# Achieving Emissions Reductions at Speed and Scale:

## *Community-Scale Climate Action Planning (CAP) Best Practices and Impact Analysis*

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December 2018

Prepared for

**CU Boulder, Masters of the Environment Program**

Capstone Partner

**Center for Climate Protection**


# Table of Contents


Executive Summary 2
Acknowledgements 4
Report Goals, Methodology, and Scope 5
Climate Change as a Global and Local Problem 7
The Role of Local Governments in Climate Change Leadership 11
CAP Structure and Development Process 13
Findings and Recommendations 16

*Does climate action planning reduce greenhouse gases?* 16
*What common challenges do cities and counties face?* 22
*What best practices can be gleaned?* 22

Suggested Future Research 32
Conclusion 32
Appendix A: Annotated Bibliography of General CAP Resources 34

I. General CAP Resources 34

A. CAP Guidelines, Templates, and Best Practices 34
B. Articles on GHG Emission Inventories 36

II. Meta-Analysis of Causal Link between CAPs and GHG reductions 36

A. Quantitative articles examining CAP impact 36
B. Empirical articles examining CAP-GHG link 38
C. Qualitative articles on CAP impact 39

Appendix B: Interview Resources 41

CURB: Climate Action Planning Decision Support Tool 42
BAAQMD "Local Government Climate Action Planning Survey Results and Recommendations"
San Diego Climate Action Report Card 46

Appendix C: Local Government Policy Mechanisms 48
Appendix D: Estimates of Local Government-led GHG Reductions 49
Appendix E: Example GHG Targets 50

## Table of Tables

*Table 1: Interview Segmentation*
*Table 2: Common GHGs and their Primary Emission Sources*
*Table 3: Estimated Cost of Global Warming*
*Table 4: Sample Evaluation Categories*
*Table 5: Sample Evaluation Criteria*
*Table 6: Example Climate Action Plan Targets*

## Table of Figures

*Figure 1: Distribution of actors leading urban climate change activities*
*Figure 2: Typical CAP Development Process*
*Figure 3: The "Plan-do-check-act cycle"*
*Figure 4: Phases of CAP Development*
*Figure 5: BART's Options Analysis Framework*
*Figure 6: Oakland's Options Analysis Framework*
*Figure 7: CURB Methodology*
*Figure 8: CURB targets highest emission sources*
*Figure 9: CURB Options Analysis Chart*
*Figure 10: BAAQMD Survey Results: CAP Implementation Barriers*
*Figure 11: Climate Action Campaign 2017 CAP Scorecard Results*
*Figure 12: Climate Action Planning Policy Approaches*

***NOTE: This report was prepared by Katie Abrams as part of her graduate work at CU Boulder. The recommendations and opinions expressed in the report are the author's own and do not necessarily reflect the view of CU Boulder or the Center for Climate Protection.***

# Executive Summary

Climate Action Plans lay out a vision, strategies, and policies for reducing greenhouse gas emissions. They are an increasingly common climate adaptation and mitigation tool for governments and corporations alike.

This report outlines challenges, best practices, and recommendations for community-level climate action plans. The intended target audience is local government sustainability staff, as well as the nonprofits and consultants that support their work. Expert interviewees were chosen from cities, counties, and consultancies in California and Colorado - two states with different climate regulatory frameworks and political tendencies – though the results contain lessons learned for local governments across the country.

A central question addressed in this report is *do climate action plans reduce greenhouse gases (GHGs)?* Cities around the world have engaged in over 8,000 climate actions – do these actually add up to tangible GHG reductions? And, given that only about 10% of the Compact of Mayors members (about 200 of about 2,000 cities) have specific emission reduction targets and mitigation plans, *how can progress be measured and tracked?*

A series of expert interviews, extensive literature review, and a meta-analysis of academic studies revealed inconclusive results on the causal connection between CAPs and GHG reductions. However, these same data points also revealed important best practices that can be leveraged to help local governments achieve emissions reductions at the speed and scale required to avert catastrophic climate change impacts.

The appendices provide details on the research methodologies, as well as a suite of resources for climate action planning.

Findings can be summarized into a series of common challenges and best practices.
Common challenges include:

- ➢ Lack of a standardized CAP template
- ➢ Lack of political, financial, and governance support
- ➢ Greater focus on “plan” than “action”

- ➢ Striking a balance between *realistic* yet *ambitious* targets
- ➢ Aligning *action* with *potential*

Six best practices emerged from expert interviews and literature review as leading recommendations for optimizing CAPs to ensure they lead to GHG reductions:

- ★ The CAP process needs to be iterative
- ★ CAPs need to include certain well-defined contents to ensure success
- ★ Utilize strategies for overcoming common sticking points (in scoping, options analysis, and evaluation)
- ★ Governance strategy is a key determinant of a CAP's success
- ★ Policy change is needed to standardize accounting methods

These recommendations are intended to apply to both novice and seasoned CAP developers.

# Acknowledgements

This report would not be possible without the guidance, encouragement, and inspiration of Capstone partner, Ann Hancock. Ann is the Executive Director of the Center for Climate Protection, a non-profit advocacy group based in Santa Rosa, California. Under Ann's skilled leadership, the center has a 17-year history of successfully advancing Sonoma County's climate reduction agenda, including championing the nation's first climate commitment made by all nine cities and a county! The organization's mission is "to inspire, align, and mobilize action in response to the climate crisis".

The author also wishes to thank the many interviewees who volunteered their time to share insights. A full list of interviewees can be found in the appendix.

Megan Day, project leader at NREL, provided excellent tools and resources.

Lastly, MENV staff including Paul Komor and Rachel Bigby provided much-needed guidance, support, and feedback.

# Report Goals, Methodology, and Scope

This report is intended to provide local governments, nonprofits, and consultants best practices and strategic insights on climate action planning, with a focus on mitigation strategies. An equally important purpose is to present an analysis of whether climate action plans contribute to GHG reductions, based on a meta-analysis of existing literature.

## Overview

The **goals** of this project are two-fold:

1. Provide partner with an assessment of the effectiveness of Climate Action Plans, including their shortcomings and best practices
2. Analyze whether climate action plans contribute to greenhouse gas (GHG) reductions.

The **methodology** included the following:

- Literature review
- Meta-analysis of research on GHG reductions that can be quantified and attributed due to local government CAP implementation strategies
- Expert and practitioner interviews
- Analysis of interview and literature review findings
- Preparation of best practices and recommendations

The **scope** of the project includes local governments across the United States. A focus on Colorado and California was chosen for interviews and CAP reviews because their vastly different regulatory frameworks and somewhat different political tendencies offers an interesting comparison.

## Methodology Details

Significant insights were gained from interviews with over a dozen experts and practitioners from local governments, academic institutions, industry groups, and regulatory bodies. The table below segments interviewees by type of organization.

| Local governments | Academic, Consultancy, & Membership Orgs | Regulatory Bodies |
|---|---|---|
| NYC Climate Change Adaptation Task Force | ICLEI | Bay Area Air Quality Management District |
| County of Marin | Georgetown Climate Center | Regional Climate Protection Authority |
| Contra Costa County | Sonoma State University | California Governor's Office of Planning & Research |
| Boulder County | Climate Action Campaign | Colorado Regional Air Quality Management District |
| City of Boulder | Sonoma Ecology Center | |
| Summit County | Minera | |
| | Carbon Disclosure Project | |
| | Brendle Group | |

*Table 1: Interview Segmentation*

In addition to interviews, the author read and reviewed numerous CAPs from Colorado and California, including:

- Berkeley, CA
- Boulder County, CO
- City of Boulder, CO
- City of Denver, CO
- City of Oakland, CA
- City of San Diego, CA
- Contra Costa County, CA
- Fort Collins, CO
- Napa County, CA
- Marin County, CA
- Pittsburg, CA
- Santa Rosa, CA
- Sonoma County, CA
- Summit County, CO

These cities were chosen for their mix of demographics, size, and urban versus rural location.

# Climate Change as a Global and Local Problem

"Climate change" refers to the planetary scale changes in Earth systems. Global warming is a phenomenon caused by rising levels of greenhouse gases (GHGs). There is strong consensus in the scientific community that rising average global temperatures are a result of human-induced GHGs. Major GHG compounds include: carbon dioxide, methane, nitrous oxide, perfluorinated carbons, sulfur hexafluoride, and hydrofluorocarbons. A GHG's ability to trap heat and remain in the atmosphere can be measured and compared using the Global Warming Potential (GWP) scale. $CO_2$, for example, has a GWP of 1, whereas $N_2O$ has a GWP of 265 (ergo $N_2O$ is 265 times more powerful than $CO_2$).

The table below provides an overview of common GHGs and their primary emission sources and GWP.

| Greenhouse Gas | Chemical Formula(s) | Primary Emissions Sources | Global Warming Potential[a] | Atmospheric Lifetime (years) |
|---|---|---|---|---|
| Carbon Dioxide | $CO_2$ | • Burning of fossil fuels<br>• Gas flaring<br>• Cement production<br>• Land use changes<br>• Deforestation | 1 | 50–200 |
| Methane | $CH_4$ | • Agricultural practices<br>• Natural gas combustion<br>• Landfill outgassing | 28 | 12.4 |
| Nitrous Oxide | $N_2O$ | • Agricultural practices<br>• Nylon production<br>• Gas-fired power plants<br>• Nitric acid production<br>• Vehicle emissions | 265 | 121 |
| Perfluorinated Carbons | $CF_4$<br>$C_2F_6$ | • Aluminum production<br>• Semiconductor manufacturing | 6,630–11,100 | 10,000 – 50,000 |
| Sulfur Hexafluoride | $SF_6$ | • Power distribution<br>• Semiconductor manufacturing<br>• Magnesium processing | 23,500 | 3,200 |
| Hydrofluorocarbons | HFC-23<br>HFC-134a<br>HFC-152a | • Consumer products<br>• Automobile air conditioners<br>• Refrigerants | 138–12,400 | 1.5–222 |

Source: Intergovernmental Panel on Climate Change 2013.

[a] The GWPs listed here are 100-year values without carbon-climate feedbacks.

*Table 2: Common GHGs and their Primary Emission Sources. Source: ICF International.*[1]

Greenhouse gases do not adhere to state boundaries. For better or worse, actions taken by one nation impact all countries. And yet, climate change is also a local problem because the effects are felt locally - from increased frequency and severity of weather events, to rising sea level and changes in crop production.

Although climate change is a global issue, the effects are felt locally. Impacts can include sea level rise, alterations in snowpack and river flows, disruption to livestock and crop production, increased risk of wildfire and flooding, changes in growing seasons, more intense and frequent storms, and shifts in water supply and demand.

In September 2018, scientists at UC San Diego and Scripps published an economic analysis of the effects of climate change by country. It concluded that the larger a country's economy, the more it stands to lose. While this makes sense on its face, it contradicts the long-held belief that "the primary beneficiaries of reductions in carbon dioxide emissions would be other countries"[2]. **What the new study shows is that the U.S. faces the costliest damages.** Further sobering is the authors' emphasis on the projections as conservative, since they focused on how climate change currently effects economies (such as through damage to property and agriculture, and higher health and energy costs); their study didn't capture longer-term effects like sea level rise.

Climate change impacts vary regionally. In California, some predict climate change could cause "tens of billions per year in direct costs, even higher indirect costs, and trillions of dollars of assets to collateral risk". These costs would be incurred due to increased drought, higher temperatures, more intense and frequent wildfires and floods, and sea level rise.[3]

[1] ICF International. 2015. *Marin County Climate Action Plan (2015 Update).* July. (ICF 00464.13.) San Francisco. Prepared for Marin County, California. Page 2-3. https://www.marincounty.org/~/media/files/departments/cd/planning/sustainability/climate-and-adaptation/chpt2marincapupdate_final_20150731.pdf?la=en

[2] Ricke, Katharine et al. *Nature Climate Change*. Country-level social cost of carbon. Volume 8, pages 895–900 (2018).

[3] Boswell, Greve, and Seale. Local Climate Action Planning. Center for Resource Economics. 2012. https://www.springer.com/la/book/9781610912013

# Policy Context: Global and Local Solutions

This section presents a high-level overview of international, national, and state-level (California and Colorado) policies related to climate action planning.

## International Policy Framework

The United Nations Environment Programme and World Meteorological Organization established the Intergovernmental Panel on Climate Change (IPCC) "to provide the world with a clear scientific view on the current state of climate change and its potential environmental and socio-economic consequences"[4]. The IPCC is comprised of over one thousand scientists from around the world who review climate science and issue reports.

