearby Allied Waste landfill, Oberlin is a participating municipality in three AMP-OH run-of-the-river hydropower projects on the Ohio river, which will begin producing electricity in 2014. While the decision against participating in the new coal plant has resulted in uncertainty for the time being, it avoids locking Oberlin into a long-term electricity contract based on a single resource, which is risky, especially in the case of coal. According to Dupee, this gives OMLPS the ability to take advantage of opportunities as they arise over the next several decades, many of which are likely to reduce Oberlin's carbon footprint. While Dupee acknowledges that in the near term, Oberlin will have to continue to purchase coal power, perhaps at a slightly higher cost than under the new AMP-GS contract, this may not be an undesirable position. Since President Obama's inauguration, his administration has consistently emphasized the importance of renewable energy, and the US EPA recently ruled that greenhouse gases must be regulated under the Clean Air Act, paving the way for much stricter regulations on GHG emissions, and perhaps carbon tax or cap-and-trade legislation (US EPA, 2009b). Given this context, a long-term contractual obligation to purchase coal-fired electricity is very risky. Therefore, the outlook for Oberlin regarding electricity sources is not overwhelmingly positive or negative at this point, but rather is simply uncertain. Oberlin City Council has also authorized a $50,000 budget for hiring a consultant in 2009 to develop a long-term power supply plan addressing how Oberlin will meet its baseload demand over the next two decades. Given the Oberlin community's concern regarding its contribution to climate change, this plan will no doubt include a discussion of emissions associated with Oberlin's power supply and could both draw from and be incorporated into Oberlin's CAP.

What have other cities done to generate renewable electricity?

To address emissions associated with electricity, other cities have taken a variety of approaches. Aspen's municipal utility, providing electricity to half the city, has a mix that is between 75 and 100% renewable, from hydro projects and wind power purchasing. In Amherst, the University of Massachusetts recently converted to a co-generation plant, reducing community-wide emissions by 10%. A biomass plant burning waste wood produces 60% of Burlington's electricity, a project completed after citizens acquired a bond over 15 years ago. Northampton has managed to obtain 10-kilowatt photovoltaic panels at no cost, and has been pursuing well-funded renewable electricity projects through various mechanisms. Oberlin should already be familiar with its electricity mix options, given the various baseload generation feasibility studies that have been produced in recent years. While the situation regarding the nearby Allied Waste landfill, which generates roughly 5% of Oberlin's power, is complicated as a result of its current contract situation, its proximity to Oberlin is certainly an asset for the City, providing an option that may factor into future emissions scenarios, if not through electricity generation for Oberlin, then potentially by replacing natural gas heating with landfill gas for some portion of the community. While there are numerous challenges associated with Oberlin's electricity situation, it is evident that many communities would envy our position as a City with an active municipal electric utility with dedicated staff, an anticipated electricity mix of 25% renewables in the very near future, and a community that has demonstrated its support for aggressive pursuit of non-coal alternatives. Nevertheless, because electricity emissions are such a large portion of Oberlin's climate footprint, addressing sources and consumption of electricity surely represents the largest 'emissions fruit' in the community.

Pricing schemes to reduce electricity consumption

As long as Oberlin's electricity has a high carbon-intensity, as is likely at least in the near and intermediate future, any measures that reduce consumption of electricity will correspondingly have a large impact on Oberlin's emissions profile. This applies to all sectors of the community. In addition to specific efficiency projects, municipalities have reduced electricity consumption through various programs. Aspen has implemented an electric rate system where consumers pay more per kWh if they consume more electricity. When budgets are tight, this kind of rate-based approach is likely to draw attention, and ideally lead to self-initiated reductions. In 2006, Boulder, Colorado became the first municipality in the country to institute a self-imposed carbon tax explicitly to fund climate action, after voters passed a resolution put forward by the City (City of Boulder, 2009). OMLPS and the City of Oberlin could consider similar taxation or pricing incentive systems to reduce electricity consumption across all sectors, keeping in mind the potential effect on businesses and residents in town.

Using ICLEI resources and CAPs from other Cities to generate ideas

It will be the job of Oberlin's climate action official(s) or work group(s) to identify in its CAP the measures that are most likely to be successful in this community at reducing emissions. In doing so, Oberlin should be sure to explore what has been done in other places. In most cases, CAPs can be found on municipalities' websites, and can be scoured for ideas that seem most compatible with Oberlin. Judging by my conversations with the eight interviewees, climate action officials and volunteers are very willing to share ideas and experiences. The sheer number of ICLEI members and completed CAPs across the country can be overwhelming, but ICLEI can make recommendations about who to contact and which CAPs to read and emulate, and the ICLEI website has a database of sample ordinances, best practice pages, and case studies. When the City reaches the stage of searching for measures to address emissions from specific municipal or community sectors, these resources, most of which are as specific as converting a school bus fleet to biodiesel, will be useful.

Including Oberlin's current and past initiatives in the CAP

Measures outlined in a CAP are not limited to new projects that the City should implement in the future—a large portion of a CAP can consist of identifying and describing measures that are already being implemented, with plans for continuing, expanding, and/or improving these programs. This will likely be the case in Oberlin, where, despite the lack of a comprehensive CAP, there are myriad projects going on throughout the community, many of which are very similar to measures found in CAPs and mentioned by interviewees. For example, OMLPS provides free residential energy audits, Oberlin's lightbulb brigade just won a Chill Out! award for distributing 10,000 compact fluorescent lightbulbs, and the Youth Energy Squad and POWER Fund renovate low-income homes to reduce energy consumption. The commercial sector is becoming greener as well, with construction in progress on the LEED East College Street Project and with the College and City seriously considering and discussing the development of a Green Arts District. The City also has been considering making the upcoming renovation of the Fire Department LEED-certified. It is beyond the scope of this discussion to include everything that has been happening on the sustainability front throughout the community, municipal government, and College, but it is evident to anyone living in Oberlin that the City's early status in the ICLEI milestone process, having only recently completed its first inventory, does not fully reflect the level of activity related to addressing climate change. It is likely that existing measures have already reduced Oberlin's emissions profile relative to what it would otherwise have been. A substantial portion of the work developing Oberlin's CAP will involve compiling existing climate action, estimating the associated reductions that have resulted, and exploring how these programs can be improved and expanded to have a greater impact. The advantage Oberlin now has is knowledge of precisely where its emissions are coming from. By monitoring emissions from the various sectors over time, it will be able to estimate whether or not certain measures are having an impact, and whether Oberlin's overall approach seems to be effective. Oberlin's CAP can then be adjusted accordingly.

The municipal government can lead the Oberlin community

An important part of ICLEI's philosophy is that municipal leadership can be a powerful way of stimulating activity in the community-at-large. This is one of the main reasons for conducting a separate inventory for municipal operations, even though, in Oberlin's case, this only represents between six and seven percent of overall community-wide emissions. With significant control over its own operations, the City can set more aggressive targets and perhaps more easily implement emissions reductions measures that will lead to visible results in its emissions profile. If the City publicizes these results and frames the issue strategically, it is likely that members of the community will emulate City projects, which presumably will have tangibly reduced costs and emissions. By setting an example, the City can make it easier for every other entity in Oberlin to move in the same low-carbon direction. While ICLEI does not explicitly address the impact of climate action on college campuses, it is likely that Oberlin College, working with the City, can play a similar role, paving the way for the community to follow the sustainability path they carve together.

