



CITY OF OAKLAND

FILED
OFFICE OF THE CITY CLERK
OAKLAND

2018 APR 12 PM 3:28

AGENDA REPORT

TO: Sabrina B. Landreth
City Administrator

FROM: Jason Mitchell
Director, Public Works

SUBJECT: Information on Progress of
Implementation of Energy & Climate
Action Plan (ECAP) and GHG
Emissions; Adoption of 2030 GHG
Reduction Target Resolution

DATE: April 2, 2018

City Administrator Approval

Date:

4/12/18

RECOMMENDATION

Staff Recommends That The City Council: 1) Receive Information On The Progress Of Implementing The Priority Actions In Oakland's Energy And Climate Action Plan, Including Level Of Progress, Metrics Used To Determine Progress/Completion, And Process To Date; 2) Receive Information On The Progress Of Reducing Greenhouse Gas Emissions; and 3) Adopt A Resolution Establishing A Greenhouse Gas Emissions Reduction Target Of 56 Percent Below 2005 Emissions By 2030.

EXECUTIVE SUMMARY

This report provides information on the administrative 2017-18 Update of the Energy and Climate Action Plan (ECAP), information on the City's Greenhouse Gas (GHG) Emissions Inventory, and a recommendation to adopt a 2030 GHG emissions reduction target of 56 percent below the baseline 2005 emissions level.

The GHG Emissions Inventory assesses the progress made in reducing emissions in the Oakland community and in the City's municipal operations. The most recent GHG Emissions Inventory, based on 2015 data, shows that Oakland has reduced emissions by 16 percent relative to the 2005 baseline year. This reduction achievement places Oakland as one of the national leaders in lowering GHG emissions. In addition to the creation of a 2015 Emissions Inventory, staff has revised the 2005, 2010 and 2013 Emissions Inventories to ensure that a consistent methodology is applied to all the City's inventories, allowing for more accurate and consistent comparison. This report provides detailed information about the progress documented in the GHG Emissions Inventory.

The ECAP, which serves as the City's primary plan for reducing GHG emissions, calls for periodic updating to reflect changes in technology, progress in implementing Action Items, and other factors necessary to ensure the Plan's viability. The ECAP had not been updated since its adoption by City Council in December 2012. Staff began the process of updating the ECAP in 2016, and has completed its administrative update to re-prioritize Action Items, revise technical

Item: _____
Public Works Committee
April 24, 2018

and demographic information, and provide updated cost information for implementing each of the remaining Action Items. The ECAP contains a Three-Year Priority Implementation Plan that establishes which Action Items require the greatest attention to meet the Council's adopted GHG reduction goal for 2020. The administrative update ensures that the ECAP will continue to guide GHG reduction strategies effectively through the remainder of the timeframe for the Plan (2020). This report provides a summary of implementation to-date and changes made in the administrative update to the ECAP.

Finally, staff recommends that City Council adopt a GHG reduction target for the year 2030. City Council has previously adopted GHG targets of 36 percent reduction by 2020 and 83 percent reduction by 2050, representing short-term and long-term targets for reducing the level of emissions generated in the City. To achieve the 2020 target, Council adopted the ECAP to cover the 10-year period from 2010-2020. To plan for the next 10 years of GHG reductions, staff is recommending a new 2030 target be established. Based on analysis of progress in reducing emissions and expected market and technology adoptions, staff is recommending a 2030 target of 56 percent reduction by 2030. This level of reduction is considered achievable with continued investment and focus by the City, and ensures Oakland remains on track to reach the long-term goal of reducing emissions 83 percent by 2050. This report provides an analysis and recommendation for the establishment of a 2030 GHG reduction target.

BACKGROUND / LEGISLATIVE HISTORY

City Council adopted two Resolutions that guide the development, update, and focus of GHG Emissions Inventories, and the ECAP. Resolution No. 82129 C.M.S., approved July 7, 2009, directs staff to develop the ECAP using a GHG reduction target of 36 percent below 2005 emissions levels by 2020. Resolution No. 84126 C.M.S., approved December 4, 2012, adopted the ECAP and establishes the procedures for administrative update of the ECAP. The adopted ECAP included the City's first GHG Emissions Inventory as an Appendix.

Resolutions No. 82129 C.M.S. and No. 84126 C.M.S. provide the basis for the current and future updates to the GHG Emissions Inventories and ECAP. Outside of the provision of the Under 2 Memorandum of Understanding (MOU) that the City adopt a 2030 GHG reduction target (details provided below), all required components of the intergovernmental agreements are met through existing City policy and ongoing actions.

The ECAP includes a section indicating that staff will provide Council with annual updates on the progress made in implementing the Plan. One formal update on progress made in implementing the ECAP was provided to Council on March 22, 2016. In addition to the Council report, staff has annually created and published a Sustainable Oakland Report to provide an overview of major accomplishments and an update on major elements and programs in the ECAP. It gives an update on sustainability actions in the city, both those led by the City government and those led by the community.

Additional City Commitments to GHG Reduction – In addition to the two Resolutions adopted by the City Council, Mayor Libby Schaaf has signed two non-binding agreements among local,

state, and regional governments to inventory GHG emissions, develop emissions reduction strategies, and report citywide emissions at a greater frequency than that specified in the ECAP. These two agreements are the Global Covenant of Mayors and the Under 2 Memorandum of Understanding. Additionally, the Mayor signed the Pacific North America Climate Leadership Agreement, committing the City to work with other progressive west coast cities and states/provinces in the United States and Canada on leading climate change programs and efforts. These three agreements are described below.

Global Covenant of Mayors – Launched at the 2014 United Nations Climate Summit, the Global Covenant of Mayors (originally titled “Compact of Mayors”) is the world’s largest coalition of city leaders addressing climate change by pledging to reduce their greenhouse gas emissions, tracking their progress and preparing for the impacts of climate change. The Compact requires the City of Oakland to inventory and report GHG emissions at least every three years, disclose climate hazards within one year, and disclose climate vulnerabilities within two years. The City entered the Covenant on August 10, 2015.

Under 2 Memorandum of Understanding (Under 2 MOU) – This agreement was signed by Mayor Schaaf in Paris at the U.N. Climate Change Conference of Parties, on December 6, 2015. Each signatory commits to limit emissions to 80 to 95 percent below 1990 levels, or below two metric tons per capita, by 2050, which is the level of emission reduction believed necessary to limit global warming to less than 2°C by the end of this century. This is consistent with the City’s adopted GHG reduction target of 83 percent by 2050.

Table 1: City Requirements Under Climate Agreements provides the requirements of compliance with the two agreements. While additional details are contained in the Global Covenant of Mayors and the Under 2 MOU, the requirements below constitute the major provisions of the efforts.

Table 1: City Requirements Under Climate Agreements

Requirement	Covenant of Mayors	Under 2 MOU	Status
Report Core GHG Emissions	Every 3 years	--	Complete
Report Climate Hazards	By 2016	--	Complete
Adopt GHG Reduction Targets	Adopt Targets as Appropriate to City	2030 and 2050 targets	2050 Target complete, 2030 target not adopted*
Report Climate Vulnerabilities	By 2017	--	Underway
Adopt Climate Action Plan	By 2018	--	Complete

* City Council adopted GHG reduction targets for 2020 and 2050.

Pacific North America Climate Leadership Agreement (PNACLA) – On June 1, 2016, Mayor Schaaf signed the PNACLA at the Clean Energy Ministerial conference in San Francisco. This agreement, between the cities of Vancouver, Seattle, Portland, San Francisco, Oakland, and Los Angeles, as well as the states/provinces of California, Oregon, Washington, and British Columbia, established a formal commitment among these governments to pursue joint efforts to

reduce GHG emissions through advanced programs focused on eliminating fossil fuels from buildings, creating clean energy, reducing waste, supporting electric vehicles, and greening municipal and port operations.

ANALYSIS AND POLICY ALTERNATIVES

2018 ECAP Progress

The ECAP was adopted on December 4, 2012 by City Council, establishing a comprehensive strategy to meet the City's 2020 GHG reduction target. It includes 175 Actions to meet the 36 percent reduction target, divided into three categories.

- Category 1: Priority Actions with Existing Resources, which identified policies and programs that can be pursued with existing departmental structures and budget commitments.
- Category 2: Priority Actions Requiring New Resources, which included critical actions for which new funding, staffing, or other support are needed to fully implement.
- Category 3: Additional Actions, which included potential programs, policies, collaborations, and partnerships that are needed to reach the 2020 target.

The progress report from 2016 documented that 25 of the 29 Category 1 actions had achieved substantial progress or were fully complete or underway, and 20 of the 32 Category 2 actions had achieved similar progress. Progress included significant accomplishments in reducing the carbon footprint of new developments, transitioning the City's vehicle fleet to electric and alternative fuel vehicles, shifting to cleaner energy, retrofitting thousands of Oakland homes and businesses with energy efficient lighting and appliances, and increasing the rates of recycling and composting across the community. Since adoption of the ECAP, the City has tripled the number of rooftop solar systems in Oakland, worked with other cities to create and launch a community choice energy program, and created a Sea Level Rise Road Map to guide the City's efforts to adapt to rising water levels in the Bay.

Based on analysis of the implementation progress made to-date and documented reductions shown in the GHG Emissions Inventory, staff initiated an administrative update to the ECAP in late 2016. This administrative update focused on modifying ECAP sections to reflect changes in funding, available technology, and incorporating recent information and knowledge of the most impactful climate programs. Additional changes included updates to technical information, updates to the Priority Actions to reflect the remaining areas of greatest need, and the addition of cost information to the remaining items to help strategize options for financing the remaining ECAP actions.

In March 2018, staff completed the administrative Update to the ECAP, providing revisions necessary to ensure the Plan's continuing viability and efficacy. These included changes to Priority Actions and the creation of a new category identifying actions that are fully implemented or complete. *Priority Actions Complete or Fully Underway*, along with *Priority Actions with Existing Resources*, and *Priority Actions Requiring New Resources* constitute the section of the ECAP entitled "Final Three Year Priority Implementation Plan". Key changes to Priority Action

Items are listed in the ECAP (**Attachment A**) Appendix Table 2. In summary, the changes to the ECAP are as follows:

- 32 Action Items have been completed or are fully underway as of early 2017 and are summarized in a new section of Chapter 4, *Priority Actions Complete or Fully Underway*
- 30 Action Items were newly prioritized, as indicated by a star icon in the *Priority Action Supported by Existing Resources* and the *Priority Actions Requiring New Resources* sections of Chapter 4
- Updated climate data was added to the report, providing an up-to-date understanding of GHG emissions in Oakland
- Cost estimates have been added to all Priority Actions in Chapter 4, indicating projected costs in both dollars and staff/consultant hours
- The Appendix has been updated to remove previous scenario analysis by sector, and revised to reflect the methodology for creating GHG inventories for communitywide emissions.

The revised ECAP builds on the implementation successes of the past six years to prioritize the remaining sustainability and climate needs identified in the Plan. These include expanding the City's infrastructure for electric vehicles, expanding the Bus Rapid Transit system, expanding climate programs in multifamily housing, increasing community engagement and coordination on climate education, and accelerating investment in energy efficiency in municipal buildings. The past six years have seen widespread accomplishments in implementing the ECAP, not only by staff but also by a wide array of community groups, non-profits, neighborhood organizations, and for-profit companies. Continuing to find ways to empower and partner with these groups is essential to accelerating the City's efforts and reaching annual levels of GHG reduction that place the City on track to meet its goals.

2015 GHG Emissions Inventory Update

Since the creation of the initial ECAP and GHG Emissions Inventory, staff has sought to regularly update emissions analysis to track progress in reducing the community's overall contribution to climate change and to evaluate the efficacy of the overall municipal program to reduce emissions. GHG emissions are comprised of six gasses, each of which has a distinct global warming potential. This potential is described in carbon dioxide equivalents (CO₂e). Describing emissions in terms of CO₂e allows for a single metric to be tracked over time, and makes comparisons and progress simpler to gauge.

Staff analyzes emissions in two different ways. The first and primary method, called a core inventory, is an accounting of all emissions generated within the boundaries of the City. This is the standard for inventories around the world, and is the required approach for reporting through the agreements discussed previously. However, this approach does not account for the emissions generated elsewhere to serve those living and working in Oakland, such as emissions from production of goods overseas, which are shipped to the United States for purchase locally. To address this, staff also calculates emissions that include all products and services consumed in Oakland. This approach, called a consumption inventory, provides a more comprehensive view of emissions for which the community is responsible. An example of this difference can be seen in emissions from driving a car. In the core inventory, only the emissions from the tailpipe are included. In the consumption inventory, the tailpipe emissions

are included, but so are emissions associated with extracting the oil, refining it into gasoline, and shipping the fuel to a local gas station.

As part of its ongoing focus on climate change, the Environmental Services Division of Oakland Public Works has completed core and consumption inventories for the 2005, 2010, 2013 and 2015 calendar years. Each inventory breaks down emissions into the categories of transportation and land use, buildings and energy use, material waste, the Port of Oakland, and local government (City of Oakland). Data on emissions in the community is typically not available until at least 18 months after the period to be evaluated, creating a gap between the current year and the most recent analysis. Both core and consumption inventories have been completed for each of the years discussed in this section.

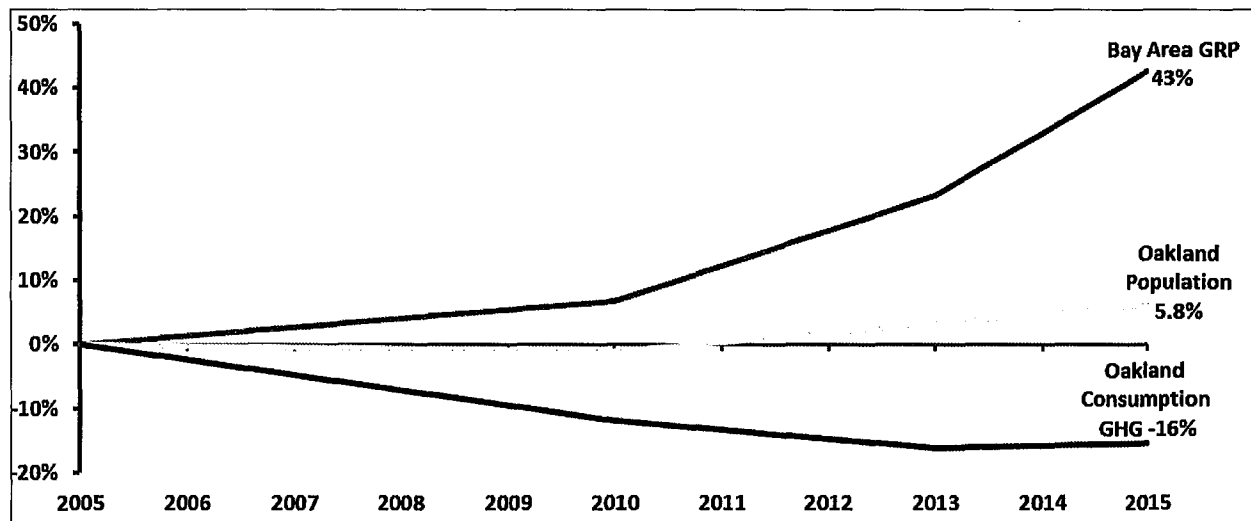
The fourth and most recent GHG Emissions Inventory covers calendar year 2015. The 2015 GHG Emissions Inventory Report (**Attachment B**) details the findings of the core and consumption inventories, along with progress towards the City's 2020 target of reducing emissions by 36 percent, and was completed in March 2018. The City's emissions have been reduced 16 percent over the 2005-2015 period. While core emissions have seen a generally consistent and steady decline over this period, the consumption emissions have seen growth in the most recent two years analyzed. This indicates that while Oakland continues to reduce emissions within its borders, greater economic activity is creating additional demand for goods and services from other areas to serve local residents. Oakland's total reduction in emissions is shown in the Table 2: GHG Emissions.