In 1997, the United Nations Framework Convention on Climate Change (UNFCCC) convened the first Meeting of the Parties and developed the Kyoto Protocol. The Protocol was a top-down approach dictating emission targets for all countries, and employing primarily market-based mechanisms like cap-and-trade. It suffered from low compliance and the United States never ratified the treaty.

In 2009, at the United Nations Climate Change Conference in Copenhagen, Denmark set out to develop an agreement to guide actions beyond the 2012 (Kyoto) target year. The Copenhagen Accord set a goal of keeping global temperature rise at or below 2 degrees Celsius (whereas the Kyoto Protocol set an emissions reduction target).

Another major milestone in international climate change policy was the 2017 Paris Agreement. More than 7,400 cities around the world signed the Paris Agreement, and nearly 6,400 joined the Global Covenant of Mayors for Climate & Energy. Although none of these agreements (Kyoto, Copenhagen, or Paris) are truly enforceable, they have spurred tremendous national and subnational efforts to reduce greenhouse gases, and serve as a platform for sharing best practices around the globe.

[4] IPCC. Organization. https://www.ipcc.ch/organization/organization.shtml (Accessed November 3, 2018)

## State Policy Framework: California and Colorado

Nationally, there is no requirement for local governments to develop climate action plans.

In California, there are multiple landmark legislations related to climate action planning: AB 32-Global Warming Solutions Act, SB 375-Sustainable Communities and Climate Protection Act, and SB 97-California Environmental Quality Act. The first was the Global Warming Solutions Act of 2006, which codified the state's GHG emissions target, capping it at 1990 levels by 2020. The AB 32 Scoping Plan articulates the role of local governments and recommends that they establish emission reduction goals for both municipal and community sources.

SB 375-Sustainable Communities and Climate Protection Act builds on the state's existing regional planning framework to tie together regional transportation planning with a goal of reducing transportation-related GHGs. The law is essentially a "bottom up" approach to involving local governments, and it directs the California Air Resources Board to set regional targets for reducing GHGs.

The third cornerstone California law regarding climate action planning is SB 97-California Environmental Quality Act (CEQA). CEQA allows local governments to streamline environmental review when their CAPs meet CEQA's stringent "tiering" requirements. Although getting CAPs to be CEQA compliant is more expensive upfront, it can help local governments avoid conducting quantitative assessments of project-level GHG emissions.[5]

CEQA requirements include 1) quantifying all primary sectors of GHG emissions within the county for 1990, 2012, and 2020; 2) including a reduction target of 30% below 1990 levels for community emissions, which is above and beyond the recommendations in the AB 32 Scoping Plan for municipalities to support the overall AB 32 reduction targets; 3) analyzing community emissions for the County and including predicted growth expected by 2020; 4) including specific measures to achieve the overall reduction target; 5) including periodic monitoring of

[5] ICF International. 2015. *Marin County Climate Action Plan (2015 Update)*. July. (ICF 00464.13.) San Francisco. Prepared for Marin County, California. Page 1-5. https://www.marincounty.org/~/media/files/departments/cd/planning/sustainability/climate-and-adaptation/chpt2marincapupdate_final_20150731.pdf?la=en

plan progress; and 6) submitting the CAP Update to be adopted in a public process following compliance with CEQA.

Meanwhile, Colorado does not have any statutes that require local governments to develop Climate Action Plans. CAPs are purely voluntary and do not need to be submitted to state agencies. However, a growing number of cities and counties are preparing CAPs for a variety of reasons - including demonstrating climate leadership and establishing a framework for complying with air quality standards, among other reasons.

# The Role of Local Governments in Climate Change Leadership

Local governments are well positioned to act on greenhouse gas reductions – through a mix of direct action and indirect advocacy. Globally, cities, consume 75% of the world's energy use and emit 80% of its GHGs.[6] Local governments have varying levels of control over (local) transportation systems, building construction, and land use.

Cities have "the right mix of authority and flexibility to experiment and innovate on 'wicked problems' like climate change".[7] Or, put another way, "Cities have unique and strong influence over several policy levers – from urban planning to public transportation – that make them critical actors in reducing GHG emissions, avoiding further carbon lock-in, and decreasing the cost of future abatement".[8]

A growing number of cities have taken voluntary measures to reduce GHGs, often through international city networks and frameworks like the United Nations Sustainable Development Goals (SDGs), international climate negotiations (UNFCCC2), and the global conference on

[6] UN Habitat. Energy. https://unhabitat.org/urban-themes/energy/ (Accessed November 2, 2018)
[7] Alisa Zomer and Angel Hsu. Cities and Climate Change: Examining the Potential of Cities to Mitigate Global Climate Change. Yale University. 2015. http://www.stanleyfoundation.org/climatechange/Zomer-Yale-CitiesandClimateChange.pdf
[8] Bloomberg, Michael. C40 Cities. Advancing climate ambition: cities as partners in global climate action. http://c40-production-images.s3.amazonaws.com/researches/images/25_Advancing_Climate_Ambition.original.pdf?1412878084 Accessed November 19, 2018

human settlements (Habitat III).[9] In addition, cities play a critical role simply because subnational governments have become the de facto climate protection leaders often forging ahead despite slow national initiative.[10]

There are notable exceptions to the limits of local government authority. Take, for example, transportation. Local governments lack authority over the most powerful levers to address transportation GHGs (i.e. fuel efficiency standards). To overcome these limitations, one of the most strategic and powerful actions a local government can take is to advocate for change at higher levels of government.

Local governments lead the majority of urban climate change activities - approximately 66% according to Global Environmental Review. The pie chart below illustrates the distribution of actors leading urban climate change activities.

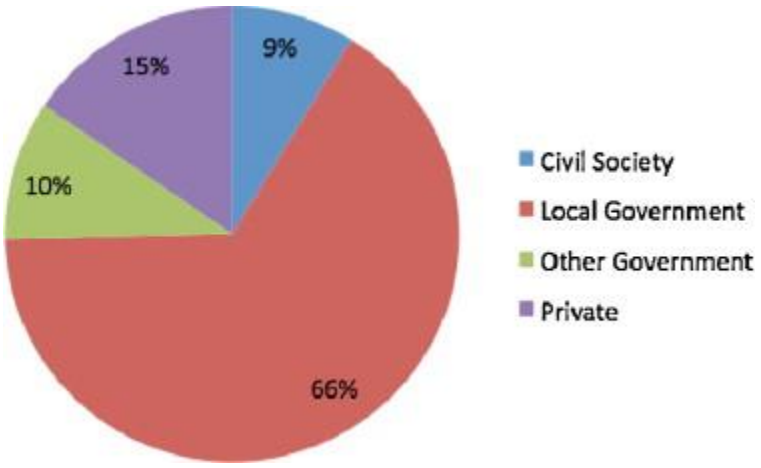


*Figure 1: Distribution of actors leading urban climate change activities.*[11]

[9] Alisa Zomer and Angel Hsu. Cities and Climate Change: Examining the Potential of Cities to Mitigate Global Climate Change. Yale University. 2015.
http://www.stanleyfoundation.org/climatechange/Zomer-Yale-CitiesandClimateChange.pdf
[10] Krause, Rachel M. 2011. "Symbolic or Substantive Policy? Measuring the Extent of Local Commitment to Climate Protection" Environment and Planning C: Government and Policy
29.1: 46-62
[11] Castán Broto, Vanesa and Harriet Bulkeley. 2013. "A survey of urban climate change experiments in 100 cities." Global Environmental Change. 23(1): 92-102.
https://www.sciencedirect.com/science/article/pii/S0959378012000891?via%3Dihub

# CAP Structure and Development Process

There are many resources available to help local governments craft climate action plans. This section serves as a primer geared towards cities and counties that are new to climate action planning. The following sections are included:

- Typical CAP Structure and Contents
- Sample CAP Development Process

## Typical CAP Structure and Contents

There is no official format for CAPs, although numerous templates exist, including those from the Urban Sustainability Directors Network (USDN), ICLEI, and others. CAPs can be visionary or detailed. Some are based on GHG inventories while others are not. Sectors typically include energy use, transportation, and waste. Some also feature land use, water, industrial, and agricultural sectors. Implementation strategies can be regulatory or incentive-based. CAPs can be standalone documents, or can be integrated in sustainability plans, climate resiliency plans, comprehensive land use plans, or another community-level planning document. The content and objectives vary depending on community context and agency vision.

CAPs nearly always focus on mitigation, although a growing number also look at adaptation. The IPCC defines "mitigation" as "An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases" and "adaptation" as "adjustment in natural or human systems to a new or changing environment".

Contents typically include at least some of the following sections:

- Background on climate change and impacts
- Policy and regulatory framework
- GHG inventory and targets
- Basic implementation plan outlining emission reduction strategies, programs, and policies
- Detailed implementation plan that includes timeline, assignment of responsibility, estimated costs and proposed funding streams
- Monitoring and evaluation plan
- Reporting framework

- Communication and education strategy
- Partnerships and stakeholder engagement strategy

CAPs may also include a discussion of co-benefits such as lower energy bills, cost savings, public health improvements, job creation, greater bicyclist safety, improved air quality, and better community aesthetics (through programs like tree planting).

The “Recommendations” section of this report analyzes which sections are often missing as well as strategies for ensuring CAPs achieve their goal of lowering emissions.

# Sample CAP Development Process

The diagram below, from UN Habitat, illustrates a typical climate action planning process. It's worth noting that the process varies significantly from place to place, organization to organization, and update to update.

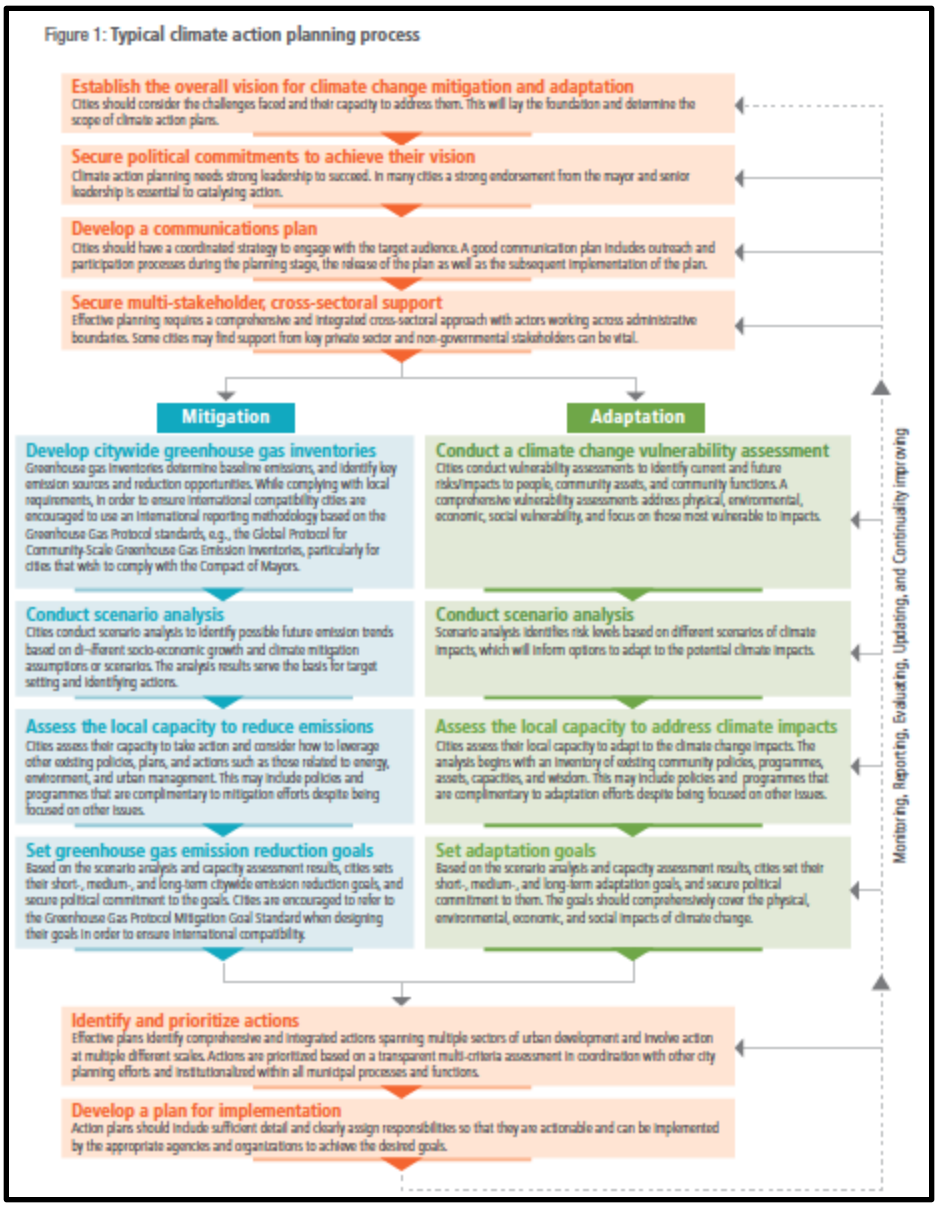


*Figure 2: Typical CAP Development Process. Source: UN Habitat*[12]

[12] UN Habitat. Guiding Principles for City Climate Action Planning. United Nations Human Settlements Programme. 2015. http://e-lib.iclei.org/wp-content/uploads/2016/02/Guiding-Principles-for-City-Climate-Action-Planning.pdf (Accessed June 17, 2018)

For more tools and information on CAPs, including links to templates, see the Appendices.