CONCLUSIONS

By joining ICLEI, the City of Oberlin made a statement that the community is ready to undertake the difficult but critical and ultimately rewarding task of reducing GHG emissions that lead to catastrophic climate change. The completion of these inventories, as the first step in the City's ICLEI commitment, is timely. In 2009, the City will be updating its Comprehensive Plan as well as hiring a consultant to develop a long-term energy plan. Simultaneously, after solidifying its new Office of Sustainability and conducting its own emissions inventory, Oberlin College will be writing its climate action plan, which is tentatively due in September. This is all happening in the context of a global economic downturn and as renewable energy, energy efficiency, and general sustainability initiatives are gaining attention around the nation and world. In this context, Oberlin's dual needs of finding alternatives to coal power and reducing emissions offer opportunities for positive synergies that lead toward solutions to both challenges. There is perhaps no better time for the City to establish a sustainable climate action framework and begin developing and implementing a detailed and comprehensive CAP. It is likely to save money for residents, businesses, and the City of Oberlin, garner regional if not national attention, foster valuable regional partnerships, and potentially attract residents, businesses, professionals, and green industries that could revitalize Oberlin's downtown.

During my interviews with representatives from other ICLEI cities, I asked why they feel it is important for small communities to spend time, energy, and resources to combat climate change when some might argue that their contributions to this global problem are minimal. In addition to citing the financial benefits of reducing energy consumption, many argued that it is simply the right thing to do, given the specter of global warming. If every entity claimed to have insubstantial emissions, nothing would be done. One official responded passionately, arguing that "no town doesn't have significant carbon emissions." Another official contextualized climate action by paraphrasing the philosophy of a particular Native American group: 'every decision should be made with the next seven generations in mind.' Part of the motivation for local climate action is certainly to leave a flourishing community for our children. Finally, many interviewees added that achieving emissions reductions goals and becoming a more sustainable community helps a city both build an attractive 'green' reputation and serve as a model for other communities. As one official noted, there is nothing as inspiring as a success story. If Oberlin aggressively pursues climate action and can demonstrate its progress, both qualitatively and quantitatively, other communities will undoubtedly notice. This is likely to stimulate other municipalities to question why such programs have not yet been realized there, and in many cases begin using Oberlin as a model for implementing their own initiatives. As more communities reduce GHG emissions while continuing to prosper, momentum could shift from a catastrophic climate trajectory toward a more moderate, livable world consisting of thriving low-carbon communities.

The chances of Oberlin being successful are good. The initial impetus for official climate action came directly from City Council, and before I began this project, the City and community had already taken numerous steps toward sustainability. While many other cities have identified municipal power utilities as something they should work toward, OMLPS is already an established and respected fixture in Oberlin. Both the City and College are beginning to draft new sustainability plans and the relationship between the City and College has become more synergistic as a result of efforts by both parties. Oberlin's City Council and community have demonstrated strong environmental values and a willingness to be active, federal funding for green projects and programs is exploding, and climate action activity in the Northeast Ohio region is expanding. Taken together, these circumstances represent a unique and unparalleled opportunity. Now that its emissions have been identified and quantified, the next steps for the Oberlin community, led by the City, are to sustain climate action through an institutionalized structure, create a climate action plan, implement and track its measures, and begin observing and publicizing its shrinking emissions profile. Having become a member of ICLEI, Oberlin is committed to accelerating its efforts to reduce emissions. By prioritizing climate action and moving forward within ICLEI's framework with hard work, some difficult decisions, enthusiasm, a cooperative spirit, creative energy, and a little luck, Oberlin can take advantage of this opportunity and emerge as a bona fide leader in addressing what many believe to be the defining challenge of the 21^{st} century.

ACKNOWLEDGEMENTS

I am grateful to many, many people for their support as I worked on this project, not all of whom I can include here.

First, I want to thank John Petersen for initially informing me of this opportunity, believing in me, and for continually providing valuable guidance, direction, ideas, suggestions, strategic counsel, thesis revisions, and encouragement. Much thanks also to Rumi Shammin for his clarification and advice regarding inventory methodology, his consistently positive attitude, and his considerable time helping revise this report. Furthermore, the confidence Eric Norenberg, Doug McMillan, Steve Dupee and City Council, especially David Sonner, had in my ability to meet this challenge allowed for this unique opportunity in the first place. This project would also not have been possible without ICLEI's immeasurable support, including Amy Malick's initial explanations of the process, Xico Manarolla's technical help, and especially Brita Pagels' inexhaustible responsiveness and advice regarding the ICLEI inventories. I am further grateful to OMLPS's Doug, Steve, and Cindy Reisinger for helping me become familiar with how the City of Oberlin works, meet other City employees, and understand the history of Oberlin's electricity system.

The early advice of Falmouth, Maine's Barbara DiBiase and Creve Ceour, Missouri's Spencer Kellum on how to approach and conduct an inventory was very helpful. Additionally, during the extensive data collection phase, many people's willingness to spend time pursuing data and explaining infrastructural and organizational complexities to me was crucial to the success of the project. These people include: OMLPS's Steve Dupee, Doug McMillan, Cindy Reisinger, Steve Wilson, and Bob Rogers, the City of Oberlin's Eric Norenberg, Beth Krosse, Heather Clawson, Karen Smith, Jeff Baumann, Dave Rucker, Dennis Kirin, Sheri Haury, Sharon Pearson, and Wendie Fleming, and Tita Reed, Oberlin College's Nathan Engstrom, Marty Plato, Ross Peacock, and Ehrai Adams, NOACA's Bill Davis and Eunah Kang, Columbia Gas of Ohio's Amy Koncelik, Sandra Cook, and Mark Balmert, Ohio Bureau of Motor Vehicle's Mary Dearwester and Stephanie Cook, Tim of Monroe Heating, General Motors' Stella Papasavva, Oberlin resident and College alumna Kristin Braziunas, Allied Waste's Chris Jaquet, Oberlin School District's John Schroth, and Green City Blue Lake's Laura Christie.

Additionally, I want to thank my eight interviewees for spending the time to provide me with an in-depth understanding of how their Cities have approached and pursued climate action since joining ICLEI.

I am grateful to the Biology and Environmental Studies Departments for providing me with workspace and resources, to Bev Burgess for logistical and scheduling help, to Twila Conley for printing assistance and a bottomless bowl of candy, and to Anna Santo for graciously sharing her lab and providing moral support during the project's final phases. Finally, without the friendship and support of my family and friends, none of my work would have been possible.

LITERATURE CITED

Adams, E. Oberlin College Residential Education Staff. 7 April 2009. Personal communication (E-mail).

Allman, L., P. Fleming, and A. Wallace. 2004. The progress of English and Welsh local authorities in addressing climate change. Local Environment 9: 271-283.

American College and University Presidents Climate Commitment (ACUPCC). 2009. Signatories of the ACUPCC. 16 March 2009. Available from http://www.presidentsclimatecommitment.org/html/signatories.php.