Table 2: Oakland GHG Emissions

		2005	2010	2013	2015
Total Emissions (MTCO₂e)	Core	2,987,669	2,717,919	2,606,893	2,497,088
	Consumption	8,907,638	7,850,363	7,467,640	7,520,929
Reduction From 2005 Baseline	Core	-	9%	12.7%	16.4%
	Consumption	-	11.9%	16.2%	15.6%

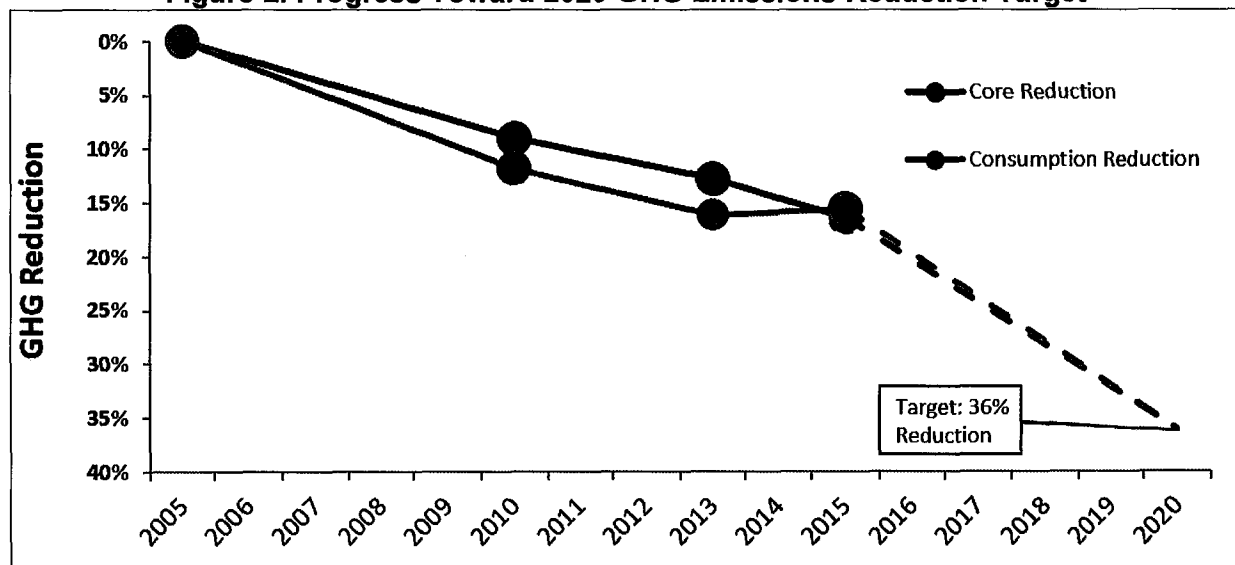
While no Oakland-specific economic activity numbers are available, over the 10-year period between 2005-2015, the Gross Regional Product, a composite figure representing overall economic activity in the Bay Area, increased by 43 percent. In the same period, the population of the city grew by 5.8 percent. Economic activity and population growth would be expected to generate additional emissions, worsening the overall performance of the City's GHG reduction efforts. However, in both the core and consumption inventories, overall emissions in Oakland have been reduced by approximately 16 percent since 2005. This demonstrates that Oakland is finding ways to reduce its emissions even as more people live and work in Oakland. Figure 1: Oakland Population, Consumption Based GHG Emissions, and Bay Area GRP shows the relationship of the economic growth of the City relative to its reduction in GHG emissions.

Figure 1: Oakland Population, Consumption Based GHG Emissions, and Bay Area GRP



While Oakland continues to make progress towards the adopted target of 36 percent reduction by 2020, the Figure 2. Progress Toward 2020 GHG Emissions Reduction Target illustrates that the City is not on track to achieve this goal. While the City is not on track to achieve its 36 percent target at the current rate of emissions reduction, this is common to almost all major U.S. cities. Based on comparisons to other U.S. cities, Oakland's progress documented in the GHG Emissions Inventory is excellent. In addition, the per capita rate of GHG emissions for Oakland is among the best in the nation for midsize and large cities. The 2015 GHG Emissions Inventory showed Oakland's per capita core emissions are 46 percent lower than the average in the state of California, and 71 percent lower than the national average.

Figure 2. Progress Toward 2020 GHG Emissions Reduction Target



2030 GHG Emissions Reduction Target Recommendation

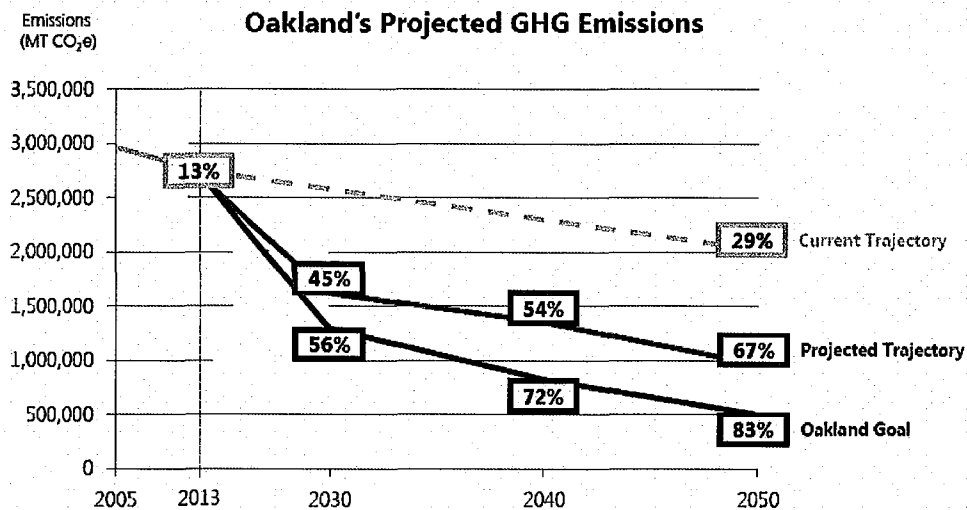
Simultaneous with the development of the 2015 GHG inventory and the administrative update to the ECAP, staff worked with Bloomberg Associates from late 2016 through March 2018 to evaluate the most cost-effective methods for the City to achieve its GHG reduction targets. This work included analysis to identify appropriate intermediate GHG reduction targets for 2030 and 2040. This was accomplished by using a newly developed climate model, CURB, to identify opportunities and measure the impact of deep GHG reductions.

CURB was developed by the World Bank, C40, Bloomberg Philanthropies, and the Global Covenant of Mayors 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 implication and cost effectiveness of potential actions; and
- Project the expected impacts of market forces together with State and Federal policies.

Oakland is the first city in North America to use the tool in depth as a key input to its planning, and the first to use the tool to help determine appropriate interim targets to meet long-term targets for reducing emissions. The CURB Final Report (**Attachment C**) provides recommendations for interim targets in 2030 and 2040 necessary to keep the City on track to meet its adopted target of reducing emissions 83 percent by 2050, and identifies the most cost-effective and impactful actions and areas of focus for reducing emissions.

Consistent with the GHG Emissions Inventory prepared by the City, the CURB Final Report concludes that the City is not on track to meet its 2020 GHG reduction target, nor its long-term 2050 target. Without government action at any level (local, State, federal), Oakland is on track to achieve a 29 percent decrease in emissions by 2050 (the rate of emissions reductions will decrease over time due to population growth). Even accounting for expected changes, including market trends and technological advances, State and Federal policies, and adopted and funded City policies Oakland is projected to fall short of its 2050 target by 16 percent. In the short term, CURB predicts that after accounting for anticipated changes, Oakland will reduce its GHG emissions 45 percent by 2030, 54 percent by 2040, and 67 percent by 2050. While these reductions are significant, they are insufficient to achieve Oakland's adopted 2050 target. CURB's projected GHG emission levels and recommended targets for Oakland, including the 2050 target of reducing emissions by 83 percent, are provided in the chart below.



CURB identifies an interim 2030 GHG emission reduction target to of 56 percent below 2005 levels to keep the City on track to meet its 2050 target. This target level is aggressive, requiring significant action by the City to achieve. However, the model provides the basis for a viable cost-effective strategy to accomplish this level of GHG emissions reduction.

While cities must consider all climate actions to achieve deep reductions, the CURB analysis shows that not all actions are equal. Given the projected changes that will occur to Oakland's building and transportation systems as new technologies are adopted and state and federal regulations take effect, CURB has identified five actions projected to have an outsized impact on the City's GHG emissions reduction efforts. Specifically, the following actions were shown to provide the most cost-effective impacts:

- Shift to 100% carbon-free energy
- Eliminate fossil fuels from building heating systems
- Improve building insulation and windows
- Significantly shift away from single occupancy vehicles
- Accelerate electrification of vehicles

Designing actions to meet the goals above would provide the City with a path to meeting the recommended 2030 GHG emission target and for coming into compliance with its commitment to the "Under 2 MOU".

The CURB Final Report, along with the GHG Emissions Inventory and the administrative update to the ECAP, provide the framework for priorities in the next iteration of the City's climate strategy. While a substantial public engagement process will be needed as part of the effort to craft impactful and meaningful action items consistent with these findings, this information provides the City with timely information about the current GHG emissions, the GHG reduction potential for a wide range of GHG reduction strategies, and cost-effectiveness evaluation of the various options available to the City.

FISCAL IMPACT

No fiscal impacts are associated with this item. The ECAP and GHG updates are considered informational for City Council. The recommendation for a Resolution to adopt a 2030 GHG reduction target will require investment of resources to accomplish, but fiscal impacts will be fully evaluated in the Council consideration of a future climate action strategy. The adoption of the target itself does not create fiscal impacts to the City.

PUBLIC OUTREACH / INTEREST

Significant public outreach and coordination was conducted by staff in preparing the administrative update to the ECAP. Staff convened multiple stakeholder groups representing the environmental and climate justice communities, local businesses, forestry advocates, and the Oakland Climate Action Coalition. In addition, staff held individual discussions with outside parties who have assisted in implementing Action Items, and coordinated updates and priorities consistent with the feedback provided in these outreach activities.

In conducting the CURB analysis, City Staff and Bloomberg Associates interviewed more than 30 local and national experts and hosted a series of sector-specific workshops with more than 50 Bay Area experts to refine data and collaboratively estimate the City's projected trajectory and actions needed to achieve GHG reduction goals.

COORDINATION

City Staff coordinated on the preparation of the GHG Emissions Inventory with multiple departments in the City, including the Planning and Building Department, Oakland Public Works, Economic and Workforce Development, Housing and Community Development, Department of Transportation, and the City Administrator's Office. Coordination with external agencies included East Bay Municipal Utility District, PG&E, Alameda County Department of Environmental Health, Association of Bay Area Governments, Bay Area Air Quality Management District, and the Metropolitan Transportation Commission. The ECAP administrative update was coordinated through multiple City departments, including Planning and Building Department, Oakland Public Works, Economic and Workforce Development, Housing and Community Development, the Port of Oakland, Department of Transportation, and the City Administrator's Office. The preparation of the CURB analysis was coordinated with the Department of Transportation, the Mayor's Office, and the Office of Transportation.

SUSTAINABLE OPPORTUNITIES

Economic: The GHG Target in the Resolution would provide direction relative to the City's ongoing commitment to reduce greenhouse gas emissions in Oakland. The strategies developed to implement these reductions have the potential to create thousands of local jobs in

green sectors including green energy, energy efficiency, recycling, technology, automotive sales and repairs, infrastructure construction, and many others.

Environmental: The establishment of a 2030 GHG reduction target would provide substantial environmental benefits. These include a reduction in Oakland's contribution to rising levels of greenhouse gas emissions, improvement of local health outcomes, opportunities for expansion of urban forest and tree canopy, reduced energy demands, and reduced pollution.

Social Equity: The establishment of a 2030 GHG reduction target would offer the opportunity to expand the social equity-focused climate programs, both in the existing ECAP and in future climate strategies. These include opportunities for expanding green jobs for disadvantaged populations, improving environmental equity across Oakland neighborhoods, addressing historic environmental and climate injustices, and building resilience in vulnerable communities.

ACTION REQUESTED OF THE CITY COUNCIL

Staff Recommends that the City Council: 1) Receive information on the progress of implementing the priority actions in Oakland's Energy and Climate Action Plan, including level of progress, metrics used to determine progress/completion, and process to date; 2) Receive information on the progress of reducing greenhouse gas emissions; and 3) Adopt a resolution establishing a greenhouse gas emissions reduction target of 56 percent below 2005 emissions by 2030.

For questions regarding this report, please contact Daniel Hamilton, Sustainability Program Manager, at (510) 238-6179.

Respectfully submitted,



JASON MITCHELL
Director, Oakland Public Works

Reviewed by:
David Ferguson, Interim Assistant Director

Reviewed by:
Becky Dowdakin, Environmental Services
Manager

Prepared by:
Daniel Hamilton, Sustainability Program
Manager

Attachments (3)

A: 2017-18 ECAP (Post-Administrative Update)

B: 2018 GHG Emissions Inventory Report

C: CURB Final Report

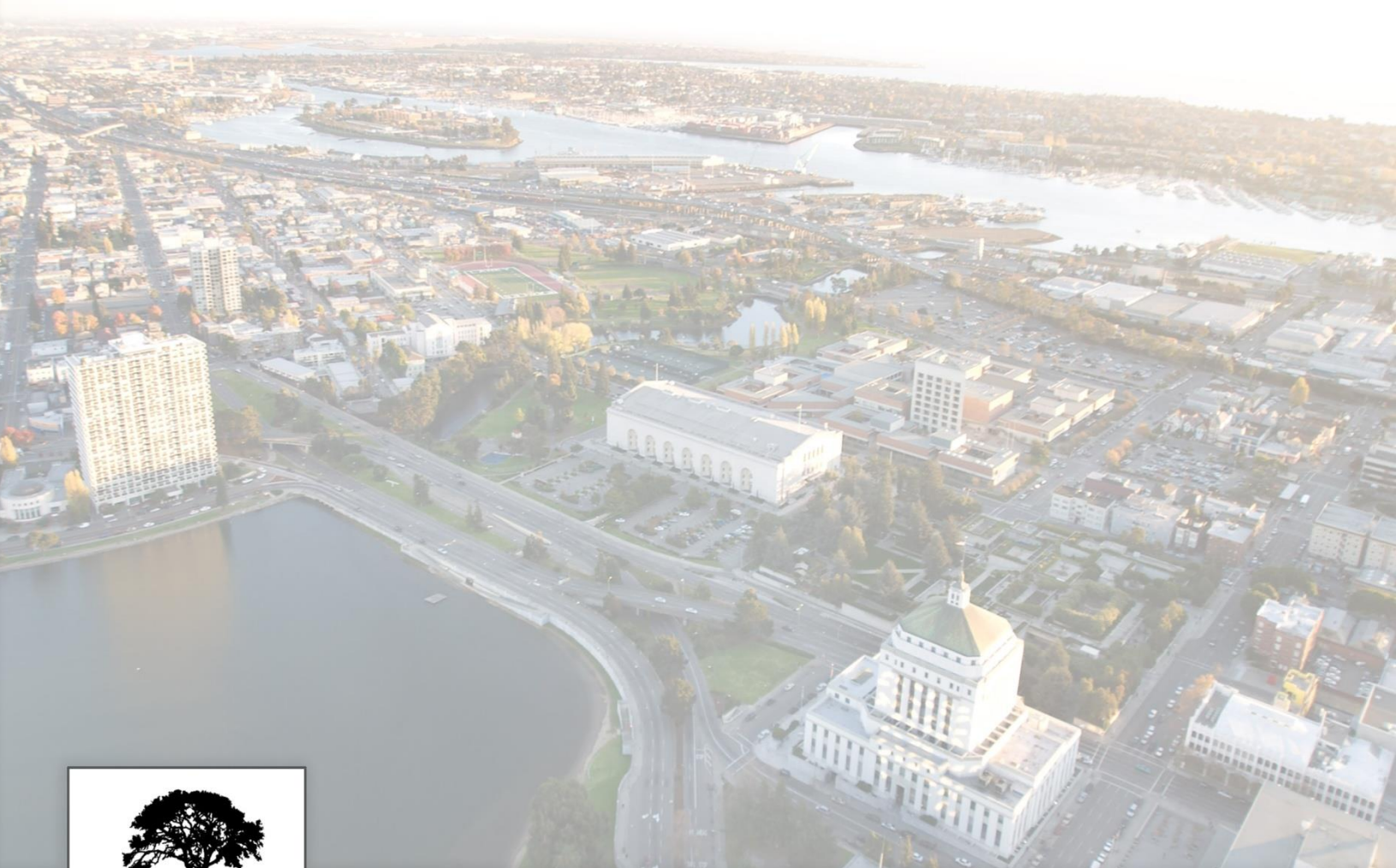
Item: _____
Public Works Committee
April 24, 2018

City of Oakland

Energy and Climate Action Plan

December 4, 2012

(Updated March 2018)



The Oakland Energy and Climate Action Plan was adopted by City Council on December 4, 2012. An Administrative Update to this document was completed in 2018.