# Findings and Recommendations

There are three questions implicit in the project goals:

- ***Does climate action planning reduce greenhouse gases?***
- ***What common challenges do cities and counties grapple with?***
- ***What best practices can be gleaned?***

## *Does climate action planning reduce greenhouse gases?*

There are dozens of research papers written by academic and trade organizations that evaluates the impact of CAPs on GHG reductions. Despite the growth of research on this topic, studies are still limited in their scope (geographic and sectoral) and continue to face methodological challenges (demonstrating causation vs. correlation). After conducting a meta-analysis of dozens of scholarly articles, the author concludes that a causal link between CAPs and GHG reductions cannot be established with the existing body of research.

This section begins by highlighting the range of findings across existing studies, then presents a summary of limitations in assessing this critical question. In essence, the literature review section attempts to answer the question *do CAPs cause GHG reductions?*, while the methodological limitation section seeks to answer the question *why is it so hard to measure a causal connection between CAPs and GHGs?*

### Highlights from Literature Review: *do CAPs cause GHG reductions?*

The range of findings below illustrates the lack of conclusiveness on a causal link between CAPs and GHGs. An annotated bibliography of all papers reviewed as part of this meta-analysis can be found in Appendix A.

Journal of Urban Economics finds positive correlation but no causal link between CAPs and GHG reductions:

*"I find that cities with climate plans have had far greater success in implementing strategies to reduce greenhouse gas emissions than their counterparts without such plans.... I find little evidence, however, that climate plans play any causal role in this success. Rather, citizens' environmental preferences appear to be a more important driver of both the adoption of climate plans and the pursuit of specific emission reduction measures. Thus, climate plans are largely codifying outcomes that would have been achieved in any case."*[13]

Energy Policy Journal finds no correlation between CAPs and GHGs:

*"There is no statistical evidence that municipalities with local action plans have lower specific energy use or GHG emissions than those who do not explicitly have one. Also, it was not proven that the evolution of specific GHG emissions over time is different for municipalities with and without local action plans."*[14]

Durham University study points to the value of policy action and GHG reduction:

*"Most experiments in the database, that is 79% of them (495 experiments) started after 2005, that is, after Kyoto was ratified. Only 5% of initiatives started before its initial adoption in 1997. This is not necessarily an indication that international agreements have direct impact in fostering climate change experimentation, but rather, that international climate change governance efforts correspond with an increasing interest on climate change in the collective imaginations of urban Actors. Climate change has gained more visibility in the city at the same time as the agreements took place".*[15]

Environment and Planning C: Government and Policy article develops index quantifying GHG-reduction policies

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[13] Adam Millard-Ball. Do city climate plans reduce emissions? Journal of Urban Economics. Volume 71, Issue 3, May 2012, Pages 289-311. https://people.ucsc.edu/~adammb/publications/Millard-Ball_2012_City_climate_plans_preprint.pdf

[14] Azevedo, Horta, and Leal. Analysis of the relationship between local climate change mitigation actions and greenhouse gas emissions - Empirical insights. Energy Policy journal. September 2017

[15] Castán Broto, Vanesa and Harriet Bulkeley. 2013. "A survey of urban climate change experiments in 100 cities." Global Environmental Change. 23(1): 92-102. http://dro.dur.ac.uk/11688/1/11688.pdf?DDC189+DDD14+d700tmt (Assessed November 2, 2018). Page 10

*"Despite the fact that only a minority of cities are explicitly undertaking climate-protection efforts, all are engaged in GHG-reducing activities. The most common of these are services, provisioned to the local public, which have important cobenefits (such as curbside recycling and public transportation).... A second key finding emphasizes the importance of policy entrepreneurs in climate protection. Whether or not local actions are explicitly framed as climate protection, cities having an identifiable policy entrepreneur in this issue area have significantly more GHG-reducing activities in place."*[16]

## Methodological Challenges: *why is it so hard to measure a causal connection between CAPs and GHGs?*

Identifying and measuring a causal connection between GHG reductions and a particular action (climate action planning) is challenging for many reasons. This section presents key challenges. This section is intended to help local governments understand the limitations of studying a link between CAPs and GHG reductions, and why the results of such measurements may be biased or incorrect. It is not intended to suggest that there is no evidence to support the claim that CAPs lead, or don't lead, to GHG reductions. And it is not intended to suggest that local governments throw in the towel and abstain from acting until a perfect methodology is developed that correlates action to reduction.

*Correlation vs. causation*

Many studies make a false leap from noting a connection between GHGs and CAPs (either positive or negative correlation), but this does not prove causation. Demonstrating causality requires using statistical tools such as a randomized trial or observational data to show that the movement of one variable (GHGs) is caused by the other variable (CAPs). Although some studies use recognized methods such as time series analysis or cross-sectional regression analysis, most urban climate action studies use imperfect proxies or point to a comovement of GHGs and CAPs over time that does not necessarily prove causality.

[16] Krause, Rachel M. 2011. "Symbolic or Substantive Policy? Measuring the Extent of Local Commitment to Climate Protection" Environment and Planning C: Government and Policy. 29.1: 46-62

A related issue is known as confounding factors. If, for example, a city takes multiple overlapping actions related to transportation (i.e. bike lanes and higher gas taxes), it can be challenging to determine how much each action contributed to air quality. This issue is also referred to as the "disaggregation issue".

It's worth noting that any GHG reductions (regardless of impetus) are positive. Creating a CAP can lead to positive "spillover" benefits even if the CAP doesn't illicit reductions as deep as the local government may have hoped for.

*Limited geographic scope*

The majority of existing climate action impact literature is focused on a specific city or country. Climate action impacts are context-dependent, therefore similar actions taken in different places may generate different results.[17]

*Limited sectoral scope*

CAPs typically include sectors like energy use, transportation, and waste. Some also feature land use, water, industrial, and agricultural sectors. At issue is that in order for studies to present an apples-to-apples comparison, they must include all sectors in their analysis. Some studies on the CAP-GHG connection, for example, only looked at energy. This misses GHG reductions from key sectors like industry and transportation. Worse, some studies attempt to compare different sectors' GHGs in assessing the merits of two different CAPs. One of the studies reviewed for this paper made a logical fallacy by concluding that since region A experienced a higher absolute GHG reduction (from energy) than region B (focused on transportation), region A's CAP was stronger than region B's.

*Spillover and free ridership*

"Spillover" refers to when participants take additional actions to reduce GHGs inspired by program activities, or when non-participants are inspired to take action. "Free ridership" is the opposite effect, where GHGs are counted but were not caused by program activity (for example, if a city claims it actively reduced its energy GHGs when in fact new federal building efficiency mandates were the source of the reductions). Spillover and free ridership

[17] C40 Cities and Ramboll. Urban Climate Action Impacts Framework. A Framework for Describing and Measuring the Wider Impacts of Urban Climate Action. https://c40-production-images.s3.amazonaws.com/other_uploads/images/1605_C40_UCAIF_report_V3.original.pdf?1518203136

can lead to over- or under-counting, and to inaccurate aggregate figures of GHG reductions across regions.

*Critical data gaps*

According to C40, the following critical data gaps remain:

1. "the availability of pre- and post-action data
2. the availability of data at the granularity that corresponds to a climate action, i.e. is the area of data collection the same as the area of the climate action
3. a lack of context specific research from a similar city setting, especially for Low- and Middle-Income Countries (LMIC)
4. insufficient data to enable a good understanding of how equitably the impacts are distributed"[18]

While local governments are beginning to gain access to and track a greater array of data, these critical data gaps must be overcome to enable monitoring and evaluation of climate actions and results.

*Inadequate proxy data*

Proxy data is used to approximate data based on other sources when actual data is not available. While proxy data can be useful, it's important to consider contextual differences. For example, if GHG impacts of increased bike activity is extrapolated from one city to another, geographic factors like topography, climate, and distance must be accounted for.

*Accounting methods*

For CAPs grounded in a GHG inventory, methodologies vary widely. Different protocols use different calculation methods, scopes (i.e. direct versus indirect emissions), and urban boundaries, for instance. In California, at least one local government (Sonoma County) has been sued over its decision to use production instead of consumption accounting. Production accounting focuses on GHGs created within the CAP's boundaries, whereas consumption accounting seeks to account for "upstream GHGs" (all GHGs used to create and transport all goods used within the CAPs boundary). Thus, in manufacturing-heavy areas, a production-based GHG inventory is likely to be higher than a consumption-based inventory; while in

[18] Ibid.

certain cities, household consumption often accounts for around 75% of GHG emissions. However, there is no regulation on which approach to use, which can lead to over- or under-counting GHGs in aggregate, and makes apples-to-apples comparisons challenging.

Hybrid accounting seeks to combine production and consumption data, but even so, exact methodologies and scopes differ. For example, different local governments use different sectors, scopes, socio-economics, etc.

Yale climate scientists noted, "the lack of standardization in accounting methods has made it difficult to provide accurate estimates of the impact of city actions globally. The voluntary nature of existing emissions reporting programs means that cities are encouraged to disclose their emissions, but not required to report many details of inventories, boundaries, baselines, and methods."[19]

Given the paucity of strong evidence, how do we craft and implement CAPs that have the best potential for making a difference? **This question of connection between CAPs and GHG reductions may always be challenging to prove with strong and clear causality, but science suggests we do not have time for inaction, so must focus on the most strategic and economically viable options to mitigate future damage.**

Considering the often high-cost of developing climate action plans, one of the items mentioned in the "Suggested Future Research" section is developing an alternative to CAPs, or a streamlined version that allows local governments to focus on *action* and not get bogged down in *planning*. In a state like California, where the array of climate challenges and solutions are somewhat similar, local governments could leapfrog the long and costly steps of original full-scale climate action planning by borrowing CAP elements from similar communities with a demonstrated history of successful implementation.

[19] Alisa Zomer and Angel Hsu. Cities and Climate Change: Examining the Potential of Cities to Mitigate Global Climate Change. Yale University. 2015. http://www.stanleyfoundation.org/climatechange/Zomer-Yale-CitiesandClimateChange.pdf

## *What common challenges do cities and counties face?*

Based on data gathered from literature review, meta-analysis, and expert interviews, the author found the following challenges across many local governments:

1. The lack of a standardized CAP template makes comparisons (geographic and temporal) and measuring progress challenging
2. There is often an inverse relationship between primary emission source and cost-effective municipal influence
3. Political, financial, and governance support can make or break the success of a CAP
4. There is often too much emphasis placed on easy wins or unrealistic targets
5. Balance must be struck between "plan" and "action"

Recognizing the many shared challenges, the question becomes *what can local governments do? What best practices can they learn from each other to overcome common challenges and optimize their CAPs for the purpose of lowering GHGs?*

## *What best practices can be gleaned?*

Six best practices emerged from expert interviews and literature review as leading recommendations for optimizing CAPs to ensure they lead to GHG reductions:

- ★ Integrate the CAP with the General Plan
- ★ The CAP process needs to be iterative
- ★ CAPs need to include certain well-defined contents to ensure success
- ★ Utilize strategies for overcoming common sticking points (in scoping, options analysis, and evaluation)
- ★ Governance strategy is a key determinant of a CAP's success
- ★ Policy change is needed to standardize accounting methods

These recommendations are intended to apply to both novice and seasoned CAP developers.

## ★ Integrate the CAP with the General Plan

Most CAPs are standalone documents. However, some cities and counties can integrate CAPs into official planning documents such as General Plans. Doing so gives the CAP "teeth"; it can enable certain strategies that might otherwise be suggestions to be legally binding if included in the General Plan. Furthermore, it can make provide a framework for obtaining resources (financial and staff).