Bai, X. 2007. Integrating global environmental concerns into urban management. Journal of Industrial Ecology 11: 15-29.

Beach, D. (Ed.). 2001. Oberlin as global citizen. EcoCity Cleveland 8:13.

Bell, R. 2002. Local governments take the lead in curbing greenhouse gas emissions. Environmental Practice 4: 65-66.

Betsill, M. 2001. Mitigating climate change in U.S. cities: opportunities and obstacles. Local Environment 6: 393-406.

Betsill, M. and H. Bulkeley. 2007. Looking back and thinking ahead: A decade of cities and climate change research. Local Environment 12: 447-456.

Bigglestone, W.E. 1981. Introduction. Pages xiii-xxv in They Stopped in Oberlin: Black Residents and Visitors of the Nineteenth Century. Innovation Group Inc., Scottsdale, AZ.

Brandt, Nat. 1991. The town that started the Civil War. Laurel, New York, NY.

Braziunas, K. POWER Program Coordinator. 19 March 2009. Personal communication (E-mail).

California Air Resources Board (CARB), California Climate Action Registry, ICLEI – Local Governments for Sustainability, and the Climate Registry. 2009. Local Government Operations Protocol: For the quantification and reporting of greenhouse gas emissions inventories; Version 1.0. September 2008. Available from http://www.icleiusa.org/programs/climate/ghg-protocol.

Center for Integrative Environmental Research (CIER), University of Maryland. July 2008. Economic impacts of climate change on Ohio. 15 January 2009. Available from www.cier.umd.edu/climateadaptation/.

City of Boulder. 2009. Boulder voters pass first energy tax in the nation. 16 April 2009. Available from http://ci.boulder.co.us/index.php?option=com_content&task=view&id=6136&Itemid=169.

City of Oberlin. 3 January 2005. Comprehensive Plan Update 2004. 3 April 2009. Available from http://www.cityofoberlin.com/Planning/planning_compplan.html.

Cleveland, C. (Lead Author); R. Costanza (Topic Editor). 2008. "Net energy analysis." In: Encyclopedia of Earth. Eds. C. J. Cleveland. Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment. 22 April 2009. Available from http://www.eoearth.org/article/Net_energy_analysis.

Collier, U. and R.E. Löfstedt. 1997. Think globally, act locally? Global Environmental Change 7: 25-40.

Dearwester, M. and S. Cook. Ohio Bureau of Motor Vehicles Records Request and Taxation Departments. 23 January 2009. Personal communication (phone).

Dupee, S. Director, OMLPS. 2009. Personal communication (phone).

Engstrom, N. Sustainability Coordinator, Oberlin College. 12 April 2009. Personal communication (E-mail).
Fleming, P.D. and P.H. Webber. 2004. Local and regional greenhouse gas management. Energy Policy 32: 761-771.
Gupta, J.K. van der Leeuw, and H. de Moel. 2007 Climate change: a 'glocal' problem requiring 'glocal' action. Environmental Sciences 4: 139-148.
Haag, A.L. 2008. What's next for the IPCC?. Nature Reports Climate Change [Published Online] 2008(1): 4-6.
Halford , G.S. and P.W. Sheehan. 1991. Human response to environmental changes. International Journal of Psychology 26: 599-611.
Hansen, J., M. Sato, R. Reudy, K. Lo, D.W. Lea, and M. Medina-Elizade. 2006. Global temperature change. Proceedings of the National Academy of Sciences 103: 14288-14293.
Hansen, J., M. Sato, P. Kharecha, D. Beerling, R. Berner, V. Masson-Delmotte, M. Pagani, M. Raymo, D.L. Royer, and J.C. Zachos. 2008. Target atmospheric CO_2: Where should humanity aim?. The Open Atmospheric Science Journal 2: 217-231.
Heede, R. and J. Swisher. 2002. Oberlin College: Climate Neutral by 2020. Rocky Mountain Institute, Snowmass, CO.
Intergovernmental Panel on Climate Change (IPCC). 2007. Summary for policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.S. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
International Council for Local Environmental Initiatives (ICLEI). 2007. Daniel Gardner – Mayor of City of Oberlin. 17 March 2009. Available from http://www.icleiusa.org/success-stories/cool-mayors/daniel-gardner-mayor-of-city-of-oberlin/.
International Council for Local Environmental Initiatives (ICLEI). 2008a. CACP Software. 13 November 2008. Available from http://www.icleiusa.org/action-center/tools/cacp-software.
International Council for Local Environmental Initiatives (ICLEI). 2008b. Five Milestones for Sustainability. September 2008. Available from http://www.icleiusa.org/programs/sustainability/five-milestones-for-sustainability/.
International Council for Local Environmental Initiatives (ICLEI). 2008c. Member Center. March 2008. Available from http://www.icleiusa.org/member-center/.
International Council for Local Environmental Initiatives (ICLEI). 16 April 2009a. CACP Software. 22 April 2009. Available from http://www.icleiusa.org/action-center/tools/cacp-software.
International Council for Local Environmental Initiatives (ICLEI). 2009b. CAPPA Decision Support Tool. 15 April 2009. Available from http://www.icleiusa.org/action-center/tools/decision-support-tool.
International Council for Local Environmental Initiatives (ICLEI). 2009c. Members. 16 March 2009. Available from http://www.icleiusa.org/about-iclei/members.
Kates, R.W., M.W. Mayfield, R.D. Torrie, and B. Witcher. 1998. Methods for estimating greenhouse gases from local places. Local Environment 3.

Koehn, P.H. 2008. Underneath Kyoto: Emerging subnational government initiatives and incipient issue-bundling opportunities in China and the United States. Global Environmental Politics 8: 53-77.

Krislov, M. 23 December 2008. Collaboration here is historic (In Letters to the Editor). 20 March 2009. Oberlin News-Tribune. Available from http://www.ourtownsnews.com/Obe/Letters/Krislov-letter.

Lutsey, N. and D. Sperling. 2008. America's bottom-up climate change mitigation policy. Energy Policy 36: 673-685.

Malick, A. Midwest Regional Director, ICLEI. 22 August 2008. Personal communication (Phone).

Manarolla, X. Program Officer, ICLEI. 13 November 2008. Personal communication (E-mail).

Marland, G., T.A. Boden, and R.J. Andres. 2008. Global, Regional, and National CO2 Emissions. Trends: A Compendium of Data on Global Change. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, TN.

McCammack, M. 2007. Hot damned America: Evangelicalism and the climate change policy debate. American Quarterly 59: 645-668.

McMillan, D. OMLPS. 6 April 2009. Personal communication (phone).

Moser, S.C. 2007. In the long shadows of inaction: The quiet building of a climate protection movement in the United States. Global Environmental Politics 7: 124-144.

National Climatic Data Center (NCDC), U.S. Department of Commerce. Land-based data. 26 January 2009. Local monthly climate data available from http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp#.

Norenberg, E. Oberlin City Manager. 2009. Personal communication (E-mail).

Oberlin Area Chamber of Commerce. Map of Oberlin. 3 April 2009. Available from http://www.oberlinchamber.org/Art-OBERLIN_City_Map.pdf.