Mayor

Jean Quan

Members of the City Council

Larry Reid (District 7)
President

Nancy Nadel (District 3)
Vice Mayor

Desley Brooks (District 6)	Rebecca Kaplan (At Large)
Jane Brunner (District 1)	Pat Kernighan (District 2)
Ignacio De La Fuente (District 5)	Libby Schaaf (District 4)

Elected Officers

Barbara Parker, City Attorney

Courtney Ruby, City Auditor

Administration

Deanna Santana, City Administrator

Arturo Sanchez, Deputy City Administrator

Fred Blackwell, Assistant City Administrator

Scott Johnson, Assistant City Administrator

LaTonda Simmons, City Clerk

Vitaly B. Troyan, P.E., Director, Public Works Department

Brooke A. Levin, Assistant Director, Public Works Department

David Ferguson, Assistant Director, Public Works Department

Mike Neary, Assistant Director, Public Works Department

The Public Works Department would like to thank the following for their contributions to this document:

Funders: City of Oakland, Bay Area Air Quality Management District

Contributors: Members of the Oakland Climate Action Coalition, AC Transit, StopWaste.Org, QuEST, Energy Solutions, Beyond Compliance, Pacific Institute, City of Berkeley, City of Hayward, Alameda County, and all members of the Oakland community who have provided input into the development of this document

City Staff: Garrett Fitzgerald (project manager), Eric Angstadt, Michelle Byrd, Napoleon Campbell, Becky Dowdakin, Diana Downton, Lesley Estes, Mark Gagliardi, Aliza Gallo, Mark Gomez, Meghan Horl, Gregory Hunter, Jeff Hutcher, Susan Kattchee, Heather Klein, Steve Lautze, Jeff Levin, Mike Neary, Jason Patton, Joann Pavlinec, Holly Pearson, Margot Prado, David Ralston, Darin Ranelletti, Alisa Shen, Peter Slote, Iris Starr, Mark Wald, Loyd Ware, Scott Wentworth, Bruce Williams, Wlad Wlassowsky, Robert Zahn, and volunteer interns Brendan Daughton, Farhad Farahmand, Brenda Gillarde, and Tulsi Patel

Consultants: ICLEI – Local Governments for Sustainability, CirclePoint

The 2018 ECAP Update

In 2016-18, City of Oakland staff worked with municipal departments, green business groups, social justice organizations, and environmental stakeholders to update the ECAP. This included cataloguing which Action Items have been completed or are fully underway; reprioritizing existing Action Items based on new economic, technological, or other realities; updating cost estimates; and including the most recent greenhouse gas emissions inventory, which was completed in 2015 for the 2013 reporting year. This revised ECAP does not add any new Action Items to the 2012 version of the document, and the overall goals remain the same as the original document – to reduce greenhouse gas emissions 36 percent by 2020 and 83 percent by 2050.

Community engagement for this Update took place in Spring-Summer 2016, and included a series of workshops, community meetings, and focus groups. Participants included the Oakland Climate Action Coalition and representatives from Oakland’s diverse network of social and environmental justice organizations, green- and clean-tech businesses and nonprofits located in Oakland, and members of the public who volunteered to weigh in at community workshops and events.

Key changes to Priority Action Items are listed in Table 2 of the Appendix. Overall changes to the ECAP are summarized below:

- 32 Action Items have been completed or are fully underway as of early 2017 and are summarized in a new section of Chapter 4, *Priority Actions Complete or Fully Underway*
- 30 Action Items were newly prioritized, as indicated by a star logo in the *Priority Action Supported by Existing Resources* and the *Priority Actions Requiring New Resources* sections of Chapter 4
- Updated climate data was added to the report
- Cost estimates have been added to all Priority Actions in Chapter 4
- The Appendix has been updated to remove previous scenario analysis by sector, and revised to reflect the methodology for creating GHG inventories for communitywide emissions.

Contents

Executive Summary	4
Chapter 1 – Background	5
The Importance of Addressing Energy and Climate Issues	5
Oakland’s Legacy of Climate Leadership	6
The Next Phase of Local Climate Action	8
Oakland’s Greenhouse Gas Emissions	9
Oakland’s 2020 GHG Reduction Goal	10
Chapter 2 – Implementation and Reporting	11
Chapter 3 – A Collaborative Approach	20
Achieving Oakland’s 2020 GHG Reduction Goal	20
Role of Federal, State and Regional Partners	21
Role of City Government and Local Action	22
Community Climate Action Guide	23
Chapter 4 – Priority Actions for the Next Three Years (2017 – 2020)	25
Priority Actions Supported by Existing Resources	26
Transportation and Land Use	27
Building Energy Use	31
Material Consumption and Waste	33
Community Engagement	35
Climate Adaptation and Increasing Resilience	41
Priority Actions Requiring New Resources	44
Transportation and Land Use	45
Building Energy Use	52
Material Consumption and Waste	58
Community Engagement	60
Climate Adaptation and Increasing Resilience	63
Priority Actions Complete or Fully Underway	68
Transportation and Land Use	69
Building Energy Use	77
Material Consumption and Waste	85
Chapter 5 – The Ten-Year Plan for Achieving Oakland’s 2020 Goal	89
Actions to Achieve a 36% GHG Reduction	90
Transportation and Land Use	91
Building Energy Use	99
Material Consumption and Waste	105
Community Engagement	109
Adapting and Increasing Resilience to Climate Change	112
Advocacy Recommendations	115
Appendix	116

The purpose of the Oakland Energy and Climate Action Plan (ECAP) is to identify and prioritize actions the City can take to reduce energy consumption and greenhouse gas (GHG) emissions associated with Oakland. The ECAP will assist the City of Oakland in continuing its legacy of leadership on energy, climate and sustainability issues, and provide a roadmap for the Oakland community to achieve broad community goals related to reducing GHG emissions.

Executive Summary

The Oakland Energy and Climate Action Plan (ECAP) was adopted by City Council on December 4, 2012. Its purpose is to identify and prioritize actions the City can take to reduce energy consumption and greenhouse gas (GHG) emissions associated with Oakland. This plan establishes GHG reduction actions, as well as frameworks for coordinating implementation and monitoring and reporting on progress. The ECAP will assist the City of Oakland in continuing its legacy of leadership on energy, climate and sustainability issues. An Administrative Update was completed in 2017-18 to revise the ECAP with progress reporting, re-prioritization based on community input, and the addition of updated cost information for implementing the actions.

In July 2009, the Oakland City Council approved a preliminary GHG reduction target for the year 2020 of 36% below 2005 levels. This planning target was developed based on recent publications of the world's leading climate scientists. The primary sources of Oakland's GHG emissions are Transportation & Land Use, Building Energy Use, and Material Consumption & Waste. The ECAP includes a ten-year plan with more than 150 actions that will enable Oakland to achieve a 36% reduction in GHG emissions with respect to each of these GHG sources. Oakland can accomplish this goal by 2020 through:

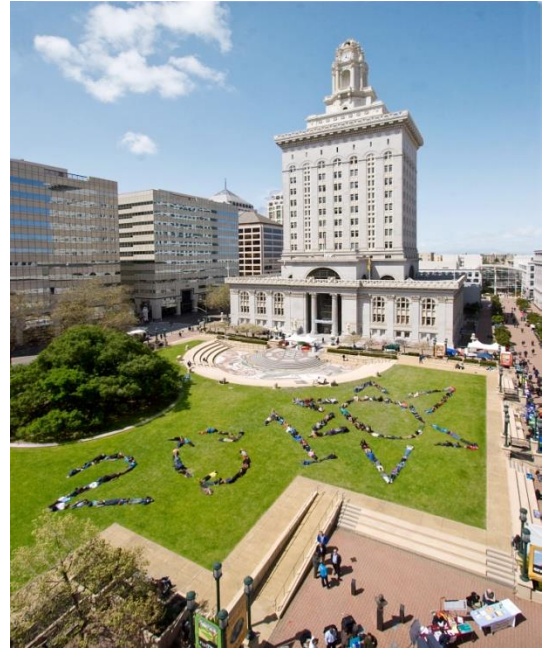
- 20% reduction in vehicle miles traveled annually as residents, workers and visitors meet daily needs by walking, bicycling, and using transit
- 24 million gallons of oil saved annually due to less driving and more fuel-efficient vehicles on local roads
- 32% decrease in electricity consumption through renewable generation, conservation and energy efficiency
- 14% decrease in natural gas consumption through building retrofits, solar hot water projects and conservation
- 62 million kWh and 2.7 million therms annually of new renewable energy used to meet local needs
- 375,000 tons of waste diverted away from local landfills through waste reduction, reuse, recycling, and composting

The ECAP also recommends a Three Year Priority Implementation Plan - a prioritized subset of actions recommended for implementation in the next three years. These priority actions will capitalize on near term opportunities and lay the groundwork for long term progress. Some of the recommended priority actions can be implemented with existing and anticipated resources. Others will require the identification of new, in some cases significant, resources to move forward. Implementation responsibility, status and resource needs are outlined for each recommended priority action.

Achieving Oakland's GHG reduction goals will require an unprecedented collaborative effort. The ECAP outlines the role that recent State policies are expected to play in reducing GHG emissions, and provides a vision for the role of additional community leadership. The ECAP also recommends steps the City can take to help Oakland adapt to the impacts of climate change and increase community resilience.

Implementing the actions identified in the ECAP has the potential to create a variety of community benefits, including energy cost savings, local green economic development and job creation, reduced local air pollution, improved public health, and other quality of life enhancements throughout Oakland.

Progress in reducing citywide GHG emissions will be reported bi-annually via a GHG Emissions Inventory. The ECAP will be updated every three years to review progress, identify new priority actions, and maintain momentum.



Chapter 1 – Background

The Importance of Addressing Energy and Climate Issues

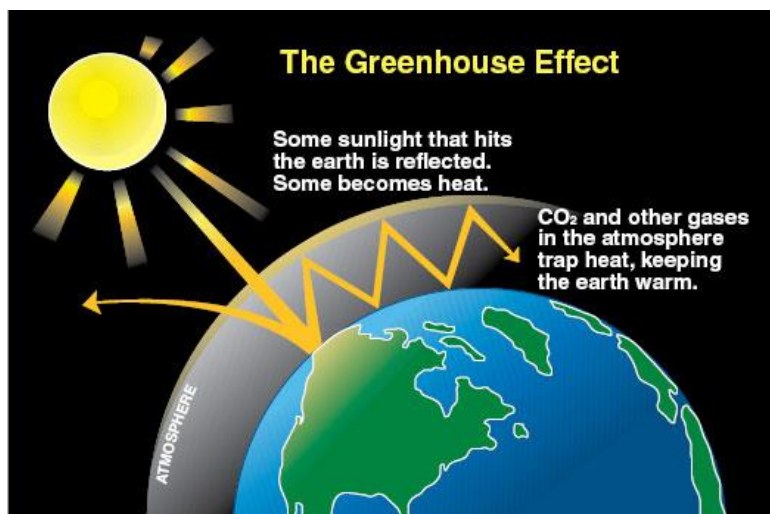
Solving the challenge of climate change is critical to preserving and improving quality of life in Oakland.

A scientific near-consensus has emerged regarding the dangers of increasing concentrations of greenhouse gas (GHG) emissions in the Earth's atmosphere, and the significant role that human activity is playing in increasing those concentrations.

Climate change is projected to impose significant ecological, health, economic and quality of life risks on Oakland and other communities.

Projected local impacts of climate change include rising Bay and delta waters, increased vulnerability to flood events, decreased potable water supply due to shrinking Sierra snowpack, increased fire danger, more extreme heat events and public health impacts, added stress on infrastructure, higher prices for food and fuels, and other ecological and quality of life impacts. Current dependence on fossil fuels not only creates GHG emissions, but imposes other risks associated with energy security, environmental impacts (e.g., the 2010 Deepwater Horizon oil spill in the Gulf of Mexico), and vulnerability to energy price volatility. These risks are magnified for economically disadvantaged communities.

Reducing greenhouse gas emissions, in Oakland and elsewhere, can help to avoid and/or lessen the severity of these impacts. Tremendous collective action will be necessary on a global scale to reduce GHG emissions to safer levels.




Transforming the threat of climate change into an opportunity for Oakland

Many actions that could be taken locally to reduce energy use and GHG emissions hold the potential to create a range of economic, health and other quality-of-life benefits in Oakland. Actions described in this plan have the potential to attract new green businesses, create hundreds of new local green jobs, and help neighborhoods thrive. By reducing fuel consumption, we can also reduce fossil fuel dependence and local air pollutants, and help to improve public health.



The City of Oakland is dedicated to doing its part to reduce GHG emissions and the threat of climate change. We recognize that many of the sources of GHG emissions can be reduced through local action. We also recognize the need to take local steps to better adapt to the impacts of climate change and improve the resiliency of our community.

We will take action, joining cities around the globe to provide the leadership needed to answer this challenge. In doing so, we are not just working to alleviate the threat of climate change, we are working to create a better Oakland, and a better world, for residents, businesses, and all members of our community.



Oakland's Legacy of Climate Leadership

Oakland has been ranked among the ten greenest cities in America several times in the last five years. Recent accomplishments include:


Constructed dozens of green buildings

Launched the Oakland Green Jobs Corps

Performed energy retrofits at over 100 of the City's largest municipal facilities

Adopted a green building ordinance for civic buildings

Installed nearly 100 miles of new bikeways and over 3,000 bike parking spaces

An aerial photograph of a city, likely New York City, showing a dense urban landscape with numerous skyscrapers and buildings. A large, green park area is visible in the center, surrounded by water. The image is used as a background for a presentation slide.

**Installed 6 megawatts of
local solar energy systems**

**Achieved leading rates of
waste diversion and recycling**

**Implemented food scraps
composting program**

**Increased emphasis on dense, transit-
oriented, mixed-use development
featuring green buildings and
alternative transportation options**

The Next Phase of Local Climate Action

Building on Oakland's legacy of climate protection progress, the next phase of action on energy and climate issues must consist of efforts in two major areas: Mitigation and Adaptation. The primary focus of this ECAP is on Mitigation – reducing energy use and GHG emissions. Recommendations are also included for moving forward with Adaptation strategies. It is important to make progress in these two areas simultaneously.