Two interviewees from California suggested this as a key best practice. First, the Center for Climate Action, based in San Diego, recommended it as one of two ways to have CAPs be legally binding (the other is CEQA certification). Second, BAAQMD included it as one of the five best practices identified through a survey of Bay Area local governments' CAPs. Specifically, they found that "Many (though not all) of the successful CAPs had incorporated emissions mitigation measures into the city's general plan, even if they also had a stand-alone climate action plan (page 3)."[20]

## ★ The CAP process needs to be iterative

The UN Guiding Principles concludes: "Climate action planning should be flexible, dynamic, and iterative".[21] The diagram below illustrates how an iterative process can work in practice:

[20] BAAQMD. Local Government Climate Action Planning Survey Results and Recommendations. March 2017. PDF

[21] UN Habitat. Guiding Principles for City Climate Action Planning. United Nations Human Settlements Programme. 2015. http://e-lib.iclei.org/wp-content/uploads/2016/02/Guiding-Principles-for-City-Climate-Action-Planning.pdf Accessed June 17, 2018. Page 9.

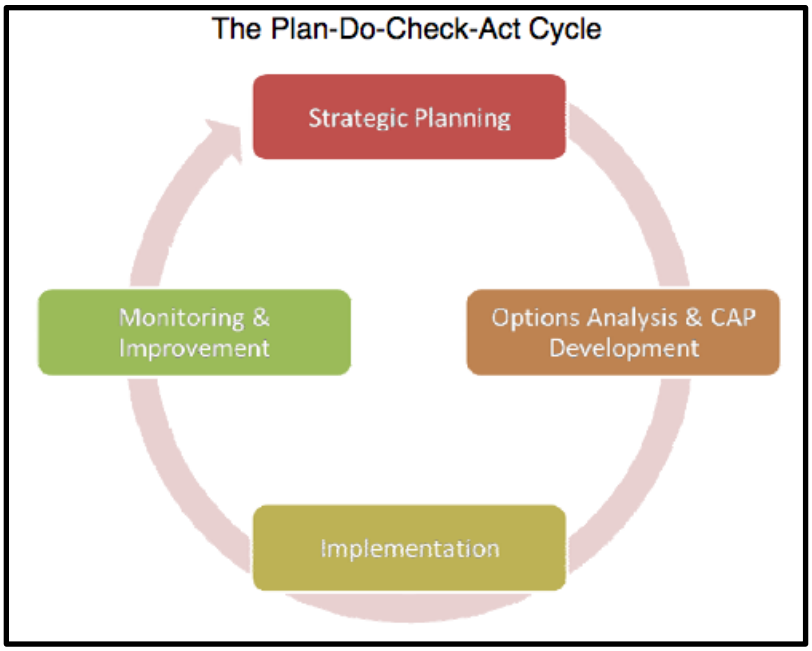


*Figure 3: The "Plan-do-check-act cycle". Source: American Public Transportation Association*[22]

All too often, local governments get funding for one or two of these items - typically "strategic planning" and "options analysis and CAP development - but then run out of funding for implementation, monitoring and improvement. Other times, local governments go through all four stages, but then do not continue the cycle, thereby missing an opportunity to apply lessons learned.

The graphic below provides more detailed information on the four iterative phases:

[22] American Public Transportation Association. Guidelines for Climate Action Planning. APTA Climate Change Standards Working Group. 2011.

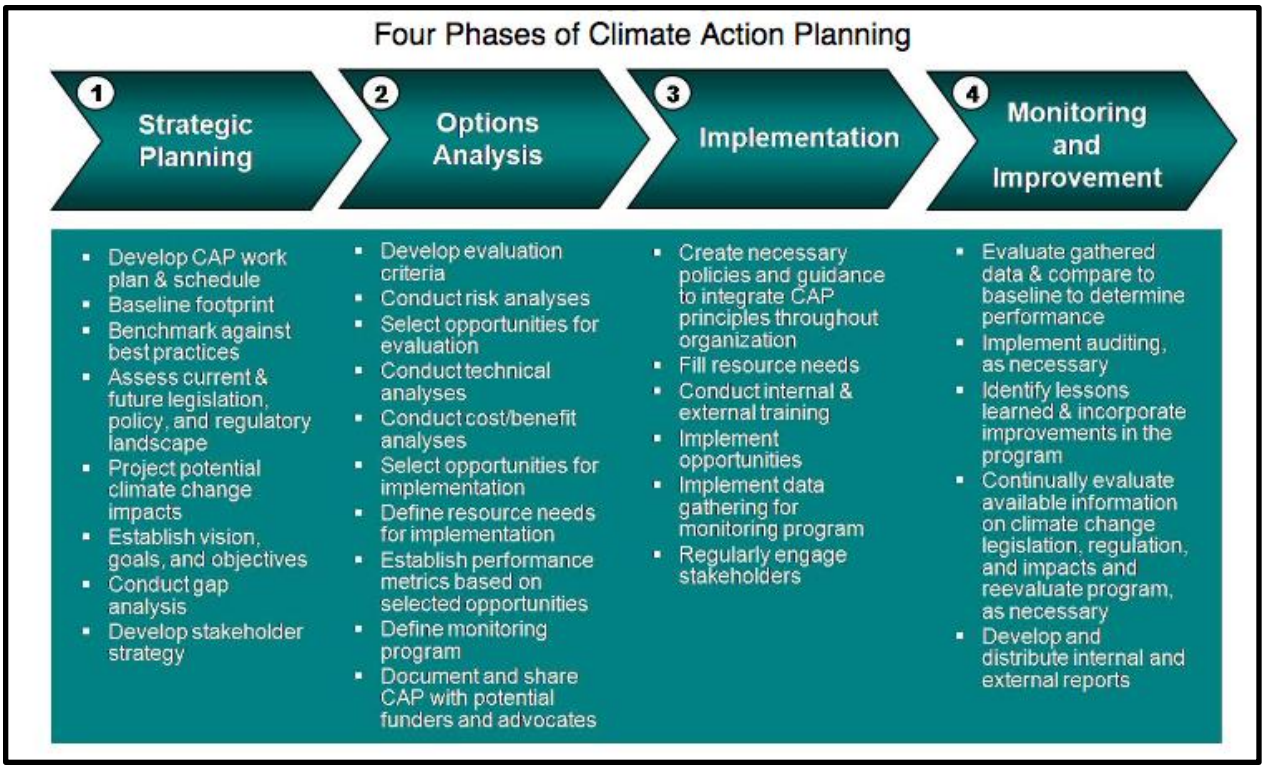


*Figure 4: Phases of CAP Development. Source: American Public Transportation Association*[23]

This graphic illustrates one approach to CAP development. It details key components of four phases of CAP development that can be taken. As noted above, step four is not the end, but rather a transition back to strategic planning and options analysis.

### ★ CAPs need to include certain well-defined contents to ensure success

Virtually all CAPs studied for this report include basic sections like strategic objectives and implementation plan. However, there are a few elements that are often missing from CAPs that could jeopardize their success. Key elements often left out include:

- **Implementation timeline:** important for accountability
- **Prioritization**: without prioritization, "pet projects" may win out, leaving behind strategies that may have been more cost-effective, had a greater potential for GHG reductions, or both

[23] American Public Transportation Association. Guidelines for Climate Action Planning. APTA Climate Change Standards Working Group. 2011.

- **Costs**: estimating implementation costs is crucial to enabling a strategic options analysis process, and to securing funding
- **Funding streams:** a best practice is to include a proposed funding source for each implementation strategy (can be general; need not identify specific organizations). Funding can include *traditional sources* (i.e. transit measures could be funded by the FTA or state DOTs), *nontraditional sources* (like federal and state environmental and energy agencies, private foundations, or other entities that fund climate change and environmental projects and pilots), or *local agencies* (who may have an interest in a given measure, or align with the plan's vision)
- **Vision**: although most CAPs include goals and targets, vision statements are also important because they can elicit community buy-in but illustrating that the CAP is locally relevant and compelling. Vision statements are typically a 3-10 year timeframe
- **Assignment of responsibility:** this section is not always common practice in today's CAPs, yet identifying roles and responsibilities is a critical determinant of success. If not appropriate to share externally, a separate internal document can be created to identify specific agencies, organizations, and stakeholder - and provide accountability and empowerment mechanisms
- **Evaluation plan**: measurement and evaluation are gaining increasing traction in CAPs, especially with a growing number of tools available. Evaluation is important because it establishes a feedback loop, thereby enabling continuous learning and improvement.

## ★ Utilize strategies for overcoming common sticking points (in scoping, options analysis, and evaluation)

### Scoping best practices

Scoping defines the contents, sectors, and boundaries of a CAP. By extension, it can define the success of the plan. Here are three best practices related to scoping.

First, map out emission sources compared to agency authority. If heavy industry contributes the lion's share of emissions, it will be harder for a city or county to reduce those emissions (although policy, rebates, and incentives could be employed to reduce emissions). On the other hand, if residential or commercial energy is the highest source of emissions, the local

government could increase carbon-free sources of electricity (i.e. through direct procurement, green tariffs, renewable portfolio standards, or carbon offsets).

A second scoping consideration is cost constraints. Third party verification is gaining popularity but can be quite expensive upfront. However, third party verification can increase the likelihood of securing funding and can garner stakeholder support. For example, some municipalities in California seek third party verification to comply with CEQA rules and to streamline future projects.

Finally, scoping ought to analyze the regulatory context. Ideally, the CAP will be framed in relationship to local, state, and national environmental regulations. California's SB 97, for example, amends the state's Environmental Quality Action to provide guidelines for addressing GHGs.

### Options analysis best practices

After scoping, options analysis is the next critical step in developing a CAP. The process of selecting implementation strategies ("options analysis") can lead to picking "pet projects" or "quick wins" with low GHGs and/or high costs. To combat these tendencies, the CAP ought to include a selection framework that ensures actions are both realistic and visionary.

Here are a few guiding principles for the options analysis process:

1. Strategies ought to include a mix of short-term wins and long-term bold initiatives.
2. Actions must be ambitious yet achievable
3. Actions must be relevant to the local context, as well as comply with regulations
4. Each action ought to specify costs (including tradeoffs), benefits (including co-benefits), and financing

An evaluation matrix can be instrumental in prioritizing options. The Bay Area Rapid Transit developed a visual options analysis matrix that shows cost on the Y-axis and feasibility on the X-matrix.

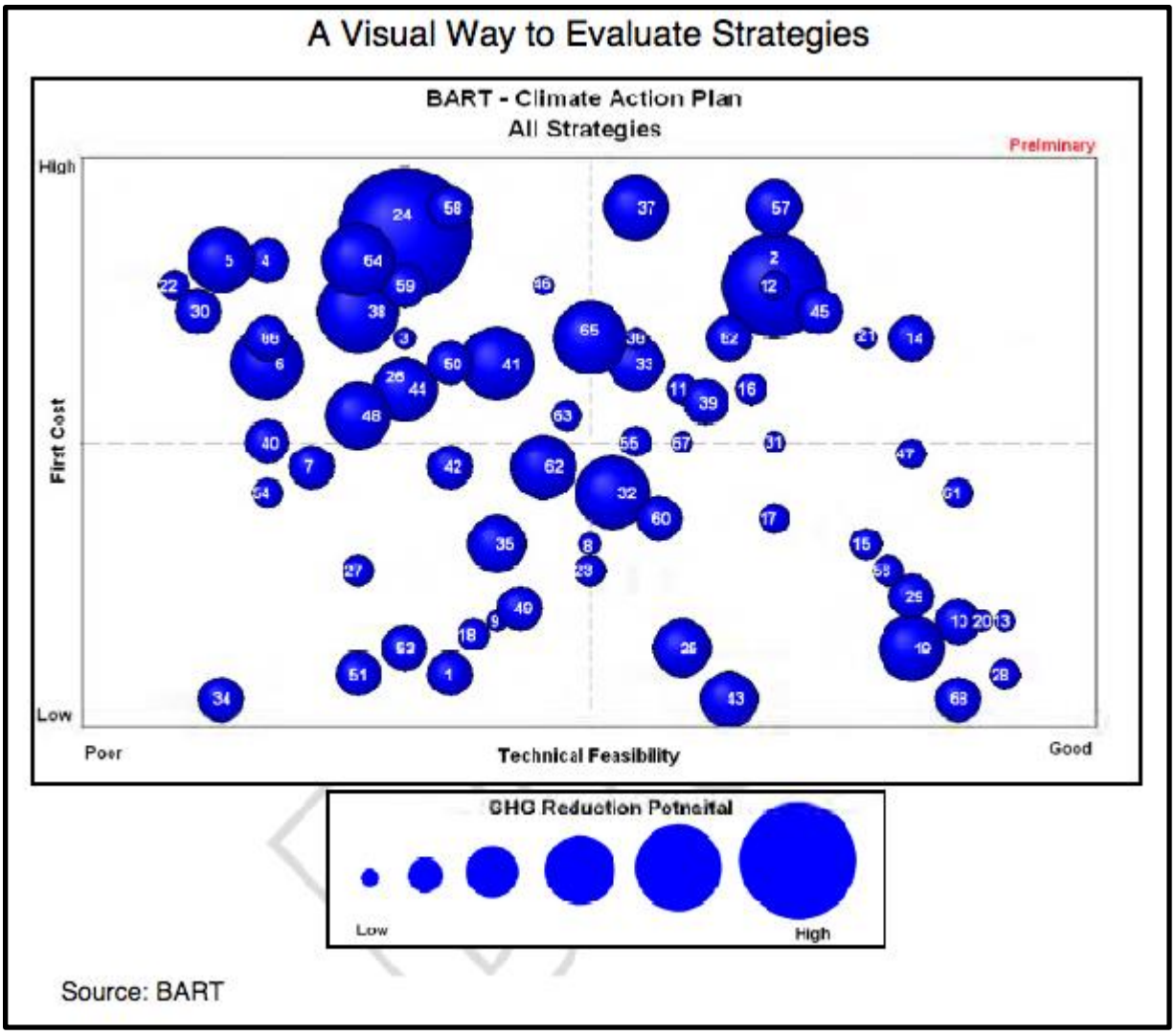


*Figure 5: BART's Options Analysis Framework. Source: BART*[24]

Similarly, the City of Oakland used a new decision support tool called CURB (developed by the World Bank, C40, Bloomberg Philanthropies, Global Covenant of Mayors, and others) to map out the return on investment versus annual GHG impact of implementation strategies. This exercise was conducted for the two main sectors determined to be the largest sources of GHGs (buildings and transportations account for over 80% of Oakland's emissions). The image below shows the ROI and GHG impact for the buildings sector.