Oberlin Heritage Center (OHC). 17 March 2009. Oberlin history timeline. 17 March 2009. Available from http://www.oberlinheritage.org/timeline1.html.

Oreskes, N. 2004. The scientific consensus on climate change. Science 306: 1686.

Orr, D. 3 February 2009. Personal communication.

Pagels, B. ICLEI Midwest Regional Coordinator. 2009 Personal communication (phone).

Parker, P., I.H. Rowlands, and D. Scott. 2003. Innovations to reduce residential energy use and carbon emissions: an integrated approach. The Canadian Geographer 47: 169-184.

Patton, M.Q. 1990. Qualitative Evaluation and Research Methods. 2nd Ed. Sage Publications, Newbury Park, CA; 169, 177-178, 283-284.

Petersen, J. 2009. Personal communication.

Providing Oberlin With Efficiency Responsibly (POWER). 5 September 2008. Press release: POWER to the people. 18 March 2009. Document available from http://www.oberlin.net/~power/about.html.

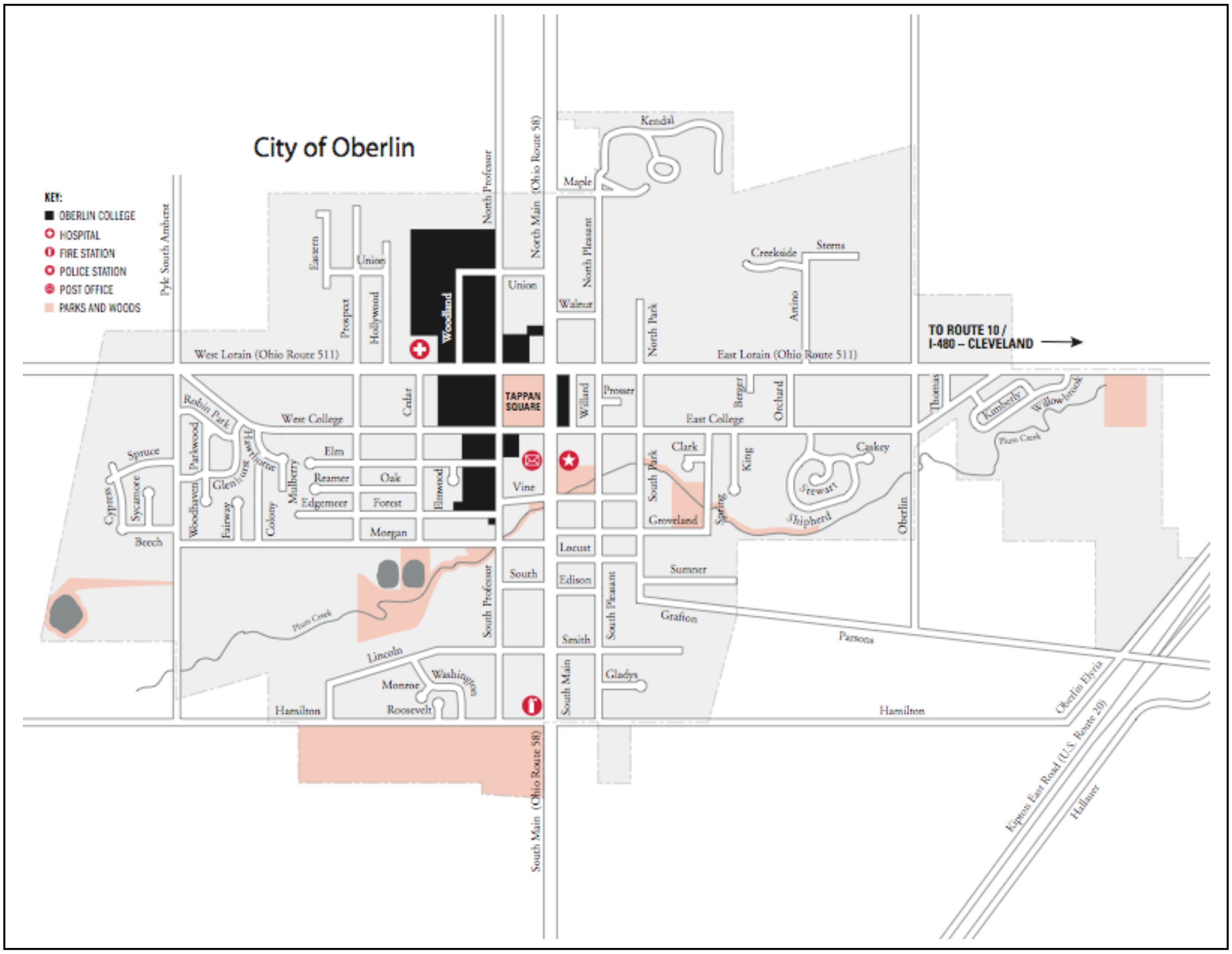
Rahmstorf, S., A. Cazenave, J.A. Church, J.E. Hansen, R.F. Keeling, D.E. Parker, and R.C.J. Somerville. 2007. Recent climate observations compared to projections. Science 316: 709.

Scheffer, M, V. Brovkin, and P.M. Cox. 2006. Positive feedback between global warming and atmospheric CO_2 concentration inferred from past climate change. Geophysical Research Letters 33: L10702.

Schreurs, M.A. 2008. From the bottom up; Local and subnational climate change politics. The Journal of Environment and Development 17: 343-355.

Schroth, J. 5 December 2008. Personal communication.
Shammin, M. and C. Bullard. 2009. Impact of Cap-and-trade Policies for Reducing Greenhouse Gas Emissions on U.S. Households. Journal of Ecological Economics. In press, accepted in revised form on 30 March 2009.
Stern, N. 2007. How climate change will affect people around the world. Pages 65-103 in The economics of climate change. Cambridge University Press, Cambridge, UK.
Torn, M.S. and J. Harte. 2006. Missing feedbacks, asymmetric uncertainties, and the underestimation of future warming. Geophysical research letters 33: L10703.
United Nations Framework Convention on Climate Change (UNFCCC). 14 January 2009. Status of ratification. 16 March 2009. Available from http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php.
United States Census Bureau. 3 March 2009. Monthly national population estimates. 16 March 2009. Available from http://www.census.gov/popest/national/NA-EST2008-01.html.
United States Bureau of Transportation Statistics (US BTS). December 2008. Table 4-23: Average Fuel Efficiency of U.S. Passenger Cars and Light Trucks. 19 April 2009. Available from http://www.bts.gov/publications/national_transportation_statistics/html/table_04_23.html
United States Census Bureau. Detailed Tables; T1. Population Estimates [10] (Oberlin city, Ohio). 5 April 2009. Available from http://factfinder.census.gov/servlet/DTTable?_bm=y&-context=dt&-ds_name=PEP_2007_EST&-mt_name=PEP_2007_EST_G2007_T001&-CONTEXT=dt&-tree_id=807&-all_geo_types=N&-geo_id=16000US3957834&-search_results=16000US3957834&-format=&-_lang=en.
United States Conference of Mayors. 12 March 2009. List of participating mayors. 16 March 2009. Available from http://www.usmayors.org/climateprotection/list.asp.
United States Energy Information Administration (US EIA). March 2009. Table 18. Carbon Dioxide Emissions by Sector and Source. Available from http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_18.xls. (DOE/EIA-0383(2009)).
United States Energy Information Administration (US EIA). 2 April 2009. U.S. Price of Natural Gas Sold to Commercial Consumers (Dollars per Thousand Cubic Feet). 20 April 2009. Available from http://tonto.eia.doe.gov/dnav/ng/hist/n3020us3M.htm.
United States Environmental Protection Agency (US EPA). 15 April 2009a. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007. Washington, D.C. (EPA 430-R-09-004). 19 April 2009. Available from http://www.epa.gov/climatechange/emissions/usinventoryreport.html.
United States Environmental Protection Agency (US EPA). 17 April 2009b. Proposed Endangerment and Cause or Contribute Findings for Gases Under Section 202(a) of the Clean Air Act (Pre-Publication Copy). Washington, D.C. (EPA-HQ-OAR-2009-0171); FRL-XXXX-X). 22 April 2009. Available from http://epa.gov/climatechange/endangerment.html.
Wallington, T.J., J.L. Sullivan, and M.D. Hurley. 2008. Emissions of CO_2, CO, NO_x, HC, PM, HFC-134a, N_2O and CH_4 from the global light duty vehicle fleet. Meteorologische Zeitschrift 17: 109-116.
White House. 2009. Energy and the environment. 16 March 2009. Available from http://www.whitehouse.gov/agenda/energy_and_environment/.