Mitigation

Mitigation refers to actions that reduce the creation of greenhouse gas emissions. These include strategies to reduce transportation fuels used to move people and goods around, reducing natural gas used to heat our homes, reducing electricity use used to light and power our buildings, and reducing consumption of material goods and disposal of materials into landfills. Reducing GHG emissions in collaboration with other communities around the world can help us to avoid, or at least lessen, some of the projected impacts of climate change.

Figure 1. Areas Targeted for GHG Reductions



Adaptation

Adaptation refers to activities that can help our community adapt to the impacts of climate change. Projected local climate impacts include sea level rise, reduced water availability from shrinking snowpack, and increased occurrence of extreme heat events and wildfires. Some impacts, such as minor sea level rise, are already starting to be observed – the result of decades of fossil fuel combustion and other activities such as deforestation. Adaptation strategies may include imposing land use restrictions in vulnerable low-lying areas, upgrading storm and sewer infrastructure, and practicing water conservation. Adaptation strategies are further discussed in later chapters.

Figure 2. Sea Level Rise Vulnerability is One of Many Projected Local Climate Impacts



Source: Pacific Institute

Oakland's Greenhouse Gas Emissions

Oakland's citywide carbon footprint can be measured in multiple ways. Each perspective illuminates opportunities to reduce greenhouse gas emissions through local action. Transportation & Land Use, Building Energy Use, and Material Consumption & Waste are the three largest sources of GHG emissions in Oakland.

Figure 3 illustrates a “sector-based” perspective of GHG emissions over which the City government has a relatively high degree of influence. These sources include emissions occurring within Oakland's boundaries, as well as external emissions from citywide electricity consumption and waste sent to landfill. From this perspective, building energy use and fuel used for transportation are both major sources of GHG emissions.

Figure 4 shows the City's GHG emissions when including the activities occurring outside of the city that are necessary to bring goods and services to Oakland. Oakland's GHG Emissions Inventory documents the lifecycle, or “consumption-based” emissions of the City, which show waste as the primary source of emissions associated with the City.ⁱ This perspective highlights the potential to reduce GHG emissions through waste reduction and recycling.

Transportation & Land Use, Building Energy Use, and Material Consumption & Waste are each significant sources of GHG emissions, and all can be addressed through local action.

Figure 3. Sector-Based View of Oakland GHG Emissions (2015)

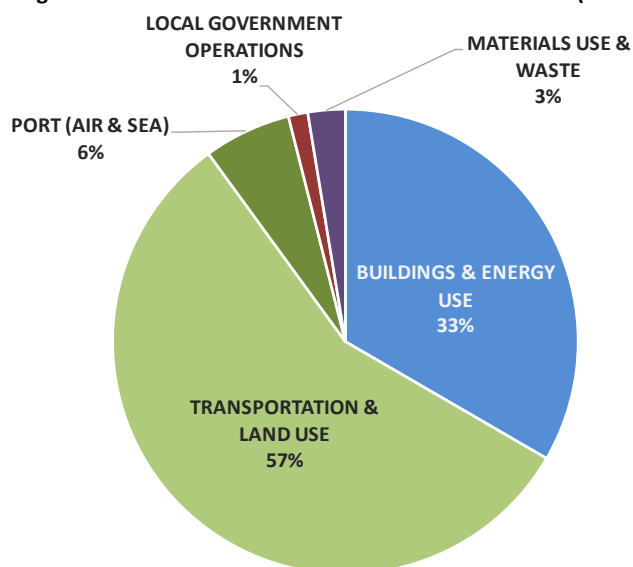
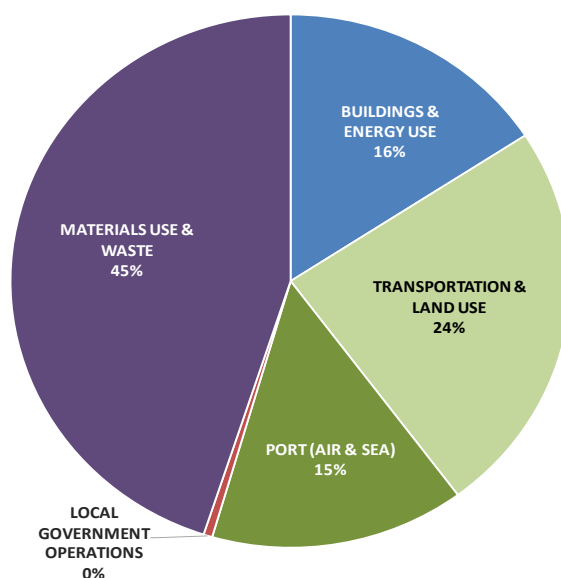


Figure 4. Consumption-Based View of Oakland GHG Emissions (2015)



For the purposes of the ECAP, these categories of GHG emission sources have been defined to include the following issues:

- **Transportation & Land Use:** integrated planning; transit-oriented development; bike/pedestrian issues; parking; vehicles/fuels; Port of Oakland operations; urban forestry; and the City fleet.
- **Building Energy Use:** new construction; building operations; retrofits of existing buildings; water use / conservation; renewable energy; product efficiency; City facilities; and streetlights.
- **Material Consumption & Waste:** waste reduction; recycling; composting; reuse and repair; rehabilitation and renovation; landfill waste; purchasing; producer responsibility; and local urban agriculture.

2020 GHG Reduction Goal

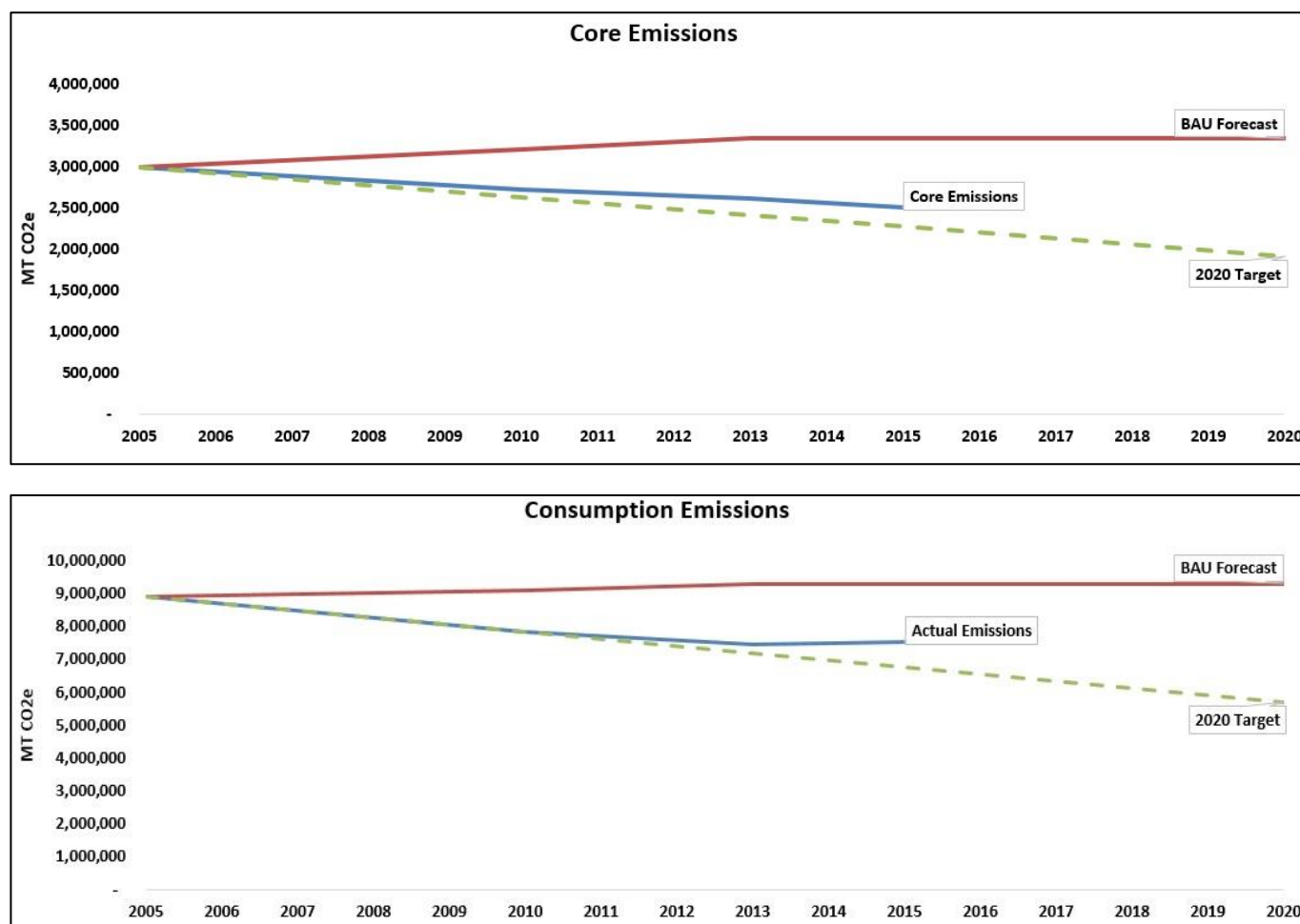
In July 2009, the Oakland City Council approved a GHG emissions reduction target for the year 2020 at 36% below 2005 levels, on a path toward reducing GHG emissions by 83% below 2005 levels by 2050.

This planning target was developed based on the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report (2007), widely recognized as the world's leading body of climate scientists. According to the reportⁱⁱ, achieving this level of GHG reductions throughout the industrial world will help to produce a level of climate stabilization that would avoid the worst future climate impact scenarios.ⁱⁱⁱ Additional background on this GHG reduction target is provided in the ECAP Appendix.

Figure 5 below shows the progress of the City in meeting the 2020 goal, from both the consumption and core perspectives. Although substantial progress has been made in reducing emissions in both perspectives, significant work remains to be completed in meeting the adopted goals. The Action Items set forth in Chapter 2 of this ECAP represent the City's strategy in targeting emissions reductions both locally and globally.

36%
Reduction in
GHG Emissions

Figure 5. Core and Consumption Emissions Reduction Progress Towards 2020 GHG Target (2015)



Chapter 2 – Implementation and Reporting

Implementing the Plan

City Departments that are responsible for each priority action will provide regular status updates to the Environmental Services Division. Annual reports will be presented to the City Council. These reports will be made publicly available on the Sustainable Oakland website, www.sustainableoakland.com.

ECAP implementation will involve an inter-agency staff team to provide staff-level coordination. This team will discuss progress and challenges in ECAP implementation. Team members will continue relationships with key external partners (e.g., PG&E, EBMUD, StopWaste.org) to foster coordination and collaboration.

Updating and Evolving the Plan

Annual updates on the status of ECAP implementation is made by staff. The full ECAP is updated every three years, including updates to Oakland GHG inventories every 2-3 years.

The City will benefit from monitoring the implementation of priority actions during the planning period (2012-2020), and will have the opportunity to learn from these observations to improve plans going forward. Successful programs may be continued and expanded, while unsuccessful actions can be dropped or reconfigured. Other unforeseen changes (e.g., technological advancements, energy price changes, economic growth rates, updated climate models, funding availability) will be considered in future updates to this plan. Future updates will also be informed by consideration of how social equity issues are impacted by ECAP implementation, both with respect to adaptation and mitigation. The City will provide ongoing opportunities for the public to receive information on the City's progress in implementing ECAP actions, and to provide input as the implementation process proceeds. These will include coordination with the community climate forums listed as Action Items in the Community Engagement section of this ECAP.

2017-18 Administrative Update

The City completed an update to the ECAP in 2017-18, revising the document to reflect progress made towards implementation since the adoption of the Plan in December 2012. This included the creation of a new category identifying actions that are fully implemented or complete. Additional changes included updates to information about Oakland's greenhouse gas emissions, revisions to action items to reflect new legislation, technology, and strategy, and addition of implementation costs to priority actions.



Priority Actions Supported by Existing Resources

Some ECAP actions can be accomplished with existing resources, or with the aid of anticipated external support (e.g., grants). The Priority Actions Supported by Existing Resources below are expected to move forward with existing or anticipated resources, and will be implemented during the next three years (2017-2020). Some of these actions are in progress, but require additional focus and attention to fully implement. Table 1 provides a summary of when the City anticipates beginning work on each action and which department/ division is responsible for implementation.

Table 1. ECAP Actions Supported by Existing Resources, by Current PA Designation

Priority Action	Implementation Start	Responsible Department/Division
PA 1. Launch and Develop a Funding Plan for the Downtown Shuttle	Underway	Economic and Workforce Development, Department of Transportation
PA 2. Advance Bus Rapid Transit in Oakland	Underway	Oakland Public Works
PA 3. Establish Alternative Mechanisms for Meeting Parking Requirements	Underway	Department of Transportation, Planning and Building Department
PA 4. Plan for Electric Vehicle Infrastructure	Underway	Oakland Public Works, Department of Transportation
PA 5. Launch a Residential Green Retrofit Program	Underway	Oakland Public Works, Housing and Community Development Department
PA 6. Implement Advanced Operating Procedures for City Facilities	Underway	Oakland Public Works
PA 7. Retrofit City Facilities to Improve Energy Performance	Underway	Oakland Public Works, Planning and Building Department
PA 8. Encourage Land Owners to Lease Space for Food Production	By 2020	Planning and Building Department
PA 9. Provide Additional Information on Energy and Climate Issues Including Energy and GHG Reduction Progress through Existing City Channels	Underway	Oakland Public Works
PA 10. Expand Outreach on Energy and Climate Issues through Partnerships with Local Organizations	Underway	Oakland Public Works
PA 11. Promote Climate-Related Educational Opportunities	Underway	Oakland Public Works
PA 12. Convene Community Climate Forums	Underway	Oakland Public Works
PA 13. Support Local Green Jobs Programs	Underway	Mayor's Office, Economic and Workforce Development, Housing and Community Development Department, Oakland Public Works
PA 14. Participate in Regional Climate Adaptation Discussions	Underway	Planning and Building Department, Economic and Workforce Development
PA 15. Include Measures to Reduce the Urban Heat Island Effect in Planning Documents	By 2020	Oakland Public Works
PA 16. Provide Staff Training on Climate Impacts and Adaptation	Underway	Oakland Public Works

Priority Actions Requiring New Resources

Putting Oakland on a steady path of progress toward achieving a 36% reduction in GHG emissions by 2020 will require the implementation of additional actions during the next three years, beyond those described above for which existing resources are available. The Priority Actions Requiring New Resources identified in Table 2 below will move forward if new resources can be found. Note that while some of these actions are already underway, they require new resources to be fully implemented. See page 40 for more information on these proposed actions.