[24] http://www.bart.gov/sustainability

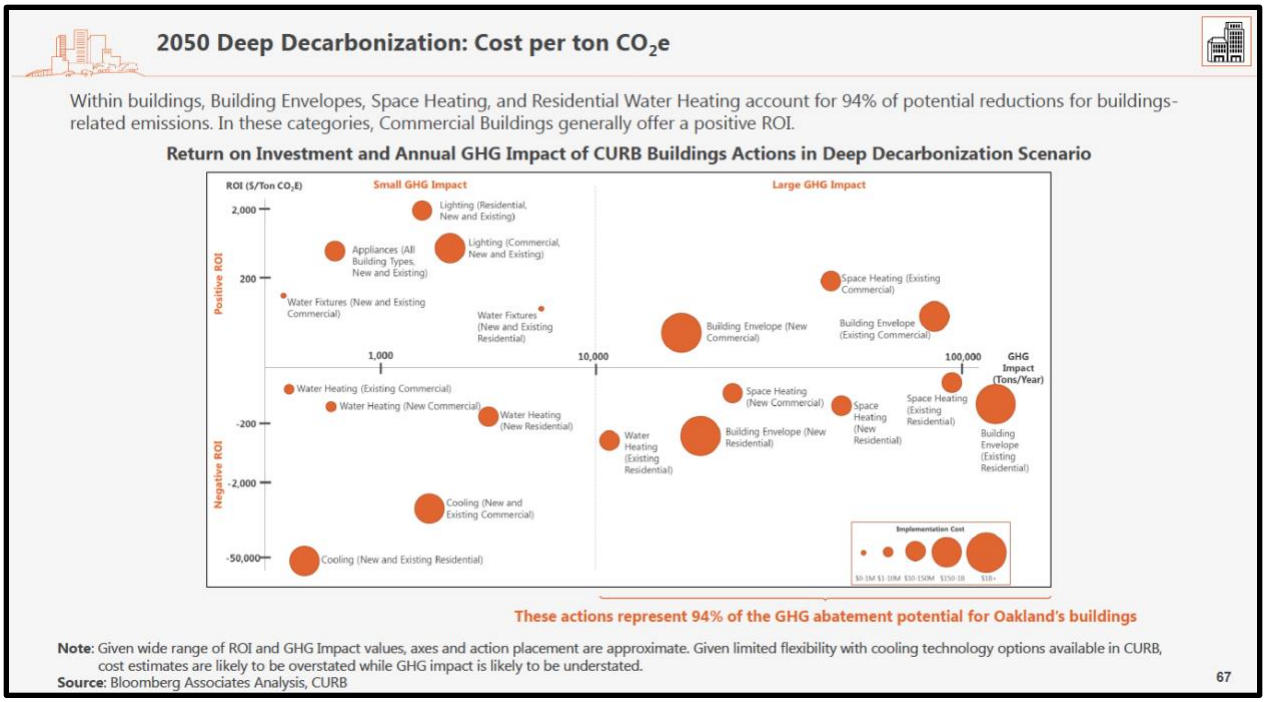


*Figure 6: Oakland's Options Analysis Framework. Source: Bloomberg Associates*[25]

For more information on Oakland's options analysis tool, see Appendix B: Interview Resources.

Options analysis is closely related to evaluation; whatever strategies are chosen through options analysis should be evaluated on an ongoing basis. The framework used for choosing strategies can be revisited for evaluating success of each strategy and the CAP overall.

## Evaluation best practices

Measurement and evaluation can be one of the hardest CAP sections for local governments to develop. Local governments can use a similar framework for evaluating strategies as they used in choosing them, or they can design a standalone evaluation framework.

The table below offers some examples of evaluation categories and indicator targets developed by the American Public Transportation Association, which has developed great resources on climate action planning:

[25] Bloomberg Associates. Pathways to Deep GHG Reductions in Oakland. March 2018.

Examples of Evaluation Categories and Indicator Targets

| Evaluation Category | Indicators *(local or regional transportation targets)* |
|---|---|
| **Operations** | • Increase in ridership *(mode share of 30%)*<br>• Reduction in auto/non-transit VMTs *(10% reduction per capita by 2035)*<br>• Reduced need for off-street parking<br>• Conversion of on-street parking to transit, bicycle and pedestrian uses<br>• Reduction in road maintenance<br>• Shorter commute times *(all modes)* |
| **Vehicles** | • Reduce transit fleet vehicle emissions *( zero emissions by 2020)*<br>• Increase in number of green vehicle registrations |
| **Facilities** | • Increase in energy efficiency and renewable energy *(respectively, 107 MW and 50 MW citywide)*<br>• Provision of infrastructure to support transit and non-transit electric vehicles |
| **Solid Waste and Recycling** | • Optimization of waste reduction *(100% diversion by 2020)* |
| **Employee Travel Demand** | • Reduction in total VMTs *(at least10% reduction by 2035)* |
| **Construction and Capital Projects** | • Diversion of construction and demolition waste from landfills *(100% diversion by 2020)* |

Sources: SFMTA Climate Action Plan (2009, Draft), Climate Action Plan for San Francisco (2004), The Electricity Resource Plan (2002), Transportation 2035 Plan for the San Francisco Bay Area (2009)

*Table 4: Sample Evaluation Categories. Source: American Public Transportation Association*[26]

Building on those criteria, the table below shows high-level criteria and considerations.

Examples of Evaluation Criteria and Considerations

| Evaluation Criteria | Considerations |
|---|---|
| **Primary** | |
| GHG emissions reduction benefit | • GHG per vehicle mile, revenue mile or passenger mile |
| Technical feasibility | • Certainty of technical advances<br>• Technology readiness<br>• Ease of implementation |
| Costs: first and life cycle | • Upfront and life cycle capital costs<br>• Long-term O&M costs |
| **Secondary** | |
| Co-benefits | • Cost savings<br>• Reduced energy demand<br>• Reduced criteria pollutant emissions<br>• Public relations<br>• Land use multiplier<br>• Travel choices<br>• Long-term O&M savings |
| Risks: adaptation and cost | • Climate resilience/adaptation<br>• Certainty of cost estimates |
| Customer satisfaction (and other key agency criteria) | • Passenger crowding<br>• Passenger comfort (temperature)<br>• Passenger safety and security |

[26] American Public Transportation Association. Guidelines for Climate Action Planning. APTA Climate Change Standards Working Group. 2011.

*Table 5: Sample Evaluation Criteria. Source: American Public Transportation Association*[27]

A framework (such as one based on the tables presented above) can be used alone or in conjunction to develop a strong evaluation framework.

### ★ Governance strategy is a key determinant in a CAP's success

Fostering both top-down and bottom-up leadership will garner greater buy-in from staff, stakeholders, and the community at large. Successful CAPs leverage local leaders and trusted messengers such as the Mayor or County Commissioner (top-down leadership), while also empowering community groups that can galvanize collective action (bottom-up leadership).

Another (related) governance strategy is to engage the public at major steps along the way. Engagements can include public meetings, education and outreach, and education programs. Early engagement helps key stakeholders and the public feel like part of the development process, which can pay large dividends during the implementation phase.

Finally, and perhaps most important, is to emphasize governance in the CAP process at large. For example, in the scoping and options analysis stages, financial and people resources should be assigned, if only at a high-level. In the evaluation planning stage, roles and procedures for data collection should be identified upfront - before implementation begins. Lastly, in some jurisdictions, having the relevant agency or government body formally adopt the plan can play an important role in institutionalizing the CAP's importance.

### ★ Policy change is needed to standardize accounting methods

Although out of local government control, standardizing GHG accounting methods would pay large dividends in benchmarking and aggregating the success of CAPs. Recent efforts to standardize accounting methods include the Global Protocol for Community-Scale Greenhouse Gas Inventories (GPC). GPC is a project lead by World Resources Institute, C40 Cities Climate Leadership Group (C40), and ICLEI-Local Governments for Sustainability.

**Recommendations to ensure high-impact climate action plans:**

- ❑ Commit to frequent revisions
- ❑ Integrate actions, staff, and funding with General Plan
- ❑ Design the plan to be standardized yet flexible
- ❑ Remember the key ingredients for success: governance structure, funding sources, realistic timelines, achievable goals, and context-appropriate programs

# Suggested Future Research

Climate action planning is quickly gaining traction in many cities and counties across the United States. As the practice becomes more common, it becomes increasingly important to evaluate its success and disseminate best practices. The following research questions could help ensure climate action planning is as impactful as possible given available resources:

- What is the cost-benefit ratio of climate action planning with regards to GHG reductions?
- Should GHG inventories form the basis for CAPs, and if so, what method should be used?
- What alternatives ought to be used when CAPs fail to deliver desired GHG reductions, or when a more streamlined approach is called for?
- How should emerging sectors like forest and land use be incorporated into CAPs?

# Conclusion

As the most recent Intergovernmental Panel on Climate Change (IPCC) report proclaims, limiting global warming to 1.5°C "would require rapid, far-reaching and unprecedented changes in all aspects of society"[28]. If we cross the 2°C threshold, coral reefs are projected to be virtually lost, the Arctic Ocean is projected to be without sea ice at least once per decade, and global sea level is projected to rise about half a meter, endangering the livelihoods and

[28] IPCC. Global Warming of 1.5°C, an IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. http://www.ipcc.ch/news_and_events/pr_181008_P48_spm.shtml

safety of millions of people living in coastal areas. Furthermore, “global net human-caused emissions of carbon dioxide (CO2) would need to fall by about 45 percent from 2010 levels by 2030, reaching 'net zero' around 2050. This means that any remaining emissions would need to be balanced by removing CO2 from the air.” In sum, “the decisions we make today are critical in ensuring a safe and sustainable world for everyone, both now and in the future”.[29]

These dire forecasts speak to the urgency of taking action immediately. The next few years will chart the course for decades to come. We cannot afford to simply plan. We must act, and act swiftly and strategically. Climate Action Planning must put equal emphasis on action and planning.

The IPCC report speaks to the need for solutions at scale. This report seeks to provide best practices for local governments to create or improve upon their climate action plans, with an ultimate goal of achieving significant greenhouse gas reductions at speed and scale.

In conclusion, although results on the causal connection between CAPs and GHG are mixed, we cannot afford to wait to act. Local governments, along with corporate, state, federa-, and international bodies must take action today to chart the course to a more sustainable tomorrow. Indeed, there are many benefits to be gleaned from taking action, including behavioral spillover benefits and momentum towards GHG reductions.

[29] Ibid.

# Appendix A: Annotated Bibliography of General CAP Resources

The annotated bibliography that follows is organized into two primary sections:

I. General CAP Resources
   A. CAP Guidelines, Templates, and Best Practices
   B. Articles on Emissions Inventories

II. Meta-Analysis of Causal Link between CAPs and GHG reductions
   A. Quantitative articles examining CAP impact
   B. Empirical articles examining CAP impact
   C. Qualitative articles examining CAP impact

There are many more excellent resources available; this bibliography is not intended to be exhaustive.