APPENDIX 1: Oberlin Map and City Limits



Source: Oberlin Area Chamber of Commerce. Available from http://www.oberlinchamber.org/Art-OBERLIN_City_Map.pdf.

APPENDIX 2: Employee Commuting Survey

Below is the short survey administered to employees of the City of Oberlin by Administrative Assistant Sharon Pearson:

"The City of Oberlin is conducting a greenhouse gas inventory. This inventory is looking at all sources of emissions related to City operations. This includes employee commuting. This information will help the City review its improvements over time. We need your help to complete the information below. Please fill in the blanks as best as you can. Names are only included to be sure we collect information from everyone. Once the survey is completed, we will remove names and only retain the data for calculations. If you have questions, please contact the City Manager's Office. Thanks!"

- One-way distance, home to work?
- How many days per week do you drive to work?
- How many weeks per year do you work?
- What year and model vehicle do you drive to work?
- Estimated MPG?

APPENDIX 3: Interviewee Contact Information and Interview Guide

City	State	Contact	Title	Phone number & email address
Brunswick	ME	Craig N. Worth	Deputy Public Works Director & Facilities Manager	(207) 725-6654 cworth@brunswickme.org
Burlington	VT	Jennifer Green	Legacy Project Co-Coordinator	(802) 865-7532 jgreen@ci.burlington.vt.us
Brattleboro	VT	Paul Cameron	Director, Brattleboro Climate Protection Committee	(802) 251-8135 pcameron@brattleboro.org
Amherst	MA	Stephanie Ciccarello	Wetlands Administrator & Energy Task Force Coordinator	(413) 259-3149 ciccarellos@amherstma.gov
Northampton	MA	Christopher Mason	Energy and Sustainability Officer	(413) 587-1055 cmason@northamptonma.gov
Mission	KS	Josh Rauch	Management Intern	(913) 676-8368 jrauch@missionks.org
Northfield	MN	George Kinney	Co-Chair, Energy Task Force	H: (507) 645-2718, W: (952) 891-7541 brian.erickson@ci.northfield.mn.us (primary contact email)
Aspen	CO	Kim Peterson	Canary Initiative Project Manager	(970) 920-5071 kimp@ci.aspen.co.us

Interview Guide

- How did your community come to be concerned with carbon emissions and/or become an ICLEI member?
- Conducting inventories:
  - When did you conduct your baseline inventory?
  - What year was the actual baseline year?
  - How often have you conducted inventories since then and/or how often do you plan on conducting inventories in the future?
  - Who has been involved and/or in charge of coordinating and conducting these inventories?
  - About how many hours per week (and for what length of time) have been required to conduct subsequent inventories?
  - Who receives and reviews these inventory results? Who are the results presented to? Is there a reporting mechanism?
  - Where can I find a detailed copy of the inventory report?
- Setting a target:
  - When did you set a target and what was it?
  - Why did/didn't you set a short term and long term target?
  - What were the major criteria used to finally decide on your target?
  - Who/what entity actually made the decision to commit to the target reductions?
  - Is there a process in place for adjusting the target with subsequent inventories?
- Climate Action Plan:
  - Do you have a climate action plan?
  - When was it created?
  - Who was involved in coordinating the development of that plan?
  - Who was included in the discussion or consulted?

- Who approves/d the plan? Is the city committed/bound to the plan?
  - Is there any course of action described for what happens if the plan fails? (Does it have any 'teeth?')
  - What portions of the action plan have been carried out?
  - Have there been any notable successes?
  - Have there been any notable shortcomings or failures?
  - Is the City and/or community on track to meet the target? Why or why not?
  - What is done if the CAP's measures are not implemented?
  - Where can I find a copy of the action plan?
- What advice would you have for us, having just completed our inventory and deciding how to go about climate action from this point forward?
- What is the role of the public in this endeavor? How are they engaged, if at all?
- Do people tend to know the climate action projects are happening?
- How were the climate action programs and projects funded? Were they incorporated into the City budget? Were grants pursued?
- Does your municipality have a publicly owned or municipal power utility?
- If someone asked why it's important to do an inventory and spend energy, time, money, and resources to reduce emissions in such a small town, what would you say?
- What is your community's population?
- Would you be available for consultation over the next couple years for advice as Oberlin moves forward on this?
- May I use your name and town in my report?

APPENDIX 4: Community-wide Inventories—CACP Outputs

5/30/2009 Page 1

Community Greenhouse Gas Emissions in 2001
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Residential			
Oberlin, Ohio			
Scope 1 - Building Heating			
Natural Gas	7,905	4.4	127,951
Subtotal Scope 1 - Building Heating	7,905	4.4	127,951
Scope 2 - Residential Electricity			
2001 Oberlin Mix (sold RE	18,480	10.4	57,746
Subtotal Scope 2 - Residential Electricity	18,480	10.4	57,746
Subtotal Residential	26,385	14.8	185,697
Commercial			
Oberlin, Ohio			
Scope 1 - Buildings/Facilities (Non-College, Non-Municipal)			
Natural Gas	17,297	9.7	279,973
Subtotal Scope 1 - Buildings/Facilities (Non-College, Non-Municipal)		9.7	279,973
Scope 1 - Municipal Buildings/Facilities			
Natural Gas	4,404	2.5	71,281
Subtotal Scope 1 - Municipal Buildings/Facilities	,404	2.5	71,281
Scope 1 - Municipal Water & Wastewater Dept Generators			
Natural Gas	11	0.0	183
Subtotal Scope 1 - Municipal Water & Wastewater Dept Generators		0.0	183
Scope 1 - Oberlin College CHP Plant			
Coal	12,679	7.1	116,819
Natural Gas	1,389	0.8	22,479
Subtotal Scope 1 - Oberlin College CHP Plant	14,067	7.9	139,298