Table 2. Priority Actions Requiring New Resources

Priority Action	Anticipated Implementation Start	Responsible Department/Division
PA 17. Increase Multi-Income Housing near Transit Hubs	2018	Planning and Building Department, Housing and Community Development Department
PA 18. Accelerate Completion of Bicycle and Pedestrian Plans	2017	Department of Transportation
PA 19. Optimize Street Design to Support Transit, Bicycling, and Walking	2017	Department of Transportation
PA 20. Expand and Enhance Public Transit Service and Amenities	2018	Department of Transportation
PA 21. Expand Car Sharing	2017	Department of Transportation
PA 22. Impose Parking Maximums and Develop Strategies to Minimize Parking Need	2016	Planning and Building Department; Department of Transportation
PA 23. Call for Climate Action by Port Tenants	2017	Elected Officials and Departmental Staff
PA 24. Develop an Urban Forestry Master Plan	2017	Oakland Public Works
PA 25. Conduct a Robust Urban Tree Inventory	2017	Oakland Public Works
PA 26. Update City Tree Ordinances	2017	Oakland Public Works
PA 27. Implement Street Tree Planting Pilot	2017	Oakland Public Works
PA 28. Accelerate City Fleet Vehicle Replacement	2019	Oakland Public Works
PA 29. Subsidize Transit and Transportation Alternatives for City Employees	2019	Human Resources Management Department
PA 30. Seek Resources to Support Energy Programs	2017	Oakland Public Works
PA 31. Encourage Citywide Energy Conservation and Efficient Product Purchasing	2018	Oakland Public Works
PA 32. Engage Largest Electricity Consumers in Energy Retrofits	2019	Economic and Workforce Development, Oakland Public Works
PA 33. Consider Energy Benchmarking Requirements for Commercial Buildings	2019	Planning and Building Department, Oakland Public Works
PA 34. Launch the Weatherization and Energy Retrofit Loan Program	2009	Housing and Community Development Department

PA 35. Create a Renter-Occupied Residential Energy Retrofit Program	2019	Housing and Community Development Department, Oakland Public Works
PA 36. Adopt and Implement a Residential Energy Conservation Ordinance	2020	Planning and Building Department, Oakland Public Works
PA 37. Facilitate Community Solar Programs	2019	Oakland Public Works
PA 38. Encourage Rainwater Harvesting	2010	Oakland Public Works
PA 39. Increase Public Landscaping with Drought-Resistant Plants and Trees	2017	Oakland Public Works
PA 40. Install water Efficient Fixtures and Equipment in Municipal Facilities	2018	Oakland Public Works
PA 41. Study Options for Advancing Next-Level Waste Reduction	2019	Oakland Public Works
PA 42. Promote Waste Reduction through Enhanced Producer Responsibility	2019	Oakland Public Works, Economic and Workforce Development Department
PA 43. Encourage Local Reuse and Repair	2018	Oakland Public Works, Economic and Workforce Development Department
PA 44. Community Climate Action Guide	2014	Oakland Public Works
PA 45. Support Local Climate Workshops	2017	Oakland Public Works
PA 46. Facilitate Community Input on Climate Issues	2017	Oakland Public Works
PA 47. Develop an Oakland Climate Action Model Practices Campaign	2018	Oakland Public Works
PA 48. Study Potential Local Climate Impacts	2015	Oakland Public Works, Planning and Building Department
PA 49. Communicate Climate Impacts to the Community	2017	Planning and Building Department, Economic and Workforce Development
PA 50. Identify and Act on Opportunities to Improve Resilience in City Plans and Policies	2016	Multiple Agencies (e.g., Oakland Public Works, Planning and Building Department, etc.) based on strategies
PA 51. Participate in Development of a Regional Climate Adaptation Strategy	2013	City Administrator (Resilience), Planning and Building Department, Oakland Public Works
PA 52. Develop a Resilience-Based Climate Adaptation Plan	2019	City Administrator (Resilience), Planning and Building Department, Oakland Public Works
PA 53. Promote the Development of Oakland's Urban Forest	2017	Multiple Agencies (e.g., Oakland Public Works, Planning and Building Department, etc.) based on strategies
PA 54. Promote Water Conservation and Efficiency	2015	Multiple Departments including Planning and Building Department, Oakland Public Works
PA 55. Promote Measures to Reduce the Impact of Floods	2010	Multiple Departments including Planning and Building Department and Oakland Public Works
PA 56. Encourage Recycled Water Delivery and Use	2017	Multiple Departments including Planning and Building Department and Oakland Public Works

Cost of Priority Actions Requiring New Resources

The ECAP includes budget estimates for resources the City would need to implement the 40 Priority Actions Requiring New Resources. The average annual cost to the City associated with implementing all 40 of these actions is projected to be approximately 25 FTE per year and \$179 million for related expenses. It is outside the scope of the ECAP to include a total budget for other actions proposed for implementation through 2020. It is important that the City identify long-term funding streams to support the continued energy and climate action.



Potential for Adverse Economic Impact

Implementation of climate actions, whether imposed by Federal, State or local law, or from voluntary community action at a level commensurate with achieving Oakland's 36% GHG reduction target, may result in potential reductions in revenues to the City associated with decreased energy and fuel consumption (e.g., Utility Consumption Tax, Alameda County Transportation Improvement Authority [Measure B-ACTIA], State Gas Tax). Conversely, an influx of new revenues may result from the creation of new green business activities (e.g., business tax and sales tax revenue associated with energy retrofit work performed, green business attraction, local job creation associated with implementation activities). It is beyond the scope of the ECAP to estimate net costs and benefits associated with achievement of the 36% GHG reduction target.

Cost to Oakland Community and Stakeholders

In addition to resources required by the City to support implementation, achieving the 36% GHG reduction target will require complementary action throughout the community in many areas. For example, the City may develop and offer programs assisting property owners in improving energy efficiency of their buildings. In most cases, those property owners would require additional resources to implement the upgrades. In another example, the City would require resources to participate in the development of a Public Transit Master Plan for Oakland. AC Transit would also require significant additional resources to increase the frequency of its service and provide amenities needed to foster significant increases in ridership.

It is beyond the scope of the ECAP to project total implementation costs that might be borne by the greater Oakland community in the course of taking primarily voluntary action at the level necessary to achieve a citywide GHG reduction of 36%. However, these costs would clearly be significant. For example, voluntary energy efficiency improvements for homes in Oakland would likely require a total investment in the hundreds of millions of dollars. Much of this work has the potential to create significant cost savings for property owners and/or tenants, and some households could experience a net positive cash flow. However, identifying resources to support initial implementation costs is a significant barrier to implementation. ECAP actions (e.g., working with partners to expand financing options) are identified to help overcome such barriers, but cannot fully remove the need for resources.

Potential Funding Opportunities

Through a variety of partnerships, both the City of Oakland and many of its partner non-profit organizations have been successful in securing resources to support new energy and climate programs. These programs include support for residential energy retrofits and expanded weatherization services, downtown commercial energy retrofits, and the launch of a new downtown free shuttle.

Opportunities to seek funds are expected to remain available throughout the life of the Plan. Assuming that capacity to seek funds exists, Oakland will continue to be competitive. Examples of funding sources the City should continue to explore include:

- State and Federal energy grants
- Foundation support
- Air District & CA Air Resources Board grants
- Emerald Cities Collaborative support

- Federal appropriations
- HUD Sustainable Communities planning grants
- EPA Climate Showcase Communities grants
- State and Federal transportation funds
- MTC directed regional transportation dollars
- California Cap and Trade dollars
- Regional gas tax/green investment fee
- Surcharges on GHG intensive energy use
- Parking rates
- Solid Waste Franchise Fees
- Federal tax credits
- EPA Clean Water Revolving Loan Fund
- Reformulated Gasoline Settlement Fund
- Development impact fees
- Permit fees
- Tax increment financing

Considerations of Job Quality and Economic Development in Implementation

Climate action by the City and complementary action by the Oakland community have the potential to foster significant green job creation and green economic development in Oakland. The City encourages the expansion of local green job training programs to help provide the workforce needed to achieve these goals. The City also encourages private employers to ensure that these are high quality, living wage jobs offering green career pathways for local residents. The City will continue to support these objectives by applying existing living wage, local hire and prevailing wage policies to its programs and projects.

Action Items Deemed Complete or Fully Underway

The ECAP, as adopted in December of 2012, included 175 action items necessary to meet the 36 percent reduction goal. As part of the 2017-18 ECAP Update, a full assessment was made of the process toward completion for each of these actions. The actions that remained incomplete were reorganized into the original three categories: (1) Priority Actions Supported by Existing Resources, (2) Priority Actions Requiring New Resources, and (3) Additional Actions. Action items that have been completed or are fully underway have been removed from these categories, and are noted below in Table 3 to illustrate progress that has been made in implementing the ECAP.

Table 3. ECAP Actions Completed or Fully Underway, by Original Priority Action (PA) Designation

Priority Action	Anticipated Implementation Start	Responsible Department/Division
PA 1. Identify and Adopt Priority Development Areas	Fully Underway	Transportation Services, Planning and Building Department - Strategic Planning, Redevelopment
PA 4. Participate in Quarterly SB 375 Discussions	Fully Underway	Transportation Services, Planning and Building Department - Strategic Planning, Housing and Community Development
PA 5. Call for Port of Oakland GHG Reduction Targets and Plans	Fully Underway	Elected Officials
PA 7. Adopt a Green Building Ordinance for Private Development	Completed Fall 2010	Planning, Building Services
PA 8. Offer Property-Based Energy Financing	Completed September 2015	Environmental Services, Planning, Building Services
PA 9. Launch a Downtown Commercial Retrofit Program	Completed 2012	Economic Development, Environmental Services
PA 10. Encourage Participation in Local Energy Efficiency Programs	Fully Underway	Environmental Services
PA 12. Conduct a Multi-Family Affordable Housing Retrofit Pilot	Fully Underway	Housing and Community Development
PA 13. Expand Weatherization Program Delivery	Completed Spring 2012	Housing and Community Development
PA 15. Create an Oakland-Specific Water-Efficient Landscaping Ordinance	Fully Underway	Planning and Building Department - Strategic Planning
PA 17. Improve Energy Performance of New City Facilities	Fully Underway	Environmental Services
PA 19. Restructure Solid Waste Management System	Completed July 2015	Environmental Services
PA 20. Refine Implementation of C&D Recycling Ordinance	Fully Underway	Building Services and Permit Center, Environmental Services
PA 21. Promote Waste Reduction at Community Events	Fully Underway	Environmental Services
PA 22. Develop Regulations Enabling Urban Food Production	Completed 2014	Planning and Building Department - Strategic Planning, Economic Development
PA 30. Develop a Comprehensive Transportation Policy Plan	Fully Underway	Department of Transportation

PA 31. Improve Transportation & Land Planning Integration in Every Planning Effort	Fully Underway	Department of Transportation, Planning and Building Department - Strategic Planning, Economic Development
PA 32. Create and Adopt a Transportation Impact Fee to Support Implementation	Completed May 2016	Department of Transportation, Planning and Building Department - Strategic Planning, Engineering, Building Services
PA 33. Update Local CEQA Standards to Reduce Emphasis on Congestion Impacts	Completed 2016	Department of Transportation, Planning and Building Department - Strategic Planning
PA 36. Conduct a Citywide Dynamic Parking Pricing Study	Fully Underway	Department of Transportation, Planning and Building Department - Strategic Planning, Finance
PA 41. Discontinue Subsidizing Parking for City Employees	Completed 2010	Human Resources, Department of Transportation, OPW Equipment Services
PA 43. Market Energy Retrofit Opportunities to All Oakland Businesses	Fully Underway	Business Development
PA 47. Encourage the Creation of On-Bill Financing for Energy Retrofits	Completed 2015	Environmental Services
PA 51. Encourage PG&E to Offer Green Power Options	Fully Underway	Environmental Services
PA 52. Monitor Community Choice Energy	Fully Underway	Environmental Services, Finance
PA 53. Enforce Mandatory Recycling	Fully Underway	Environmental Services, Building Services (Code Compliance)
PA 54. Conduct Residential Social Marketing Campaigns and Business Outreach	Fully Underway	Environmental Services
Non-PA. Increase Density near Transit to Improve Livability	Fully Underway	Planning and Building Department - Strategic Planning, Department of Transportation
Non-PA. Promote Bicycle Safety Training, Transit System Use, and Other Non-Auto Transportation	Fully Underway	Department of Transportation
Non-PA. Encourage the Creation of Local Bike Sharing Programs	Fully Underway	Department of Transportation
Non-PA. Upgrade to Energy-Efficient Streetlights	Completed June 2014	Oakland Public Works - Electrical Services Division
Non-PA. Provide City Employee Staff Training on Climate Issues.	Fully Underway	Environmental Services Division

Tracking and Reporting on Progress

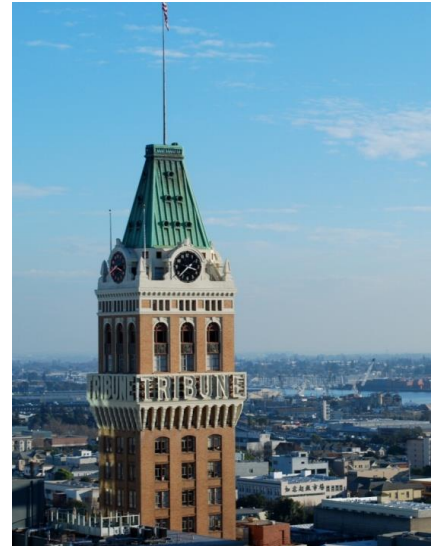
The City will report on the status of priority actions and key performance metrics on an annual basis beginning one year after ECAP adoption. Reporting will be delivered through a variety of dissemination methods to various interest groups and stakeholders. Multiple actions identified in the Community Engagement section of the ECAP will serve as additional vehicles for reporting on implementation progress.

Oakland's success in reducing energy use and GHG emissions will be measured through regular GHG Emissions Inventories. Inventories will continue to be conducted utilizing the best available information, including GHG accounting systems similar to those used previously to ensure accurate comparisons to the baseline 2005 emissions. While not an exhaustive list, these systems form the basis of data included in GHG emissions analysis, and help inform the City's progress in meeting the GHG reduction goal.

Key Performance Metrics

Transportation and Land Use

- Vehicle miles traveled
- Gallons of petroleum fuel consumed
- Percent of mode share represented by each form of transportation
- Miles of identified bikeways
- Number of bicycle and electric vehicle parking spots
- Electric Vehicle ownership rate
- Percent of Oakland residents living within ½ mile of major bike lane
- Total number of transit passenger miles traveled
- Total number of bus service hours
- Total miles of bus lines
- Funding allocated to transit projects (all sources)
- City fleet fuel consumption
- Per capita airplane miles traveled



Building Energy Use

- Community-wide electricity consumption
- Community-wide natural gas consumption
- Number of low-income residential units served by weatherization assistance programs
- Number of homes participating in residential energy retrofit programs
- Number of properties utilizing property-assessed energy financing
- Number of commercial and industrial buildings participating in energy rebate programs
- Percent of electricity from carbon-neutral sources
- Amount of energy (kWh and therms) generated from local renewable sources
- Amount of energy (kWh and therms) consumed by City operations
- Amount of electricity (kWh) generated at City facilities

Material Consumption

- Lifecycle greenhouse gas emissions from discarded materials
- Number of repair businesses in Oakland

Waste Reduction

- Tons of waste landfilled
- Tons of material recycled by City franchisees or contractors
- Tons of organic material composted by City franchisees or contractors
- Amount of construction and demolition (C&D) debris diverted from landfills
- Amount of waste generated by City operations

Community Leadership

- Number of individuals pledging to take and/or reporting climate actions

Chapter 3. A Collaborative Approach

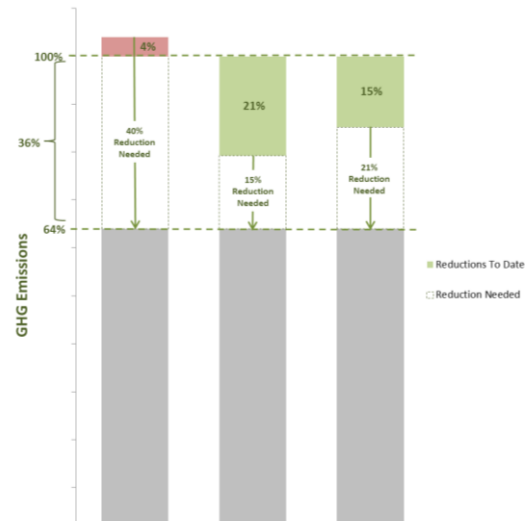
Achieving Oakland's 2020 GHG Reduction Goal

Achieving a 36 percent reduction in citywide GHG emissions by 2020 requires a collaborative effort between government, business, and residents. This effort requires unprecedented action to address all three of the major sources of GHG emissions:

- Transportation & Land Use
- Building Energy Use
- Material Consumption & Waste

For the purpose of developing the ECAP, Oakland's GHG reduction goal is applied to each of these three categories of GHG emission sources. This level of GHG reduction can be accomplished by 2020 by achieving the following targets:

Figure 6. Applying the 36% GHG Reduction Goal in Each Emissions Source Category



20% reduction in vehicle miles traveled annually as residents, workers and visitors meet daily needs through transit, walking, and bicycling

24 million gallons of gasoline and diesel saved annually on local roads due to less driving and more fuel efficient vehicles

32% reduction in annual electricity consumption through conservation and energy efficiency in homes and businesses

14% reduction in annual natural gas consumption through retrofits to Oakland's homes and commercial buildings and aggressive conservation

62 million kWh and 2.7 million therms of renewable energy production annually from local solar panels, biofuels, and other renewable energy technologies

375,000 tons of waste diverted annually away from local landfills through waste reduction, reuse, recycling, and composting



Role of Federal, State, Regional Partners

The ECAP is intended to complement actions taken by federal, state and regional governments to address the threat of climate change.