## I. General CAP Resources

### A. CAP Guidelines, Templates, and Best Practices

1. **Climate Action Plan Template** - from California Statewide Energy Efficiency Collaborative
   http://californiaseec.org/resource/climate-action-plan-template/
   a) Energy-focused

2. **Quickstart Guide for Climate Action Planning** - from California Statewide Energy Efficiency Collaborative
   http://californiaseec.org/resource/quick-start-guide-for-climate-action-planning/
   a) Available to members only

3. **COP21: Annex to Guiding Principles for City Climate Action Planning.** https://unhabitat.org/cop21-guiding-principles-for-city-climate-action-planning-annex

4. **American Public Transportation Association. Guidelines for Climate Action Planning. APTA Climate Change Standards Working Group. 2011.**
   a) Focused on transit, but very detailed and process-oriented guideline to agency CAP
   b) Great visuals

c) Performance and metric-oriented

5. **UN Habitat. Guiding Principles for City Climate Action Planning. United Nations Human Settlements Programme. 2015.** http://e-lib.iclei.org/wp-content/uploads/2016/02/Guiding-Principles-for-City-Climate-Action-Planning.pdf June 17, 2018
    a) More high-level and visionary
    b) Presents an overview of typical CAP development process

6. **Boswell, Greve, and Seale. Local Climate Action Planning. Center for Resource Economics. 2012.** **https://www.springer.com/la/book/9781610912013**
    a) Contents: background and context, importance of CAPs, sample contents

7. **Calhoun, Koben, Jacob Corvidae, Jon Creyts, Matt Jungclaus, James Mandel, Elizabeth O'Grady, and Peter Bronski. The Carbon-Free City Handbook. Rocky Mountain Institute, November, 2017. rmi.org/carbonfreecities**
    a) Focused on 22 strategies within buildings, transportation, electricity, industry, and biological resources. Discusses role of taking actions that have lower GHG reduction potential but that are catalysts for other key actions, and that visibly demonstrate municipal leadership. Also discusses the distinction between actions cities control vs. influence (ie. they control their assets and operations).

8. **carbonn® Climate Registry.** http://carbonn.org/
    a) "The carbonn® Climate Registry (cCR) is a free global reporting platform for climate action by local and subnational governments – cities, towns, states, provinces and regions. It facilitates structured reporting on climate change mitigation and adaptation, also supporting vertically integrated reporting between different levels of government. It currently supports reporting of Measurable, Reportable and Verifiable"

9. **Capacity building and Decision Support Tool, 2013.** https://www.ihs.nl/en/research/research-projects
    a) "The Climate Actions Prioritization (CLIMACT Prio) tool is a climate awareness, decision support and capacity building tool for the prioritization and assessment of climate mitigation and/or adaptation actions at a local level. The Excel-based system uses a multi-criteria approach to assist decision-makers and urban planners to identify a wide range of decision criteria and set"

10. **ICLEI, Local Governments for Sustainability,** an association of over 1200 local governments working for sustainability which work together since 1990.

11. **Cities for Climate Protection,** an affiliate program of ICLEI in which cities commit to concrete actions for carbon reduction.

12. **C40 Cities Climate Leadership Group (C40),** a network of cities created in 2005 by the London May and the Clinton Foundation's climate change initiative.

### B. Articles on GHG Emission Inventories

1. **Khan and Sovacool. Testing the efficacy of voluntary urban greenhouse gas emissions inventories. *Climate Change* (2016) 139:141-154.**

2. **C40 Cities. Consumption-based GHG emissions of C40 cities. 2018.**
    a) Discusses methodologies and results from 79 C40 cities

## II. Meta-Analysis of Causal Link between CAPs and GHG reductions

### A. Quantitative articles examining CAP impact

1. **Boswell, Greve, and Seale. As Assessment of the Link Between Greenhouse Gas Emissions Inventories and Climate Action Plans. 2010. Journal of the American Planning Association, 76:4, 451-462, DOI.**
    a) Review of 30 city's CAPS and GHG inventories across the U.S. showed "mixed adherence to these standards. Although most communities preparing climate action plans do begin with a GHG emissions inventory, many fail to follow through on conducting adequate emissions forecasts, setting meaningful reduction targets, or linking their mitigation measures to these forecasts and targets…. [Therefore] these plans may not effectively address the climate change problem…. We hope that the city planning profession can take a more prominent role in bringing principles of good planning to the emerging field of climate action planning" (page 460).
    b) This conclusion is from an article published 8 years ago, so the same conclusion cannot be assumed to still hold true.

2. **Castán Broto, Vanesa and Harriet Bulkeley. 2013. "A survey of urban climate change experiments in 100 cities." Global Environmental Change. 23(1): 92-102.**
https://www.sciencedirect.com/science/article/pii/S0959378012000891?via%3Dihub
    a) "Cities100 is a publication and shared mission between Sustainia and C40 Cities100 to identify 100 leading city solutions to climate change within ten different sectors, serving as a guide to policies, programs and projects all over the world that seek to create a resilient and productive urban environment. The 100 solutions point to the reality"

b) Analyzes where and when urban climate change experiments occur, types of "experiments", and governance/leadership. Nearly 80% action (in database) began after 2005 Kyoto (not causation but correlation that may indicate the impact international climate change governance efforts have on urban actors). Majority of "experiments" are infrastructure (31%) followed by built environment (25%) then transportation (19%). Adaptation accounts for 12%. Local governments lead 66% of urban climate change initiatives, followed by 15% conducted by the private sector.
c) Key takeaways: Summarizes limitations in analyzing impact (limited quantitative students or rigorous analytical case study comparisons)

3. **Alisa Zomer and Angel Hsu. Cities and Climate Change: Examining the Potential of Cities to Mitigate Global Climate Change. Yale University. 2015.** http://www.stanleyfoundation.org/climatechange/Zomer-Yale-CitiesandClimateChange.pdf
    a) Challenges in assessing and comparing impact due to different methodological approaches, and summary of initiatives to standardize accounting
    b) Works cited links to a wealth of resources

4. **Krause, Rachel M. 2011. "Symbolic or Substantive Policy? Measuring the Extent of Local Commitment to Climate Protection" Environment and Planning C: Government and Policy. 29.1: 46-62**
    a) Abstract: "Over 1000 US municipalities have formally committed to reduce their local greenhouse gas (GHG) emissions through participation in one of several climate-protection networks. This has attracted the attention of researchers interested in theories of free riding and local political decision making who question why municipalities become engaged in this global effort. However, whereas joining a climate-protection network or adopting an emissions-reduction goal are relatively low-cost acts, the *implementation* of such policies entails higher costs. This raises legitimate questions about the extent and type of follow-through made on municipal climate-protection commitments. With this paper I begin to fill in the data gap around municipal climate-protection initiatives and construct an index that quantifies the GHG-reduction policies implemented by local governments. Data informing the index are collected on municipalities in the US state of Indiana and are used to test theories of local political decision making."
    b) Findings: "Despite the fact that only a minority of cities are explicitly undertaking climate-protection efforts, all are engaged in GHG-reducing activities. The most common of these are services, provisioned to the local public, which have important co-benefits (such as curbside recycling and public transportation). Conversely, very few Indiana municipalities have taken steps to institutionalize climate protection as a formal and explicit policy issue. A second key finding emphasizes the importance of policy entrepreneurs in climate protection. Whether or not local actions are explicitly framed as climate protection, cities having an identifiable policy entrepreneur in this issue area have significantly more GHG-reducing activities in place."

5. **Adam Millard-Ball. Do city climate plans reduce emissions? Journal of Urban Economics. Volume 71, Issue 3, May 2012, Pages 289-311. https://people.ucsc.edu/~adammb/publications/Millard-Ball_2012_City_climate_plans_preprint.pdf**
    a) "Using data from California, I provide the first quantitative analysis of the impacts of climate plans. I find that cities with climate plans have had far greater success in implementing strategies to reduce greenhouse gas emissions than their counterparts without such plans. For example, they have more green buildings, spend more on pedestrian and bicycle infrastructure, and have implemented more programs to divert waste from methane-generating landfills. I find little evidence, however, that climate plans play any causal role in this success. Rather, citizens' environmental preferences appear to be a more important driver of both the adoption of climate plans and the pursuit of specific emission reduction measures. Thus, climate plans are largely codifying outcomes that would have been achieved in any case."

6. **Bulkeley, Harriet, and Michele Betsill. 2003. Cities and Climate Change: Urban Sustainability and Global Environmental Governance. London and New York : Routledge**
    a) Analysis of local actions and policy mechanisms, implementation issues and innovation (more so than GHG impacts)

## B. Empirical articles examining CAP-GHG link

1. **Azevedo, Horta, and Leal. Analysis of the relationship between local climate change mitigation actions and greenhouse gas emissions - Empirical insights. Energy Policy journal. September 2017**
    a) "In the context of the three countries analyzed, there is no statistical evidence that municipalities with local action plans have lower specific energy use or GHG emissions than those who do not explicitly have one. Also, it was not proven that the evolution of specific GHG emissions over time is different for municipalities with and without local action plans. Neither the exploratory data analysis nor the panel data regression analysis were able to detect a significant impact of the existence of local plan on GHG emissions. … From the regression analysis, it was possible to confirm that external factors that are not directly related to local climate change mitigation actions may have a significant impact on local GHG emissions. In particular, the local and/or national specificities, and time. … For future research, it would be interesting to complement this study with additional variables that may capture other changes in the local energy system in order to identify the potential effects of existing and past local climate change mitigation actions" (pages 209-210)
    b) Methodological concerns: study looked at national-level, so not comparable to local government action. Furthermore, the study

used different types of data for each of the three countries (for Portugal and Sweden, it used annual energy use by sector and fuel type; but for the UK it used annual GHG emissions per capita by sector - since energy use data wasn't available).

## C. Qualitative articles on CAP impact

1. **NewClimate Institute and C40 Cities. Opportunity 2030: Benefits of Climate Action in Cities. Quantifying the benefits of city-level measures in buildings, transport and energy supply.**
    a) Focuses on projected impacts of certain measures, not actual results
    b) Projected impacts include socioeconomic and health-related benefits, such as job creation (equivalent to 4-12% unemployment population for residential building retrofit measures), lower ambient air pollution, greater energy security, improve mobility and accessibility to city services for lower-income groups
    c) Global assessments projected to be published by the end of Q3 2018, available through an online dashboard

2. **Erickson, P., and K. Tempest (2014). Advancing climate ambition: How city-scale actions can contribute to global climate goals. SEI Working Paper No. 2014-06.** https://www.sei.org/publications/advancing-climate-ambition-how-city-scale-actions-can-contribute-to-global-climate-goals/
    a) "The paper argues that cities have an important role to play in deepening the ambition of global climate targets and quantifies the potential contributions of urban areas to global climate change mitigation, with a focus on sectors over which city leaders have particular influence."
3. **C40 Cities and Ramboll. Urban Climate Action Impacts Framework. A Framework for Describing and Measuring the Wider Impacts of Urban Climate Action.** https://c40-production-images.s3.amazonaws.com/other_uploads/images/1605_C40_UCAIF_report_V3.original.pdf?1518203136
    a) "Framework supports the development of an evidence base which allows for the collection and identification of tools and methods to calculate and quantify impacts (positive impacts vs. negative impacts) of climate actions, and strives towards establishing a more unified and comprehensive approach to cost-benefit analysis of urban climate actions.
    b) The Framework does not yet provide detail on how to measure the scale or magnitude of the impacts, or provide evidence directly: it supports identifying relevant impacts and which population groups might be more affected."
    c) Taxonomy: social, environmental, economic

4. **Deborah Salon, Sinnott Murphy & Gian-Claudia Sciara (2014). Local climate action: motives, enabling factors and barriers, Carbon Management, 5:1, 67-79, DOI: 10.4155/cmt.13.81**
   https://www.tandfonline.com/doi/pdf/10.4155/cmt.13.81
   a) The motives for local climate action often came from within communities and include both tangible local co-benefits of action, as well as the concept that climate action is the 'right thing' to do. Important factors that enable action include strong local champions, supportive residents, and state and national policies and actions. Important barriers to action include lack of local-government staff time and financial resources.

# Appendix B: Interview Resources

The following climate action experts were instrumental in the development of this report. They generously volunteered their time to share insights, resources, challenges, and best practices.