This report has been generated for Oberlin, Ohio using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Community Greenhouse Gas Emissions in 2001
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Scope 1 - Oberlin College Non-CHP Heating			
Natural Gas	2,755	1.5	44,587
Subtotal Scope 1 - Oberlin College Non-CHP Heating		1.5	44,587
Scope 1 - OMLPS Power Plant			
Light Fuel Oil	174	0.1	2,101
Natural Gas	272	0.2	4,405
Subtotal Scope 1 - OMLPS Power Plant	446	0.2	6,505
Scope 2 - Electricity (Non-College, Non-Municipal)			
2001 Oberlin Mix (sold RE	58,918	33.0	184,106
Subtotal Scope 2 - Electricity (Non-College, Non-Municipal)		33.0	184,106
Scope 2 - Municipal Electricity			
2001 Oberlin Mix (sold RE	2,366	1.3	7,394
Subtotal Scope 2 - Municipal Electricity	2,366	1.3	7,394
Scope 2 - Oberlin College Non-CHP Electricity			
Solar	0	0.0	231
2001 Oberlin Mix (sold RE	21,195	11.9	66,229
Subtotal Scope 2 - Oberlin College Non-CHP Electricity		11.9	66,460
Subtotal Commercial	121,460	68.1	799,787
Transportation			
Oberlin, Ohio			
Scope 1 - Transportation			
Gasoline	22,426	12.6	260,996
Diesel	4,516	2.5	52,030
Subtotal Scope 1 - Transportation	26,942	15.1	313,025
Subtotal Transportation	26,942	15.1	313,025

Community Greenhouse Gas Emissions in 2001
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Waste			
Oberlin, Ohio			
Scope 3 - Leaves & Brush Collection			*Disposal Method - Compost*
Plant Debris	-83	0.0	
Subtotal Scope 3 - Leaves & Brush Collection	-83	0.0	
Scope 3 - Solid Waste			*Disposal Method - Managed Landfill*
Paper Products	1,592	0.9	
Food Waste	297	0.2	
Plant Debris	-21	0.0	
Wood/Textiles	-127	-0.1	
Subtotal Scope 3 - Solid Waste	1,740	1.0	
Subtotal Waste	1,657	0.9	
Other			
Oberlin, Ohio			
Scope 1 - Fugitive Emissions: Community Refrigeration			
Carbon Dioxide	680	0.4	
Subtotal Scope 1 - Fugitive Emissions: Community Refrigeration		0.4	
Scope 1 - Fugitive Emissions: Electric Maintenance			
Sulphur Hexafluoride	418	0.2	
Subtotal Scope 1 - Fugitive Emissions: Electric Maintenance		0.2	
Scope 1 - Fugitive Emissions: Vehicle A/C			
HFC-134a	885	0.5	
Subtotal Scope 1 - Fugitive Emissions: Vehicle A/C5		0.5	
Subtotal Other	1,984	1.1	
Total	178,427	100.0	1,298,509

This report has been generated for Oberlin, Ohio using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Community Greenhouse Gas Emissions in 2007
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Residential			
Oberlin, Ohio			
Scope 1 - Building Heating			
Natural Gas	8,444	4.8	136,666
Subtotal Scope 1 - Building Heating	8,444	4.8	136,666
Scope 2 - Residential Electricity			
2007 Oberlin Community I	19,227	11.0	62,757
Subtotal Scope 2 - Residential Electricity	19,227	11.0	62,757
Subtotal Residential	27,671	15.9	199,423
Commercial			
Oberlin, Ohio			
Scope 1 - Buildings/Facilities (Non-College, Non-Municipal)			
Natural Gas	10,893	6.2	176,318
Subtotal Scope 1 - Buildings/Facilities (Non-College, Non-Municipal)		6.2	176,318
Scope 1 - Municipal Buildings/Facilities			
Natural Gas	4,653	2.7	75,321
Subtotal Scope 1 - Municipal Buildings/Facilities	,653	2.7	75,321
Scope 1 - Municipal Water & Wastewater Dept Generators			
Natural Gas	19	0.0	304
Subtotal Scope 1 - Municipal Water & Wastewater Dept Generators		0.0	304
Scope 1 - Oberlin College CHP Plant			
Coal	16,645	9.5	153,363
Natural Gas	827	0.5	13,384
Subtotal Scope 1 - Oberlin College CHP Plant	17,472	10.0	166,747

This report has been generated for Oberlin, Ohio using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Community Greenhouse Gas Emissions in 2007
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Scope 1 - Oberlin College Non-CHP Heating			
Natural Gas	5,464	3.1	88,438
Subtotal Scope 1 - Oberlin College Non-CHP Heating		3.1	88,438
Scope 1 - OMLPS Power Plant			
Light Fuel Oil	81	0.0	980
Natural Gas	582	0.3	9,423
Subtotal Scope 1 - OMLPS Power Plant	663	0.4	10,402
Scope 2 - Electricity (Non-College, Non-Municipal)			
2007 Oberlin Community I	58,415	33.5	190,665
Subtotal Scope 2 - Electricity (Non-College, Non-Municipal)		33.5	190,665
Scope 2 - Municipal Electricity			
2007 Oberlin Community I	2,837	1.6	9,260
Subtotal Scope 2 - Municipal Electricity	2,837	1.6	9,260
Scope 2 - Oberlin College Non-CHP Electricity			
Solar	0	0.0	496
2007 Oberlin College Elec	15,761	9.0	83,944
Subtotal Scope 2 - Oberlin College Non-CHP Electricity		9.0	84,440
Subtotal Commercial	116,177	66.6	801,895
Transportation			
Oberlin, Ohio			
Scope 1 - Transportation			
Gasoline	21,727	12.5	254,178
Diesel	4,604	2.6	53,038
Subtotal Scope 1 - Transportation	26,330	15.1	307,216
Subtotal Transportation	26,330	15.1	307,216

This report has been generated for Oberlin, Ohio using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Community Greenhouse Gas Emissions in 2007
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)
Waste			
Oberlin, Ohio			
Scope 3 - Leaves & Brush Collection			*Disposal Method - Compost*
Plant Debris	-76	0.0	
Subtotal Scope 3 - Leaves & Brush Collection	-76	0.0	
Scope 3 - Solid Waste			*Disposal Method - Managed Landfill*
Paper Products	1,553	0.9	
Food Waste	290	0.2	
Plant Debris	-21	0.0	
Wood/Textiles	-124	-0.1	
Subtotal Scope 3 - Solid Waste	1,698	1.0	
Subtotal Waste	1,622	0.9	
Other			
Oberlin, Ohio			
Scope 1 - Fugitive Emissions: Community Refrigeration			
Carbon Dioxide	1,360	0.8	
Subtotal Scope 1 - Fugitive Emissions: Community Refrigeration		0.8	
Scope 1 - Fugitive Emissions: Electric Maintenance			
Sulphur Hexafluoride	418	0.2	
Subtotal Scope 1 - Fugitive Emissions: Electric Maintenance		0.2	
Scope 1 - Fugitive Emissions: Vehicle A/C			
HFC-134a	814	0.5	
Subtotal Scope 1 - Fugitive Emissions: Vehicle A/C4		0.5	
Subtotal Other	2,592	1.5	
Total	174,391	100.0	1,308,534