The Federal government has begun to take an increasing interest in solving the challenge of climate change. President Obama issued an executive order in 2009 calling for GHG reductions in Federal government operations.^{iv} The U.S. Environmental Protection Agency has also begun to take steps to recognize GHG emissions as an environmental problem. While federal leadership is recognized and beneficial, the ECAP is structured to ensure local commitment and progress on climate policy and greenhouse gas reductions can continue regardless of national priority or focus.

In California, climate policies adopted at the State level (e.g., AB 32, SB 375, SB 350) aim to reduce statewide GHG emissions to 1990 levels by 2020, with a doubling of energy efficiency and renewable energy by 2030.^v Executive Order S-3-05 issued by Governor Schwarzenegger calls for statewide GHG reductions of 80% below 1990 levels by 2050.^{vi}

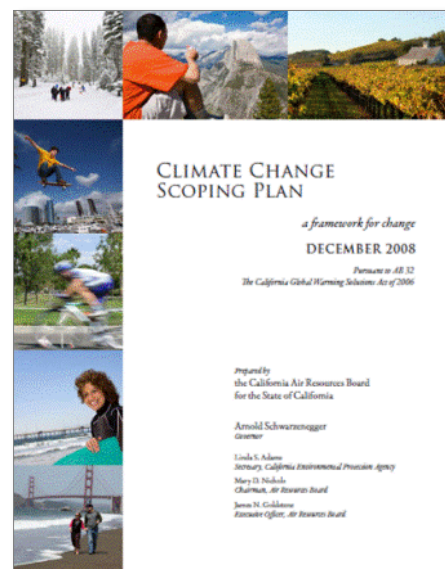
In December 2008, the California Air Resources Board (CARB) adopted the Climate Change Scoping Plan, outlining a variety of State-driven strategies to help achieve these statewide goals.^{vii} Complementary and supplemental local actions will be needed to help reach these goals. Among the strategies contained in the CARB Scoping Plan are: vehicle fuel efficiency and low carbon fuel standards; energy efficiency standards for buildings; aggressive renewable portfolio standards for electricity generation; hybrid vehicle support; high speed rail; industrial sector energy efficiency measures; growing sustainable forests; and recycling and waste measures. While some of these strategies may not affect Oakland, most will have some impact in Oakland and are considered in the context of developing local GHG reduction targets and plans to meet the targets.

State policies are projected to result in significant progress toward Oakland's 2020 GHG reduction goal.

Some of the State-driven strategies, such as requiring the sale of more fuel-efficient vehicles and lower carbon fuels, are projected to reduce GHG emissions in Oakland without imposing new burdens on local government. Other State strategies outline goals for reducing GHG emissions that will only be met if action is taken by local governments and communities.

For the purpose of quantifying GHG emissions and needed reductions, projections of Oakland's 2020 GHG emissions have been adjusted based on projected changes in population, economic activity and vehicle miles traveled.^{viii} These projections also assume implementation of State-driven strategies that will not require additional local government action. Achievement of other State-defined goals requiring local action is not assumed without the implementation of actions recommended in this ECAP.

The role of regional partners in achieving Oakland's future GHG reduction goals is very significant. Regional partners such as the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) are working to reduce emissions through development of regional housing allocations for Bay Area cities, transportation plans, and priority development areas. Several strategies that hold promise would require new regional action by a regional body or the collective action of all the cities and counties.



Role of City Government and Local Action

The primary purpose of the ECAP is to identify and prioritize actions the City can take to reduce energy consumption and GHG emissions associated with Oakland. The ECAP also tells the story of action the Oakland community would need to take in partnership with the City to achieve a 36 percent reduction in GHG emissions.

The City of Oakland can provide leadership and leverage, and can play an important role in helping to reduce citywide energy use and GHG emissions. The City can enact new policies; develop new plans, programs and projects; and help to educate and motivate additional community progress.

For example, land use and transportation plans developed by the City can help to orient new development around transportation networks that reduce dependence on automobiles and associated GHG emissions. Examples of relevant City planning documents include: the General Plan Land Use and Transportation Element and Housing Element; the Zoning Code; and the Bicycle and Pedestrian Master Plans.

City policies and programs can help to reduce energy use associated with residential and commercial buildings as well. For example, the City's proposed Green Building Ordinance for Private Development would help to ensure that new residential and commercial buildings and rehabilitations of existing buildings are designed to achieve high levels of energy efficiency and green performance.

The City has significant influence over GHG emissions associated with materials and waste through its solid waste management programs. The City's garbage franchise agreement and recycling service contracts define the type, frequency and cost of garbage, recycling and compost collection services, and can be tailored to keep more materials out of landfills.

The City also has an important role to play in educating and motivating all members of the Oakland community to join in the effort to reduce energy use and GHG emissions. The City can encourage voluntary action, promote model local practices, provide opportunities for new ideas from the community to further strengthen local efforts, and track and report on Oakland's progress in reducing energy use and GHG emissions.

Achieving a 36 percent reduction in GHG emissions will require unprecedented leadership by the City and the Oakland community

Leadership from local businesses, non-profit organizations, civic groups and others will be essential to achieving Oakland's 36% GHG reduction target. As champions connected throughout the Oakland community, these organizations can help to build a movement around local climate action.

Oakland's success in reducing GHG emissions will ultimately depend on the day-to-day decisions of individuals. For example, achieving a 36% GHG reduction target will require all members of the community to drive an average of 20% less by walking and biking for neighborhood trips, using public transit, combining trips, and telecommuting where possible. Thirty percent of Oakland's homes and businesses will need to undergo energy improvements. Local service providers (e.g., PG&E, AC Transit) will play key roles in enabling individuals to make choices that reduce GHG emissions. These and other organizations will have a big role to play in creating interest and encouraging action throughout the community.



Community Climate Action Guide

Achieving significant GHG reductions will require everyone in the Oakland community working together. Below are ideas to consider as you reduce your own climate footprint. To view more ideas, download a stand-alone copy of this guide, and access tools for calculating your own carbon footprint, visit the City's website at www.sustainableoakland.com. Please also see the Community Climate Action Guide created by OCAC, available at <http://oaklandclimateaction.org>.



First Steps

Greening Your Home

- Try adding a layer before turning on the heat
- Plug all appliances into powerstrips and turn off the strips when not in use
- Replace incandescent light bulbs with LED bulbs
- Choose ENERGY STAR labeled appliances
- Insulate your water heater and lower the water heater temperature
- Install and use a clothesline
- Use timers on connected appliances, such as gaming systems
- Install weather stripping around external doors
- Conserve water with water-efficient showerheads and faucets

Getting Around

- Switch one work commute trip per week to biking, walking, taking transit or telecommuting
- Accomplish at least two neighborhood trips per week by biking or walking
- Plan out non-work trips in advance and combine where possible
- Carpool with neighbors, co-workers

Consume Less, Waste Less

- Recycle and compost all eligible materials
- Bring your own bag for shopping
- Purchase durable goods made from recycled materials
- Avoid excessively packaged goods
- Consider repair and reuse options before purchasing new items
- Eat meat at one less meal each week

Lead the Way

- Educate your family and establish green family practices
- Discuss action opportunities with neighbors, such as lowering water heater temperature, hiring an energy improvement contractor, or biking to work one day per week
- Discuss safe routes to school, transit, walking and bicycling with neighbors and help create a safe street environment



Bigger Steps

Greening Your Home

- Have a home energy audit done and take actions that will pay for themselves within 5-10 years
- Look for opportunities to include passive solar design to minimize winter heating needs in new building or remodeling projects
- Collect rainwater for outdoor water needs
- Plant trees on your property
- Plant water-efficient landscaping, including smart controllers (See Bay Friendly Guidelines)
- Install solar panels on your home or select optional green power alternatives from your electricity provider

Getting Around

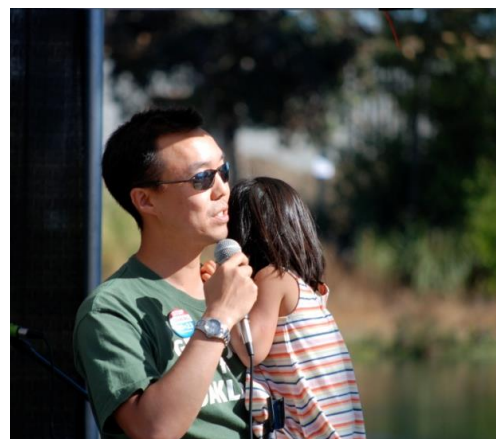
- Purchase a hybrid or electric vehicle
- Purchase a bike and ride it often
- Choose to live where automobile dependence can be minimized (e.g., near transit, work, school, shopping)
- Try not owning a car
- Fly less often for business; try web meetings & video conferencing

Consume Less, Waste Less

- Repair and reuse goods whenever possible
- Adapt used materials for new purposes (e.g., mason jars for cups)
- When shopping in stores, look for options in Oakland first
- Plant a garden to grow your own food
- Freeze, can, dry and preserve seasonal fruits and vegetables
- Go vegetarian

Lead the Way

- Become a mentor to other members of the community
- Become a community resource and share your skills and experience with others taking local climate action



Chapter 4

Leveraging Near-Term Opportunities and Laying the Groundwork for Long Term Progress: Final Three-Year Priority Implementation Plan

It is important for the City to prioritize its efforts carefully, and proactively implement the highest-priority recommended actions when the necessary resources are available. This chapter presents a Priority Implementation Plan for making progress toward Oakland's 36% GHG reduction target in the final three years of the 2020 ECAP.

The Three-Year Priority Implementation Plan is divided into three sections:

- **Priority actions supported by existing resources**
- **Priority actions requiring new resources**
- **Priority actions complete or fully underway as of Spring 2017**

In each section, recommended priority actions are grouped into the three primary GHG reduction categories, along with a set of highlighted community engagement recommendations, and steps to assist Oakland in adapting to climate change, in the following order:

- Transportation & Land Use
- Building Energy Use
- Material Consumption & Waste
- Community Engagement
- Climate Adaptation & Increasing Resilience

Priority actions recommended using existing and anticipated resources are summarized with descriptions of current implementation status. Priority actions recommended for implementation that will require new resources include status updates if available and estimates of resource needs, along with recommended implementation responsibility if resources become available.

While some GHG reduction activities are listed as Priority Actions, full implementation of all ECAP action items is necessary for Oakland to achieve a 36 percent reduction in GHG emissions by 2020. Prioritization is intended to assist City staff and community partners in identifying which measures hold the most potential in the near term, due to timeliness, available funding, depth of GHG reduction, or other factors. It is the intent of the City to pursue completion of all action items by 2020.

Priority Actions Supported by Existing Resources

During the end of the ECAP period (2017-2020), the City will implement a prioritized set of recommended actions for which resources are available. These recommended actions can be implemented using existing or anticipated resources and staffing levels, including anticipated grants from the California Energy Commission (CEC), Bay Area Air Quality Management District (BAAQMD), and others. Implementation of some Priority Actions will benefit from expected and recently awarded Greenhouse Gas Reduction Fund grants, funded by California’s Cap and Trade system. Many of the actions included in this section are already in progress.

These priority actions will create GHG reduction benefits and lay the foundation for future actions that can create additional GHG reductions in the coming years. Additional resources to continue and/or expand these actions beyond the next three years, as well as to implement additional energy and climate actions, will be necessary to continue Oakland’s progress as a national and global climate leader.

How to Read This Section


Each action below is presented through a standard format containing each of the following elements.

Priority Action identifier

Brief summary of the recommended priority action


Brief action statement

PA 1. Identify Priority Development Areas

(TLU-6)  Obtain Priority Development Area status from the Association of Bay Area Governments for all appropriate areas of Oakland to enable more competitive eligibility for local transportation and infrastructure funding.

Description:	Description of the action
Responsibility:	Division or Agency responsible for implementation of the action
Status:	Current implementation status of the action
Costs:	Total estimated cost of implementing the action if the action is expected to be a one-time event, or annual operating cost if ongoing program

Reference to where action appears in the 2020 list in Chapter 5

 The star icon (shown at left) indicates actions in the Three Year Priority Plan that were newly prioritized during the 2017 ECAP Update.



Supporting Resources

Supporting resources are summarized for each Priority Action. The total cost associated with implementing all proposed Three Year Priority Actions supported by existing resources is projected to be approximately 5.5 staff FTE per year, 0.5 fellow time per year, and an additional \$ 9.10 million for related expenses (e.g., consultant support).

Transportation and Land Use

Combustion of fossil fuels for transportation is a major source of GHG emissions associated with Oakland, and all of California. This includes people moving to and from home, work, school, shopping, recreation, and other destinations, as well as the transport of goods. Other local air pollutants linked to increased incidence of health problems such as asthma, heart disease, and cancer, many of which disproportionately affect Oakland's low income and vulnerable populations, also result from use of transportation fuels.

Addressing transportation emissions presents a tremendous opportunity to simultaneously reduce GHG emissions and improve the health and safety of Oakland residents. Efforts to reduce GHG emissions from the transportation sector also present opportunities to create a more equitable, sustainable, affordable, and healthy Oakland, by addressing the interconnections between land use and transportation. How and where housing, jobs, shopping, and other opportunities are located has a fundamental effect on both GHG emissions and the choices that people have for meeting their daily needs.

A number of tools are available to help the City reduce GHG emissions associated with transportation and land use. These include: land use and transportation planning; providing interconnected bicycle and pedestrian options; tailoring parking policies to reduce vehicle trips; supporting affordable, safe, and reliable public transportation options; promoting fuel-efficient vehicles and low- or zero-carbon fuels; partnering with the Port of Oakland to reduce Port-related emissions; engaging employers to reduce commute and business trips; promoting urban forestry; and improving the City vehicle fleet.

Between 2012 and 2017, Oakland has made progress in a number of these areas, embracing a variety of climate-friendly development principles in the City's General Plan, focusing new development around transit hubs, adopting forward-thinking Bicycle and Pedestrian Master Plans and significantly expanding the city's bikeway network, and adopting a Clean Fleets policy aimed at improving the fuel efficiency of the City's vehicle fleet.

A number of other ongoing actions are recommended for completion during the next three years. These actions include:

- Expand and Develop a Sustainable Funding Plan for the Downtown Shuttle (operational since 2013)
- Advance Bus Rapid Transit in Oakland (under construction since 2017)
- Plan for Electric Vehicle Infrastructure (ongoing implementation since 2012)

The following Transportation and Land Use priority actions are supported by existing resources. Some were completed as one-time actions, while others will require ongoing investment. Although funds have already been allocated, implementation of these priority actions will cost an average of 0.7 FTE per year and \$ 7.43 million for expenses throughout the next three years. Following are descriptions of each of these actions, along with information on implementation status.