1. Abby Young, Bay Area Air Quality Management District
2. Aleka Seville, Regional Climate Protection Authority
3. Alice LeBlanc, advisor on NYC's Climate Change Adaptation Task Force
4. Dana Armanino, County of Marin
5. Donna Lee, Summit County
6. Greg Guibert, City of Boulder Chief Resiliency Officer
7. Jody London, Contra Costa County
8. Judy Dorsey, the Brendle Group
9. Kaylyn Bopp and Steve and Steve McCannon, Colorado Regional Air Quality Council
10. Lea Yancey, Boulder County
11. Marianna Grossman, Minerva Consultancy
12. Miya Kitahara, Alameda County
13. Sam Krasnobrod, former ICLEI intern and CU Boulder alum
14. Sophie Wolfram, Climate Action Campaign

The experts listed above shared a handful of resources that may be useful to those who are new to climate action planning, as well as those looking to glean innovative tools from leading local governments. Here are excerpts from a few resources they shared:

# CURB: Climate Action Planning Decision Support Tool

CURB is a decision support tool developed by the World Bank, C40, Bloomberg Philanthropies, Global Covenant of Mayors, and others to assist cities in the creation of climate action plans to reduce GHG emissions. The tool was designed to:

- "Provide 'strategic-level' analysis to help the city identify and prioritize low carbon infrastructure and GHG reduction actions
- Help cities make the best use of limited funding by focusing on the actions with greatest impact
- Allow cities to quickly see the emission implications and cost effectiveness of potential actions"[30]

Oakland is the first city to use the tool. Oakland has ambitious targets to reduce GHGs 83% by 2050 (over a 2011 baseline). Despite its leadership as a signatory to the Global Covenant of Mayors and U.S. Climate Alliance, Oakland is not on track to meet its target. It engaged Bloomberg Associates to pilot the CURB model.

The images below illustrate key elements of the model: the methodology, the data-driven framework for choosing which sectors to focus on, and the options-analysis framework.

**Methodology**: CURB employs a four step process to identify where to focus city action.

Step 1: identify baseline conditions.

Step 2: model a projected trajectory vs. a deep decarbonization trajectory.

Step 3: conduct a gap analysis between the two trajectories.

Step 4: develop priority city actions by overlaying the gap analysis with potential GHG reductions.

[30] Bloomberg Associates. Pathways to Deep GHG Reductions in Oakland. March 2018.

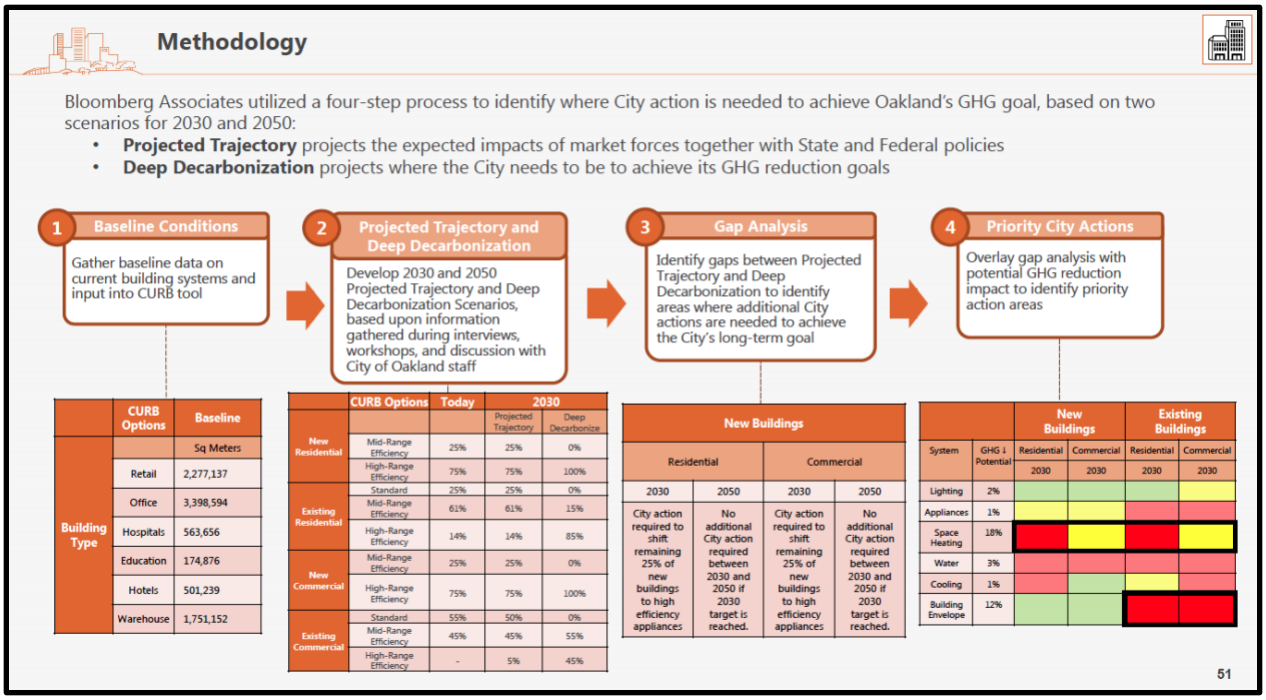


*Figure 7: CURB Methodology*[31]

In Oakland, buildings and transportation generate 86% of the city's GHGs. The CURB model uses information like this to focus city actions where impact potential is the greatest.


[31] Ibid.

*Figure 8: CURB targets highest emission sources*[32]

CURB's options analysis framework overlays the gap analysis with potential GHG reductions in a visual format that makes it relatively easy to select implementation strategies with the highest impact and lowest cost. It's worth noting that the return on investment (illustrated below) and GHG Abatement Curve (not pictured here) do not identify who incurs the cost or receives the benefit of each implementation strategy.

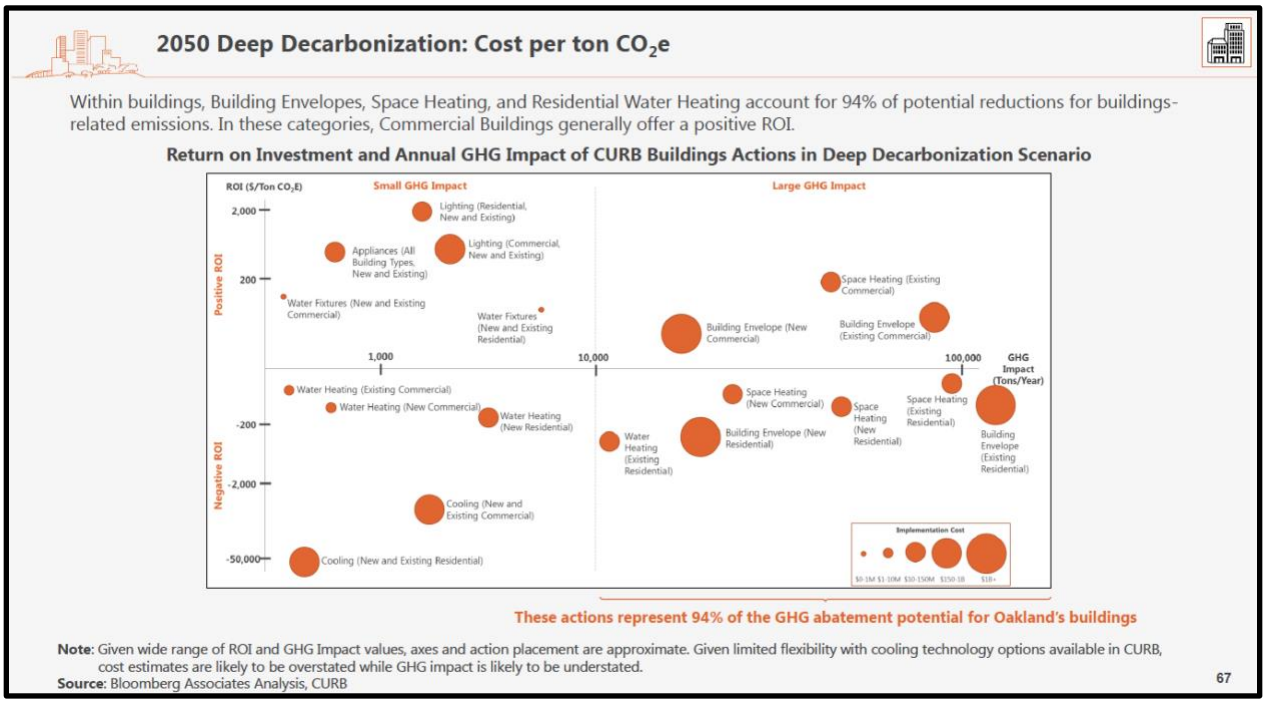


*Figure 9: CURB Options Analysis Chart*[33]

## BAAQMD "Local Government Climate Action Planning Survey Results and Recommendations"

In March 2017, the Bay Area Air Quality Management District (BAAQMD) surveyed local governments. There are 62 cities and counties in the nine-county Bay Area that have adopted formal CAPs. The three objectives of the survey were to identify successful attributes of a

[32] Ibid.
[33] Ibid.

CAP, inform the direction of future BAAQMD assistance programs, and provide local governments with feedback. Here is an excerpt from the survey results:

**Elements of a Successful CAP**

"What makes for a successful program? By cross-referencing self-reported CAP implementation with available GHG emissions data, we identified several programs that have achieved concrete success, from individual measures to entire CAPs. Though there was significant variation among the programs, certain commonalities stood out:

> **Full-time sustainability coordinator** – Many of the most successful CAPs are championed by a full-time sustainability coordinator who oversees and coordinates implementation.
>
> **Frequent reporting** – All of the CAPs we identified as 'successful' report annually or more frequently to a specified overseeing body.
>
> **Largely funded by internal funds** – Of the CAPs identified as 'successful,' most relied on internal funds (general fund or similar) for the majority of their programs.
>
> **Incorporated into General Plan** – Many (though not all) of the successful CAPs had incorporated emissions mitigation measures into the city's general plan, even if they also had a stand-alone climate action plan.
>
> **BAAQMD Resources** – Every successful CAP identified reported using two or more BAAQMD resources to aid their implementation. The most commonly used resources were 'tools and guidance', and 'funding,' though many also used 'information sharing' and 'consumption-based inventories.'

"It is important to note that while these stood out as commonalities, most were not uniformly employed by all of the most successful CAPs. These characteristics alone do not guarantee a successful CAP, nor does lacking these components ensure an unsuccessful one."[34]

In addition to gathering information on what makes CAPs successful, the BAAQMD sought to better understand barriers. The figure below illustrates the top implementation barriers local governments face, according to the BAAQMD survey results:

[34] BAAQMD. Local Government Climate Action Planning Survey Results and Recommendations. March 2017.

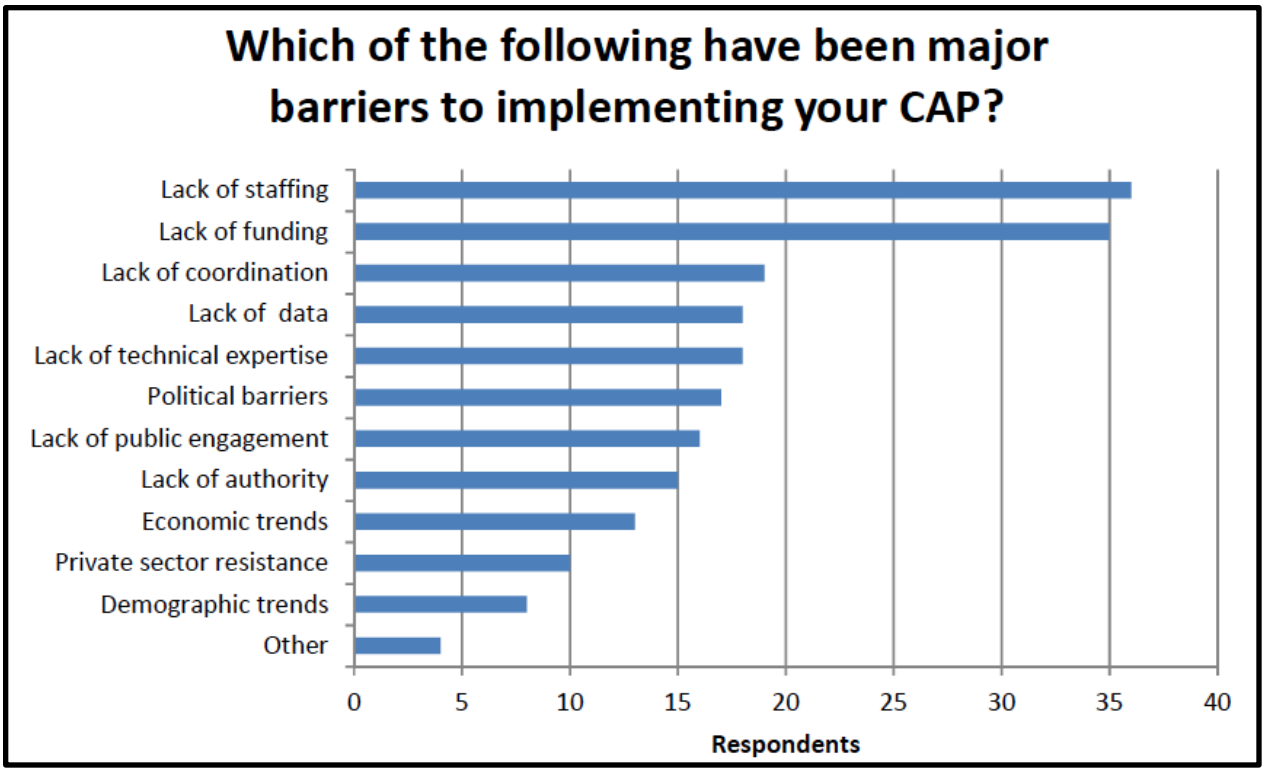


*Figure 10: BAAQMD Survey Results: CAP Implementation Barriers*[35]