This report has been generated for Oberlin, Ohio using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

APPENDIX 5: Municipal Operations Inventories—CACP Outputs

5/30/2009

Government Greenhouse Gas Emissions in 2001
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
Oberlin, Ohio				
Scope 1 - Cemetery Dept				
Natural Gas	150	1.4	2,435	0
Subtotal Scope 1 - Cemetery Dept	150	1.4	2,435	0
Scope 1 - City Hall				
Natural Gas	676	6.3	10,947	0
Subtotal Scope 1 - City Hall	676	6.3	10,947	0
Scope 1 - Fire Dept				
Natural Gas	304	2.9	4,927	0
Subtotal Scope 1 - Fire Dept	304	2.9	4,927	0
Scope 1 - OMLPS Buildings				
Natural Gas	1,379	12.9	22,323	0
Subtotal Scope 1 - OMLPS Buildings	1,379	12.9	22,323	0
Scope 1 - OMLPS Power Plant				
Light Fuel Oil	174	1.6	2,101	0
Natural Gas	272	2.6	4,405	0
Subtotal Scope 1 - OMLPS Power Plant	446	4.2	6,505	0
Scope 1 - Utility/Finance Office				
Natural Gas	231	2.2	3,733	0
Subtotal Scope 1 - Utility/Finance Office	231	2.2	3,733	0
Scope 2 - Cemetery Dept				
2001 Oberlin Mix (sold RE	49	0.5	152	0
Subtotal Scope 2 - Cemetery Dept	49	0.5	152	0
Scope 2 - City Hall				
2001 Oberlin Mix (sold RE	342	3.2	1,068	0
Subtotal Scope 2 - City Hall	342	3.2	1,068	0

This report has been generated for Oberlin, Ohio using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Government Greenhouse Gas Emissions in 2001
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Scope 2 - Fire Dept				
2001 Oberlin Mix (sold RE	56	0.5	175	0
Subtotal Scope 2 - Fire Dept	56	0.5	175	0
Scope 2 - OMLPS Buildings				
2001 Oberlin Mix (sold RE	130	1.2	407	0
Subtotal Scope 2 - OMLPS Buildings	130	1.2	407	0
Scope 2 - OMLPS Power Plant				
2001 Oberlin Mix (sold RE	1,208	11.3	3,775	0
Subtotal Scope 2 - OMLPS Power Plant	1,208	11.3	3,775	0
Scope 2 - OMLPS Substations & Switch Stations				
2001 Oberlin Mix (sold RE	170	1.6	533	0
Subtotal Scope 2 - OMLPS Substations & Switch Stations		1.6	533	0
Scope 2 - Other Buildings/Facilities				
2001 Oberlin Mix (sold RE	-3	0.0	-11	0
Subtotal Scope 2 - Other Buildings/Facilities	-3	0.0	-11	0
Scope 2 - Utility/Finance Office				
2001 Oberlin Mix (sold RE	80	0.8	251	0
Subtotal Scope 2 - Utility/Finance Office	80	0.8	251	0
Subtotal Buildings	5,219	49.0	57,220	0
Vehicle Fleet				
Oberlin, Ohio				
Scope 1 - City Diesel Fleet				
Diesel	141	1.3	1,623	18,508
Subtotal Scope 1 - City Diesel Fleet	141	1.3	1,623	18,508

Government Greenhouse Gas Emissions in 2001
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Scope 1 - City Gasoline Fleet				
Gasoline	305	2.9	3,569	39,843
Subtotal Scope 1 - City Gasoline Fleet	305	2.9	3,569	39,843
Subtotal Vehicle Fleet	446	4.2	5,191	58,351
Employee Commute				
Oberlin, Ohio				
Scope 3 - Employee Commute				
Gasoline	308	2.9	3,575	
Diesel	3	0.0	30	
Subtotal Scope 3 - Employee Commute	310	2.9	3,605	
Subtotal Employee Commute	310	2.9	3,605	
Streetlights				
Oberlin, Ohio				
Scope 2 - Streetlights				
2001 Oberlin Mix (sold RE	874	8.2	2,730	0
Subtotal Scope 2 - Streetlights	874	8.2	2,730	0
Scope 2 - Traffic Lights				
2001 Oberlin Mix (sold RE	85	0.8	266	0
Subtotal Scope 2 - Traffic Lights	85	0.8	266	0
Subtotal Streetlights	959	9.0	2,997	0
Water/Sewage				
Oberlin, Ohio				
Scope 1 - Wastewater Buildings/Facilities				
Natural Gas	696	6.5	11,258	0
Subtotal Scope 1 - Wastewater Buildings/Facilities	696	6.5	11,258	0

This report has been generated for Oberlin, Ohio using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Government Greenhouse Gas Emissions in 2001
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Scope 1 - Wastewater Generator				
Natural Gas	5	0.1	86	0
Subtotal Scope 1 - Wastewater Generator	5	0.1	86	0
Scope 1 - Water Dept Buildings/Facilities				
Natural Gas	967	9.1	15,658	0
Subtotal Scope 1 - Water Dept Buildings/Facilities	967	9.1	15,658	0
Scope 1 - Water Dept Generator				
Natural Gas	6	0.1	96	0
Subtotal Scope 1 - Water Dept Generator	6	0.1	96	0
Scope 2 - Wastewater Buildings/Facilities				
2001 Oberlin Mix (sold RE	1,114	10.5	3,481	0
Subtotal Scope 2 - Wastewater Buildings/Facilities	1,114	10.5	3,481	0
Scope 2 - Water Dept Buildings/Facilities				
2001 Oberlin Mix (sold RE	489	4.6	1,527	0
Subtotal Scope 2 - Water Dept Buildings/Facilities	489	4.6	1,527	0
Subtotal Water/Sewage	3,277	30.8	32,107	0

Waste

Oberlin, Ohio

Scope 3 - Municipal Operations Waste			*Disposal Method - Managed Landfill*	
Paper Products	13	0.1		0
Food Waste	2	0.0		0
Plant Debris	0	0.0		0
Wood/Textiles	-1	0.0		0
Subtotal Scope 3 - Municipal Operations Waste	14	0.1		0
Subtotal Waste	14	0.1		0

This report has been generated for Oberlin, Ohio using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Government Greenhouse Gas Emissions in 2001
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Other				
Oberlin, Ohio				
Scope 1 - Fugitive Emissions: Electric Line Maintenance				
Sulphur Hexafluoride	418	3.9		
Subtotal Scope 1 - Fugitive Emissions: Electric Line Maintenance		3.9		
Scope 1 - Fugitive Emissions: Fleet A/C				
HFC-134a	12	0.1		
Subtotal Scope 1 - Fugitive Emissions: Fleet A/C	12	0.1		
Subtotal Other	430	4.0		
Total	10,655	100.0	101,120	58,351