Priority Actions

PA 1. Launch and Develop a Funding Plan for the Downtown Shuttle

(TLU-13) Launch and sustain a downtown free shuttle to increase transit use in the downtown area. Explore options to expand the shuttle up the Broadway corridor.

Description: The City launched a new downtown shuttle serving the Broadway corridor from Jack London Square to the Uptown area in 2010, and in 2014, ridership surpassed three million. Rides on the shuttle are free to the public. The shuttle is projected to create a net reduction in GHG emissions by reducing the need for private automobile trips; the City estimates that the shuttle reduces vehicle miles driven by 3.3 million each year, eliminating over 800 tons of CO² emissions annually. The shuttle also benefits downtown merchants.

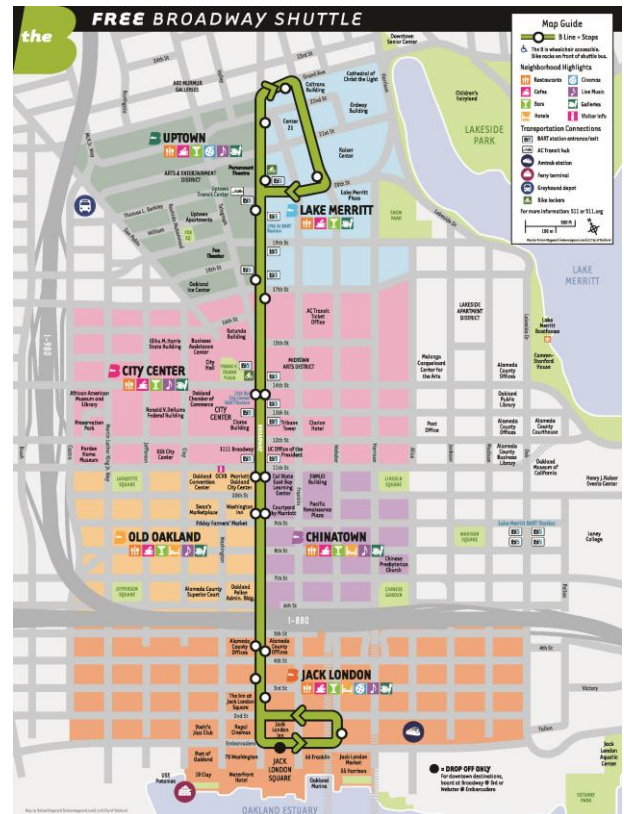
The launch and initial operating phase of the shuttle was supported by a grant from the Bay Area Air Quality Management District. Funding is in place to support the operation of the shuttle for a two-year period. During this time, the City will work to develop a long-term funding strategy to sustain the shuttle beyond the grant period, including development of a “fair share” methodology for assigning a portion of the costs to new development.

Existing staff resources are sufficient to support the launch of the shuttle. Additional resources may be needed to perform urban economic analysis, outreach and strategy development to create an ongoing sustainable funding stream beyond the grant period.

Responsibility: Economic and Workforce Development

Status: The Broadway Shuttle is fully operational, providing 685,229 individual trips in 2016, running until 10-pm on weekdays and 1am on Friday and Saturday nights. Each year, approximately \$910,000 is raised from private property owners and public transit agencies to cover the shuttle’s annual operating costs. Currently, the City is studying the feasibility and potential for an expansion to the Broadway Shuttle to enhance the local and regional transit systems' efficiency, improve connectivity between the corridor's neighborhoods, and spur economic development on and adjacent to Broadway. The Study Area includes Broadway, the city’s central downtown corridor, from Jack London Square to Kaiser Permanente Medical Center, and 40th Street from Broadway to MacArthur BART.

Costs: 0.5 FTE per year plus \$900,000 of expenses per year
Cost Total: \$980,000 annually



PA 2. Advance Bus Rapid Transit in Oakland

(TLU-14) Support implementation of bus rapid transit (BRT) in Oakland along the Broadway and International Boulevard corridors while minimizing short-term potential impacts to neighborhoods and businesses.

Description: Establishing new fixed guideway transit service will be critical to reaching our emissions goals and fostering shifts from automobile travel to transit. Bus Rapid Transit (BRT) offers a significant opportunity to make transit easier, faster, safer, more reliable, and more convenient. The City is working with AC Transit to establish a 9.5 mile BRT system on these routes, from the San Leandro BART station to Oakland's Uptown. Service will run as fast as every five minutes during peak hours, and vehicles will be powered by hybrid electric or clean diesel.



City staff and consultants provide services on an as-needed basis to support, facilitate, and oversee the BRT project construction and operations. These resources are sufficient to support and oversee the BRT construction and operations from the City's standpoint.

Based on its experience with this initial BRT project, the City should consider other opportunities to advance BRT as a local and regional strategy.

Responsibility: Oakland Public Works

Status: The project is under construction and is being phased through various zones to minimize impacts to the community. Portions of project work are also being staged and scheduled over the next year and a half. Revenue service is expected to begin by late 2018.

Costs: The City's construction phase costs include \$1,450,000 reimbursable from AC Transit plus an additional \$230,000 in funding for staff in at least three different departments and technical consultants plus \$2,500,000 for business sustainability programs.
Cost Total: \$4,180,000

PA 3. Establish Alternative Mechanisms for Meeting Parking Requirements

(TLU-28) Develop regulations that would permit parking requirements to be met through alternative approaches demonstrated to reduce parking demand and GHG emissions.

Description: The City will seek resources to conduct a comprehensive review of parking policy regulations for new development. New regulations will be developed for parking requirements in the planning code pertaining to new development on private property. These regulations would permit parking requirements to be met through alternative approaches demonstrated to reduce parking demand and GHG emissions. These approaches may involve a range of transportation demand management strategies, including on-site car-share vehicles, secure bicycle parking and showers, and subsidized transit passes.

Responsibility: Department of Transportation, Planning and Building Department

Status: In 2016, the City amended its minimum parking requirements to reduce parking in most new developments. The new regulations removed minimum parking requirements and imposed parking maximums and mandatory car share spaces for all new developments in downtown; further reduced parking minimums in transit-oriented development zones; and adjusted requirements for nearly all other development and zoning types, including special requirements for affordable housing. In addition to these changes, in 2017 the new Department of Transportation launched a

three-year Demand Responsive Parking and Transportation Demand Management initiative, designed to maximize efficient use of parking through active management of the supply as part of a multi-modal approach to developing neighborhood transportation infrastructure and mode-shift.

Within the next five years, the City plans to conduct a study on the effectiveness and impacts of the 2016 parking regulations, and consider overhauling the residential parking program based on the results of that study.

Costs: 0.08 FTE for two years plus \$250,000 of expenses
Cost Total: \$285,000

PA 4. Plan for Electric Vehicle Infrastructure

(TLU-33) Participate in regional electric vehicle (EV) infrastructure planning and develop new processes to support local use of electric vehicles.

Description: The City will seek resources to address EV infrastructure planning and develop new processes to facilitate community adoption of EV technologies. The City is already partnering with other Bay Area cities and other partners in an effort to make the Bay Area the EV capital of the United States.

Achieving this vision will require planning and implementation of EV charging infrastructure in publicly accessible locations throughout the community, including industrial zones and transit village areas where infrastructure improvements are being contemplated. It will also require increased institutional capacity and changes, such as new permitting processes to enable private residents and businesses to install charging infrastructure.

The City will also seek to add EVs, plug-in hybrid vehicles and supporting charging infrastructure to the municipal vehicle fleet.



Responsibility: Oakland Public Works, Department of Transportation

Status: In 2014, the City hired an Energy Policy Analyst whose duties include securing resources to expand the City's electric vehicle infrastructure. Activities to date have included securing over \$250,000 in grants to install public EV chargers at City-owned public parking facilities; updating the City's building code to require enhanced EV charging infrastructure in all new construction; pursuing additional funding opportunities to advance a transition to EVs for hard-to-reach sectors including low-income residents, multifamily buildings, and medium-duty truck fleets; participating in regional working groups to advance EVs across the Bay Area; and working with local stakeholders to identify solutions for expanding the network of EV chargers.

Costs: 60 hours staff time per year
Cost Total: \$9,000 annually

Building Energy Use

Energy used to heat, light, and power Oakland's buildings and for outdoor lighting is another major direct source of GHG emissions. Natural gas consumption is the largest source of GHG emissions related to buildings, followed by emissions from power plants that supply Oakland's electricity.

A number of methods are available to the City to reduce GHG emissions from building energy use. These include optimizing energy efficiency in new construction; retrofitting existing buildings to reduce energy consumption; promoting energy and water conservation and efficiency; advancing the use of renewable energy; reducing the use of natural gas; and improving the energy performance of municipal facilities. Oakland's greatest opportunities lie in retrofitting the city's existing building stock.

Oakland already has made progress in a number of these areas, adopting green building ordinances for civic and private buildings, implementing energy retrofits in most of the City's existing 100 largest facilities, working with partners to guide implementation of East Bay Energy Watch programs delivering energy efficiency services to local businesses, promoting green building construction, and installing more than six megawatts of solar electric panels. A number of actions identified as Priority Actions in the 2012 ECAP have been completed or are fully underway; these include adopting a Green Building Ordinance for Private Development in October 2010; offering Property Based Energy Financing throughout Oakland as of September 2015; and successfully completing a Stimulus-funded Downtown Commercial Retrofit Program.



The following Building Energy Use priority actions are supported by existing resources. Some were completed as one-time actions, while others will require ongoing investment. Although funds have already been allocated, implementation of these priority actions will cost an average of 2.6 FTE per year, 100 fellow hours per year, and \$564,000 for expenses throughout the next three years. Following are descriptions of each of these actions, along with information on implementation status.

Priority Actions

PA 5. Launch a Residential Green Retrofit Program

(BE-21) Launch a new energy retrofit program to improve energy efficiency of existing single-family and multi-family residential properties via promoting green improvements; providing green construction specs; certifying green contractors; connecting homeowners, landlords and tenants with financing options (e.g., new property-based financing), and providing quality assurance support.

Description: The Energy Upgrade California (EUC) residential energy retrofit program was seeded by contributions from local governments throughout Alameda County in 2009 and supported by ARRA funding, and has since grown to be a statewide umbrella brand for a suite of energy efficiency programs. The initial funding enabled the development of green building technical guidance for existing single family residential retrofits. Under the leadership of the Association of Bay Area Governments and StopWaste, the local EUC administrator, Oakland is now partnering with other local governments and agencies throughout Alameda County and across the region to implement the program. EUC fosters energy efficiency, water conservation, and other green improvements of existing single-family and multi-family residential properties in Oakland and throughout Alameda County. The program performs outreach to promote green improvements; provide green construction technical guidance; maintain a green contractor certification system; connect

homeowners, landlords, and tenants with financing options (e.g., property-based financing); and providing quality assurance support. The program also promotes the value of third-party certification of energy and green building improvements.

Responsibility: Oakland Public Works, Housing & Community Development

Status: Oakland's single family homes and multifamily buildings are eligible for incentives and assistance through BayREN's local version of Energy Upgrade California. From the program's full launch in 2014 through January 2017, 79 Bay Area multifamily building projects totaling 4,027 residential units had completed construction and received rebates through the EUC Bay Area Multifamily Building Enhancements program; in Oakland, 2,000 multifamily residential units had construction completed through the program. And, in 2016 alone, 329 single family Oakland homes were served by the EUC Home Upgrade and Advanced Home Upgrade programs, yielding savings of 100,529 therms and 126,545 kWh.

Costs: 2 hours staff time per year
Cost Total: \$300 annually

PA 6. Implement Advanced Operating Procedures for City Facilities

(BE-42) Enhance and implement standard operating procedures to improve energy efficiency in City facility operations.

Description: Continuous improvement of written standard operating procedures (SOPs) is necessary to ensure that City facilities operate with superior energy efficiency. New and enhanced written SOPs will be developed through interdepartmental collaboration and added to existing standards used by Oakland Public Works to sustain American Public Works Association accreditation. These SOPs will cover a range of topics including utility cost reporting, energy efficiency retrofitting, direct digital controls, lighting equipment maintenance, and photovoltaic equipment maintenance.

Responsibility: Oakland Public Works

Status: Building Energy Management Systems (EMS) have been installed in most major municipal buildings, with enhanced controls for HVAC and lighting systems. Monthly reports are prepared and distributed for review and use by building managers.

Costs: 40 hours staff time per year and 100 hours from Sustainability Fellowship Staff (fellow time)
Cost Total: \$24,000 annually plus \$1,400

PA 7. Retrofit City Facilities to Improve Energy Performance

(BE-44) Perform energy efficiency upgrades to existing City facilities, supported by ARRA funding.

Description: The City will retrofit existing municipal facilities to improve energy efficiency and reduce operating costs. Several energy retrofit projects have been funded by the ARRA Energy Efficiency and Conservation formula block grant. These projects include modifications to the Police Administration Building's lighting, heating, ventilating and air conditioning (HVAC) equipment; the City Administration Building automated HVAC controls; Data Center servers; and lighting systems throughout City facilities.

Responsibility: Oakland Public Works, Planning and Building Department

Status: A variety of facilities have been retrofitted to improve energy efficiency, including the buildings listed above. Significant opportunities remain among municipal buildings for efficiency projects.

Costs: 2.5 FTE per year; capital costs to vary based on availability of financing
Cost Total: \$490,000 annually for staffing; capital costs not estimable at present

Material Consumption and Waste

The manufacture, transport, use, and disposal of material goods represents the largest single source of consumption-based emissions. While many of these emissions do not occur within Oakland's geographic boundaries, consumption and disposal decisions (which include what we buy, how and how long we use it, and what we do with it when we've finished with it) made by each member of the Oakland community play a major role in the creation of these GHG emissions, both globally and locally.

The Oakland City Council adopted a Zero Waste Goal in 2006, calling for a 90% reduction in waste sent to landfill by 2020. The City's Zero Waste Strategic Plan outlines strategies for meeting this goal, which prioritize "systems" solutions to reduce landfilled waste, and expand waste reduction, recycling, and composting programs. By pursuing the City's adopted Zero Waste strategies, Oakland can help to create GHG reductions on the same or greater order of magnitude compared to those related to transportation and building energy use. Because GHG emissions affect Oakland regardless of where they are created, reducing emissions associated with materials and waste represents a significant local opportunity.



A number of tools are available to the City to reduce GHG emissions associated with material consumption and waste. These include restructuring Oakland's municipal code, garbage franchise agreement, and residential recycling service contracts; increasing reuse, repair, recycling, and composting; advocating for statewide producer responsibility legislation; and promoting local food and material choices. Replacing energy-intensive virgin resources with energy-efficient recycled resources can create significant GHG benefits, help to address global resource depletion, and lead to local economic development benefits. Composting organic wastes can help to replace emissions-intensive, petroleum-based fertilizers with carbon-capturing, water-saving compost, and reduces toxic runoff from California's farms. The Zero Waste hierarchy of reduce, reuse, recycle, and compost can be viewed as a global energy efficiency program that significantly reduces the energy and other natural resources used to create consumer goods, from cars to packaging to food. Many of these actions have already been accomplished or started in the first years of the ECAP period.

Oakland had already made progress in a number of these areas prior to the ECAP's adoption, adopting a Zero Waste Goal and Strategic Plan, offering residential curbside compost collection on a citywide basis, adopting a construction and demolition debris ordinance, developing regulations enabling urban food production, and promoting responsible purchasing behaviors such as buying recycled-content products. Since the ECAP's adoption, further progress has been made, as the City restructured its Solid Waste Management System and franchise hauler contracts, was instrumental in implementing a county-wide ban on single-use carry-out plastic bags, and improved implementation of the Construction and Demolition Debris Ordinance.