## San Diego Climate Action Report Card

San Diego based advocacy group the Center for Climate Action prepares an annual assessment of the region's CAPs efforts. The stated goal is "to spur cities to take action to protect our region's future with legally binding Climate Action Plans that include ambitious emissions reductions targets and best practices gleaned from models in the region. We hope also to arm residents throughout the region with a tool that increases transparency and enables them to hold their local government accountable for doing their part to reduce the pollution that causes climate change."[36]

A summary of the report card results from 2017 are below:

[35] Ibid.
[36] Center for Climate Action. San Diego Climate Action Report Card. https://www.climateactioncampaign.org/reportcard2017/ (Accessed August 7, 2018)

## Breakdown of Scores

- Full Credit - Partial Credit - No Credit

| CAP Scores | San Diego | Del Mar | San Marcos | Carlsbad | National City | Encinitas | Solana Beach | Chula Vista |
|---|---|---|---|---|---|---|---|---|
| | 98 | 73 | 70 | 64 | 52 | 93 | 80 | 61 |
| CAP Adopted (10 pts.) | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Legally Binding (10 pts.) | 10 | 3 | 10 | 10 | 7 | 10 | 6 | 0 |
| State GHG Targets (10 pts.) | 10 | 10 | 10 | 10 | 2 | 10 | 10 | 2 |
| Implementation & Monitoring (10 pts.) | 8 | 9 | 8 | 9 | 6 | 10 | 7 | 7 |
| Equity & Jobs (10 pts.) | 10 | 0 | 5 | 0 | 9 | 8 | 0 | 1 |
| Clean Energy (20 pts) | 20 | 19 | 5 | 11 | 6 | 21* | 19* | 18 |
| Transportation & Land Use (20 pts.) | 20 | 12 | 19 | 11 | 9 | 15 | 18 | 13 |
| Zero-Waste (5 pts.) | 5 | 5 | 0 | 0 | 0 | 4 | 5 | 5 |
| Tree Canopy (5 pts.) | 5 | 5 | 3 | 3 | 3 | 5 | 5 | 5 |

| Implementation Scores | San Diego | Del Mar | San Marcos | Carlsbad | National City |
|---|---|---|---|---|---|
| | 67 | 52 | 6 | 60 | 31 |
| Annual Monitoring Report Published (10 pts.) | 10 | 5 | 0 | 10 | 5 |
| Summary of Progress (15 pts.) | 13 | 5 | 0 | 14 | 5 |
| Progress Reported by Measure (15 pts.) | 10 | 10 | 0 | 15 | 5 |
| Equity & Jobs (10 pts.) | 2 | 2 | 0 | 0 | 2 |
| Clean Energy (20 pts.) | 17 | 15 | 2 | 12 | 3 |
| Transportation & Land Use (20 pts.) | 7 | 7 | 4 | 7 | 8 |
| Zero-Waste (5 pts.) | 5 | 5 | 0 | 0 | 0 |
| Tree Canopy (5 pts.) | 3 | 3 | 0 | 2 | 3 |

*Figure 11: Climate Action Campaign 2017 CAP Scorecard Results*

It's worth noting that points are awarded for transparency on reporting quantitative GHG goals, but the report card does not actually assess GHG reductions. So a city could score really poorly on the structural elements of their CAP, but end up reducing GHGs significantly - and this wouldn't be factored into the report card. Or, as is the case with the city of San Diego, a city could get high marks for the structural set up, and still be a leader in implementation - but miss its CAP targets (as happened in 2017).

# Appendix C: Local Government Policy Mechanisms

CAPs provide local governments with a framework for determining the best strategies to reduce emissions. The figure below presents six approaches and policy mechanisms that local governments can take, as well as their advantages and limitations.

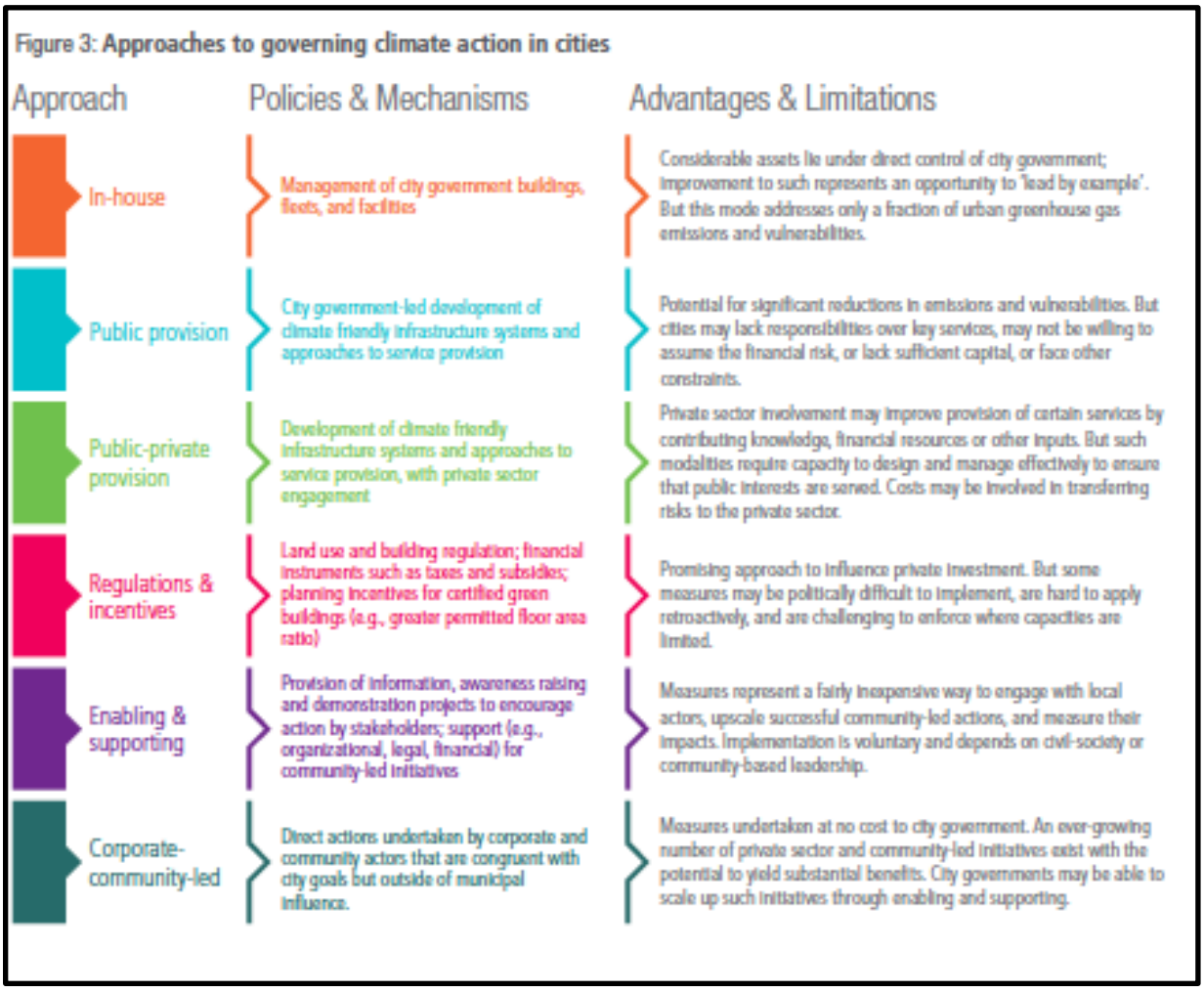


*Figure 12: Climate Action Planning Policy Approaches. Source: UN Habitat*[37]

[37] UN Habitat. Guiding Principles for City Climate Action Planning. United Nations Human Settlements Programme. 2015. http://e-lib.iclei.org/wp-content/uploads/2016/02/Guiding-Principles-for-City-Climate-Action-Planning.pdf (Accessed June 17, 2018)

# Appendix D: Estimates of Local Government-led GHG Reductions

A report by Arup and C40 estimates that global city actions across 228 cities (totalling over 400 million people) could reduce emissions by 13GtCO2e (compared to 2050 business as usual forecast). Meanwhile, Bloomberg Philanthropies and C40 estimates that the Compact of Mayors could spur 454 million tons of CO2 reductions by 2020 domestically.[38]

ICLEI reported early results of CAPs in their 2009 annual report, noting the following achievements:

- Seattle, Washington reduced greenhouse gases to 8% below 1990 by 2005
- Minneapolis, Minnesota reduced emissions by 7% between 2000 and 2006
- San Francisco, California reduced emissions by 5% between 1990 and 2005 (including 8% from peak emissions in 2000)
- Portland, Oregon reduced local carbon emissions by 1% over 1990 levels by 2008, despite rapid population growth
- Broward County, Florida reduced greenhouse gas emissions by 62,491 metric tons annually between 1997 and 2007[39]

None of these statistics demonstrates causation, nor do they normalize for variables like the economy, population, or weather. But they were impressive figures when released in 2009, and may have helped catalyze more cities to take action.

[38] Alisa Zomer and Angel Hsu. Cities and Climate Change: Examining the Potential of Cities to Mitigate Global Climate Change. Yale University. 2015. http://www.stanleyfoundation.org/climatechange/Zomer-Yale-CitiesandClimateChange.pdf

[39] Boswell, Greve, and Seale. Local Climate Action Planning. Center for Resource Economics. 2012. https://www.springer.com/la/book/9781610912013

# Appendix E: Example GHG Targets

The table below provides a snapshot of GHG reduction targets. It is a best practice (and required, in some states) for local government CAPs to specifically reference and roll up to the state's GHG reduction target.

Examples of State and Regional Targets

| Entity | Targets | Notes and Source |
|---|---|---|
| California (statewide) | • 2000 levels by 2010<br>• 1990 levels by 2020<br>• 80% below 1990 by 2050 | Executive Order S-3-05 (http://www.dot.ca.gov/hq/energy/ExecOrderS-3-05.htm), AB 32, SB 375 |
| Hawaii (statewide) | • 1990 levels by 2020 | Act 234 (http://hawaii.gov/dbedt/info/energy/planning/greenhouse) |
| Illinois (statewide) | • 1990 levels by 2020<br>• 60% below 1990 levels by 2050 | Governor's greenhouse gas reduction goals (http://illinois.gov/PressReleases/ShowPressRelease.cfm?SubjectID=2&RecNum=5715) |
| Maine (statewide) | • 1990 levels by 2010<br>• 10% below 1990 by 2020<br>• 75-80% below 2003 long-term | LD 845, HP 622 (http://www.legislature.maine.gov/legis/bills_121st/LD.asp?LD=845) |
| Massachusetts (statewide) | • 1990 levels by 2010<br>• 10% below 1990 by 2020<br>• 75-85% below 1990 long-term | Massachusetts Climate Protection Plan of 2004 (http://www.newamerica.net/files/MAClimateProtPlan0504.pdf) |
| New Jersey (statewide) | • 1990 levels by 2020<br>• 80% below 2006 levels by 2050 | Executive Order #54 (http://www.state.nj.us/infobank/circular/eojsc54.htm) |
| New York (statewide) | • 5% below 1990 by 2010<br>• 10% below 1990 by 2020 | New York State Energy Plan (http://www.nyserda.org/Energy_Information/energy_state_plan.asp) |

*Table 6: Example Climate Action Plan Targets. Source: American Public Transportation Association*[40]

[40] American Public Transportation Association. Guidelines for Climate Action Planning. APTA Climate Change Standards Working Group. 2011.