This report has been generated for Oberlin, Ohio using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Government Greenhouse Gas Emissions in 2007
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Buildings				
Oberlin, Ohio				
Scope 1 - Cemetery Dept				
Natural Gas	155	1.4	2,507	0
Subtotal Scope 1 - Cemetery Dept	155	1.4	2,507	0
Scope 1 - City Hall				
Natural Gas	696	6.1	11,273	0
Subtotal Scope 1 - City Hall	696	6.1	11,273	0
Scope 1 - Fire Dept				
Natural Gas	313	2.7	5,074	0
Subtotal Scope 1 - Fire Dept	313	2.7	5,074	0
Scope 1 - GMD Dept				
Natural Gas	118	1.0	1,918	0
Subtotal Scope 1 - GMD Dept	118	1.0	1,918	0
Scope 1 - OMLPS Buildings				
Natural Gas	1,420	12.4	22,987	0
Subtotal Scope 1 - OMLPS Buildings	1,420	12.4	22,987	0
Scope 1 - OMLPS Power Plant				
Light Fuel Oil	81	0.7	980	0
Natural Gas	582	5.1	9,423	0
Subtotal Scope 1 - OMLPS Power Plant	663	5.8	10,402	0
Scope 1 - Other Buildings/Facilities				
Natural Gas	30	0.3	486	0
Subtotal Scope 1 - Other Buildings/Facilities	30	0.3	486	0
Scope 1 - Utility/Finance Office				
Natural Gas	237	2.1	3,844	0
Subtotal Scope 1 - Utility/Finance Office	237	2.1	3,844	0

Government Greenhouse Gas Emissions in 2007
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Scope 2 - Ballfield				
2007 Oberlin Community I	90	0.8	294	0
Subtotal Scope 2 - Ballfield	90	0.8	294	0
Scope 2 - Cemetery Dept				
2007 Oberlin Community I	64	0.6	209	0
Subtotal Scope 2 - Cemetery Dept	64	0.6	209	0
Scope 2 - City Hall				
2007 Oberlin Community I	350	3.1	1,143	0
Subtotal Scope 2 - City Hall	350	3.1	1,143	0
Scope 2 - Fire Dept				
2007 Oberlin Community I	66	0.6	216	0
Subtotal Scope 2 - Fire Dept	66	0.6	216	0
Scope 2 - GMD Dept				
2007 Oberlin Community I	200	1.8	653	0
Subtotal Scope 2 - GMD Dept	200	1.8	653	0
Scope 2 - OMLPS Buildings				
2007 Oberlin Community I	116	1.0	380	0
Subtotal Scope 2 - OMLPS Buildings	116	1.0	380	0
Scope 2 - OMLPS Power Plant				
2007 Oberlin Community I	1,355	11.9	4,423	0
Subtotal Scope 2 - OMLPS Power Plant	1,355	11.9	4,423	0
Scope 2 - OMLPS Substations & Switch Stations				
2007 Oberlin Community I	159	1.4	520	0
Subtotal Scope 2 - OMLPS Substations & Switch Stations		1.4	520	0
Scope 2 - Other Buildings/Facilities				
2007 Oberlin Community I	-414	-3.6	-1,352	0
Subtotal Scope 2 - Other Buildings/Facilities	-414	-3.6	-1,352	0

Government Greenhouse Gas Emissions in 2007
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Scope 2 - Utility/Finance Office				
2007 Oberlin Community I	89	0.8	289	0
Subtotal Scope 2 - Utility/Finance Office	89	0.8	289	0
Subtotal Buildings	5,709	50.0	65,264	0
Vehicle Fleet				
Oberlin, Ohio				
Scope 1 - City Diesel Fleet				
Diesel	183	1.6	2,113	49,171
Subtotal Scope 1 - City Diesel Fleet	183	1.6	2,113	49,171
Scope 1 - City Gasoline Fleet				
Gasoline	352	3.1	4,129	86,579
Subtotal Scope 1 - City Gasoline Fleet	352	3.1	4,129	86,579
Subtotal Vehicle Fleet	535	4.7	6,242	135,751
Employee Commute				
Oberlin, Ohio				
Scope 3 - Employee Commute				
Gasoline	345	3.0	4,037	
Diesel	3	0.0	34	
Subtotal Scope 3 - Employee Commute	348	3.0	4,071	
Subtotal Employee Commute	348	3.0	4,071	
Streetlights				
Oberlin, Ohio				
Scope 2 - Streetlights				
2007 Oberlin Community I	837	7.3	2,730	0
Subtotal Scope 2 - Streetlights	837	7.3	2,730	0

This report has been generated for Oberlin, Ohio using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Government Greenhouse Gas Emissions in 2007
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Scope 2 - Traffic Lights				
2007 Oberlin Community I	89	0.8	290	0
Subtotal Scope 2 - Traffic Lights	89	0.8	290	0
Subtotal Streetlights	925	8.1	3,020	0
Water/Sewage				
Oberlin, Ohio				
Scope 1 - Wastewater Buildings/Facilities				
Natural Gas	716	6.3	11,594	0
Subtotal Scope 1 - Wastewater Buildings/Facilities	716	6.3	11,594	0
Scope 1 - Wastewater Generator				
Natural Gas	0	0.0	4	0
Subtotal Scope 1 - Wastewater Generator	0	0.0	4	0
Scope 1 - Water Dept Buildings/Facilities				
Natural Gas	996	8.7	16,124	0
Subtotal Scope 1 - Water Dept Buildings/Facilities	996	8.7	16,124	0
Scope 1 - Water Dept Generator				
Natural Gas	18	0.2	299	0
Subtotal Scope 1 - Water Dept Generator	18	0.2	299	0
Scope 2 - Wastewater Buildings/Facilities				
2007 Oberlin Community I	1,187	10.4	3,873	0
Subtotal Scope 2 - Wastewater Buildings/Facilities	1,187	10.4	3,873	0
Scope 2 - Water Dept Buildings/Facilities				
2007 Oberlin Community I	534	4.7	1,742	0
Subtotal Scope 2 - Water Dept Buildings/Facilities	534	4.7	1,742	0
Subtotal Water/Sewage	3,451	30.2	33,635	0

Government Greenhouse Gas Emissions in 2007
Detailed Report

	Equiv CO_2 (tons)	Equiv CO_2 (%)	Energy (MMBtu)	Cost ($)
Waste				
Oberlin, Ohio				
Scope 3 - Solid Waste			*Disposal Method - Managed Landfill*	
Paper Products	13	0.1		0
Food Waste	2	0.0		0
Plant Debris	0	0.0		0
Wood/Textiles	-1	0.0		0
Subtotal Scope 3 - Solid Waste	14	0.1		0
Subtotal Waste	14	0.1		0
Other				
Oberlin, Ohio				
Scope 1 - Fugitive Emissions: Electric Line Maintenance				
Sulphur Hexafluoride	418	3.7		
Subtotal Scope 1 - Fugitive Emissions: Electric Line Maintenance		3.7		
Scope 1 - Fugitive Emissions: Fleet A/C				
HFC-134a	15	0.1		
Subtotal Scope 1 - Fugitive Emissions: Fleet A/C	15	0.1		
Subtotal Other	433	3.8		
Total	11,416	100.0	112,233	135,751

This report has been generated for Oberlin, Ohio using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.