The following Material Consumption and Waste priority action is supported by existing resources. Although funds have already been allocated for this action, implementation will cost an average of \$4,200 for expenses and 100 fellow hours per year throughout the next three years. Following is a description of the action, along with information on implementation status.



Priority Action

PA 8. Encourage Land Owners to Lease Space for Food Production

(MW-18) Encourage local utilities, public agencies and other large land owners to offer commercial leases to local organizations for the purpose of local food production and/or foraging.

- Description:** The City will encourage local utilities, public agencies, and other large land owners to offer commercial leases to local organizations for the purpose of local food production and/or foraging.
- Responsibility:** Planning and Building Department
- Strategic Planning
- Status:** The City plans to begin work on this action during the next three years.
- Costs:** 100 hours fellow time per year
Cost Total: \$1,400 annually



Community Engagement

The City and its partners have an important role to play in educating and motivating all members of the Oakland community to join in the effort to reduce energy use and GHG emissions, and in providing tools and pathways to more effectively engage in that effort. Through its leadership, networks, and existing communication channels, the City can help to spur the high levels of community participation needed to solve the challenge of climate change, and seed opportunities for new ideas from the community to further strengthen local efforts. In addition, the City can track and report on Oakland's progress in reducing energy use and GHG emissions, and promote local examples of model practices throughout the community.



However, while the City can put Oakland in position to reduce GHG emissions, Oakland's success in meeting its climate goals will ultimately depend on the day-to-day decisions of individuals. For example, achieving Oakland's GHG reduction goals will require all members of the community to drive an average of 20% less. As much as possible, everyone will need to accomplish neighborhood trips by walking and biking, using public transit, combining trips, and telecommuting. 30% of Oakland's housing stock will need to undergo energy improvements, and 30% of Oakland's businesses will need to participate aggressively in energy efficiency programs. All Oaklanders must work to achieve the city's Zero Waste goals by recycling and composting. While the City has a profound responsibility in ensuring the infrastructure and appropriate policy environment to facilitate these decisions, local organizations also have a big role to play in motivating interest and action throughout the community, and helping demonstrate paths to success.

The City of Oakland can foster additional voluntary community action by setting a positive example, offering a vision of needed community actions, and encouraging and collaborating with local organizations where appropriate to accelerate progress. Achieving Oakland's GHG reduction goals will require engagement of early adopters and harder-to-reach residents alike. Local organizations, including community-based organizations, business, labor, educational institutions, and others, can help to educate, motivate, and empower the entire community to participate in and benefit from local climate action. As champions connected throughout the city, these organizations can help to build a movement around local climate action.

A number of actions that involve community engagement are recommended for completion during the remainder of this ECAP period. These actions include:

- Expand Outreach and Engagement on Energy and Climate Issues
- Partner with Local Organizations to Expand Engagement
- Convene Quarterly Community Climate Forums
- Produce an Annual Climate Progress Report
- Support Local Green Jobs Programs

The following Community Engagement priority actions are supported by existing resources. Some were completed as one-time actions, while others will require ongoing investment. Although funds have already been allocated, implementation of these priority actions will cost an average of 2 FTE per year, 0.4 fellow time per year, and \$978,000 for expenses throughout the next three years. Following are descriptions of each of these actions, along with information on implementation status.

Priority Actions

PA 9. Provide Additional Information on Energy and Climate Issues Including Energy and GHG Reduction Progress through Existing City Channels

(CE-1, CE-15,

& CE-17) Expand the City's website and other outreach channels to track and report annually on Oakland's progress in reducing energy use and GHG emissions and provide more comprehensive and action-oriented information regarding opportunities to reduce energy use and GHG emissions.

Description: The City can accelerate community action and increase transparency by enhancing its use of existing outreach channels. For example, content on the City's website can be enhanced to report regularly and in greater depth on Oakland's progress toward reducing GHG emissions, including GHG reduction achievements of the Oakland community; provide key performance metrics for evaluating Oakland's progress toward achieving climate goals; highlight model practices and examples of leadership throughout the community; illuminate opportunities for the community to provide input to relevant City planning documents, policies and programs; support local action; and provide action-oriented recommendations for community consideration at home and work.

The City can also expand its promotion of the Alameda County Green Business Program, and encourage more businesses to become certified (as of March 2017, there are 190 certified Green Businesses in Oakland). The City provides additional information via annual events such as EarthEXPO, Bike to Work Day, and the Art and Soul Festival, but has more untapped potential in sharing information and participation opportunities through its Stewardship programs.

Responsibility: Environmental Services

Status: Two comprehensive GHG emission inventories have been completed since the ECAP's 2012 adoption by Council, with a third planned for late 2017. The City reports GHG emissions annually through the Carbon Disclosure Project (CDP), as well as through the Global Covenant of Mayors. The *Sustainable Oakland Report*, a climate action progress report on the status of selected climate actions and key performance metrics for evaluating Oakland's climate progress, is published annually and posted to the City's website. This report can be provided to community organizations, associations, networks, businesses, schools, and other interested parties for further dissemination throughout the community. Energy and climate content on the City's website can be found at www.sustainableoakland.com. This includes information about new programs, such as PACE financing, Energy Upgrade California, and more, as well as links to this document and to Oakland's emissions inventories. Finally, the City is in the process of creating an online Sustainability Dashboard to showcase specific climate and energy progress.

Since the ECAP was written, the City has expanded green building information provided through its Green Building Resource Center located near the Planning and Building counters in the Dalziel Building at 250 Frank H. Ogawa Plaza. New content is constantly being added to the City's Green Building Resource Center, and to the green building pages on the City's website. Further improvements will be made in the process of the current re-design of the City's website. In concert with the City's resilience efforts, Environmental Services staff are developing and enhancing tools to enhance engagement with vulnerable and disadvantaged communities across Oakland to ensure that these communities are able to take maximum advantage of the City's energy and climate resources. Finally, the City has not fully leveraged novel ways of collecting information and ideas from residents about innovative approaches to climate mitigation. Since the ECAP adoption in 2012, social media tools have proliferated; an enhanced social media presence could aid in the efforts both to spread messages about climate action, and to collect information and ideas from the community. Doing so would likely require additional resources.

Costs: 0.20 FTE per year, 504 hours staff time per year, and 0.33 fellow time per year
Cost Total: \$130,000 annually

PA 10. Expand Outreach on Energy and Climate Issues through Partnerships with Local Organizations

(CE-2) Partner with community-based organizations, neighborhood associations, business associations, and others to promote local climate action throughout the community through new and traditional channels.

Description: By partnering with local organizations, the City can more efficiently and effectively reach all members of our diverse community to foster engagement on energy and climate issues. This outreach can highlight and encourage the community to take advantage of existing climate action programs. It can also help to educate and motivate community members to make additional changes to reduce GHG emissions in the areas of energy efficiency and conservation at home and work, alternative transportation options, food and material goods consumption and disposal, and more.



Collaborating organizations may have a geographic, demographic, topical, or other focus. Examples include community-based organizations, environmental justice organizations, neighborhood associations, business associations, faith-based organizations, community centers, schools, and others. Their efforts might include building ongoing local networks, holding neighborhood-scale events and workshops, encouraging engagement on City policy and planning efforts, and implementing community-led demonstration projects. Basic information and messaging can be delivered to local partners for their use under existing resources. New resources would be required to help develop accessible, multi-language educational and promotional materials that collaborating organizations could utilize to support more effective outreach, and to more effectively support demonstration projects.

Responsibility: Environmental Services

Status: Dozens of local organizations have come together around both the development and implementation of the Energy and Climate Action Plan, demonstrating significant organizing capacity and commitment to energy and climate issues. The City has provided information to these organizations to share through their networks, and has partnered with these organizations in outreach events and workshops. Great potential exists to enhance these collaborations to further expand outreach and engagement, including in conjunction with the City's Resilient Oakland Initiative.

Costs: 0.55 FTE per year
Cost Total: \$120,000 annually

PA 11. Promote Climate-Related Educational Opportunities

(CE-8) Encourage OUSD and other organizations to provide educational opportunities on energy and climate issues to local youth, and to integrate energy and climate action within operational practices where possible (e.g., safe routes to school and green schools programs).



Description: Reaching out to youth, via the educational curriculum as well as through the design of the environments in which they learn and play, is one of the most important channels for conveying the importance of climate action and achieving sustainable behavior change that will affect our society for generations to come. City of Oakland staff – including Sustainability, Environmental

Stewardship, and Resilience staff – frequently work with teachers and other personnel from Oakland schools to guest lecture, help plan or participate in environmental events, judge student competitions, and more. The City will continue to expand these efforts where possible, aiming to reach a broader range of youth from all parts of the city.

Working with school facility staff to lower the environmental impact of school operations and to transform schools into examples or living laboratories in which students can see climate-friendly and resilient practices at work is also critical. City staff will endeavor to partner with school personnel to encourage best environmental practices, and, where feasible, to pursue funding and other opportunities to improve the resilience and adaptive capacity of school facilities.

Responsibility: Environmental Services

Status: This work is ongoing. In recent years, Environmental Services staff have begun to bolster relationships with school personnel, including teachers and OUSD facilities staff.

Costs: 24 hours staff time per year plus 48 hours fellow time per year
Cost Total: \$4,000 annually

PA 12. Convene Community Climate Forums

(CE-10) Convene community climate forums three times per year to provide informal opportunities for members of the public and local community organizations to learn about local climate protection progress and opportunities, network, and provide suggestions.

Description: The Oakland community, including those who live, work, study, shop, and/or play here, includes a wide variety of informed, dedicated individuals with the capacity to contribute ideas to speed progress on energy and climate actions. The City will convene community forums three times each year dedicated to discussion of energy and climate issues.

The community climate forums may be convened as informal meetings enabling community members to learn about energy and climate action progress and opportunities, network, and provide suggestions to City staff and each other. These forums can also provide a venue for partnering organizations to make presentations on related issues.

Responsibility: Environmental Services

Status: The City held forums in 2012 and 2013, but were not continued due to staffing constraints. Other community organizations, such as the Oakland Climate Action Coalition (OCAC), have conducted community forums for their members and the broader community. In years where the City was unable to hold forums, City staff participated in forums convened by OCAC and other community partners. The City convened two forums and a series of smaller focus groups in the Spring and Summer of 2016 in conjunction with the ECAP update. There remains a need for a more comprehensive, centrally-organized, and regularly-held set of forums. As of early 2017, the City is working with partners to determine a viable pathway for holding regular forums.

Costs: 45 hours staff time per year
Cost Total: \$7,000 annually

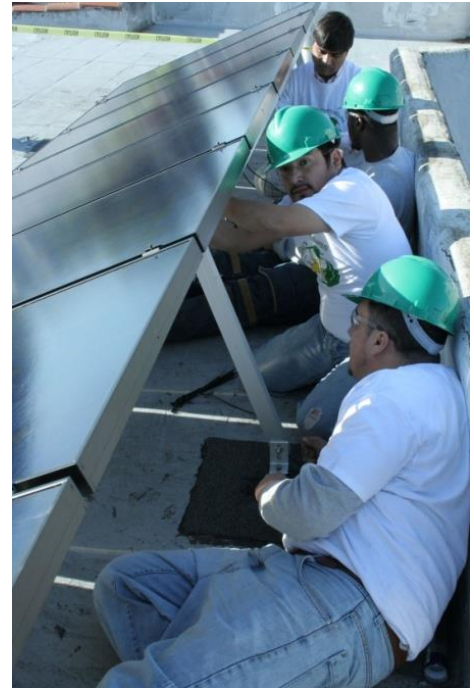
PA 13. Support Local Green Jobs Programs

(CE-20) Engage with local green jobs training providers to coordinate strategic planning and encourage programs to develop local workforce capacity and assess, train, and place local residents to perform energy retrofits and other green improvements.

Description: Many of the actions recommended in the ECAP have the potential to create demand for new local green jobs. Examples include green building construction, retrofitting existing buildings, installing solar panels, creating new bikeways, installing electric vehicle charging equipment, providing

recycling services, growing more local food, and installing water-efficient landscaping. The City will engage with the Workforce development Board, Green Corridor partners, and local green jobs training providers (e.g., the Oakland Green Jobs Corps) to encourage curricula and skills development in alignment with projected demand for new green workforce. These efforts can improve training opportunities for Oakland residents and help to increase the employment success of local green job program graduates.

For example, in 2009-2011, the City worked with the Peralta Community College District to run a two-year Green Works development program in the Coliseum Redevelopment Area. Funds were used to provide 40 East Oakland young adults with green education and training via special courses taught through the Peralta Community College District, including green landscape construction and site design. Project participants worked with local neighborhood stakeholders to help construct green landscape design-build projects that improve neighborhood parks and public places in the Coliseum area of East Oakland. In 2014, the City partnered with Laney College, Rotary Club of Oakland, and Passive House CA, to retrofit a previously burned, blighted, and abandoned home to the highest standards of energy efficiency and sustainability. The program taught valuable building science skills while students remodeled the home, reusing as many of the materials on-site as possible. The home's new residents will rarely need to use mechanical heating, and will enjoy improved indoor air quality and a healthy home.



Responsibility: Mayor's Office, Economic and Workforce Development, Housing, Environmental Services

Status: Since the ECAP was first written, "green job training" has evolved such that green jobs have been integrated into broader job training programs. Today, neither Green Corridor partners nor the Oakland Green Jobs Corps exist. The Cypress Mandela Training Center, which administered the Oakland Green Jobs Corps, operates a thriving construction skills training program, which continues to prepare its trainees for placement with solar installers and contractors using green building techniques. The City participates in ongoing dialogues with local green job training program providers and related programs. Examples of recent and current activities include the Green Residential Construction unit in the Vocational Training program at Youth Employment Partnership, which receives Federal funds appropriated via the City's Workforce Development Board. Other green employment linked to City sponsored or supported programs include training and internships for Civicorps members delivered by Waste Management of Alameda County as part of its solid waste (Mixed Materials and Organics) contract with the City; promotional support from the City for low income residential solar installations performed by GRID Alternatives for the installation of solar panels on low income owner-occupied homes; and City sponsorship of the California Youth Energy Services program to Oakland's youth, which has cumulatively trained more than 100 at risk youth in energy and water efficiency auditing skills. In April 2017, the City provided technical support to a consortium led by California Interfaith Power and Light for a Green Jobs Fair engaging 15 different employers to encourage connections for Oakland youth to entry level green jobs. The City's Housing Rehabilitation Program currently partners with Laney College, the Cypress Mandela Training Center, and others to teach energy efficiency and green building retrofit skills. The City's

Residential and Lending Services Program has partnered with Alliance for West Oakland Development and are currently in conversation with Civicorps about job training for construction jobs, which include sustainable and green building methods.

Costs:

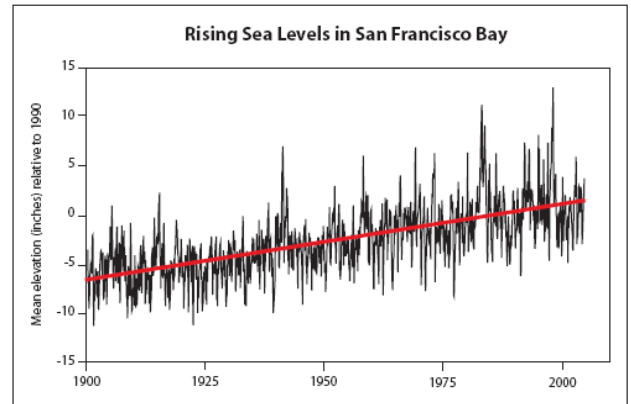
0.25 FTE per year and 115 hours in other staff time per year

Cost Total: \$65,000 annually

Climate Adaptation and Increasing Resilience

Some impacts of climate change, such as sea level rise and changing precipitation patterns, are already affecting the community – the result of decades of fossil fuel combustion and other activities, such as deforestation, that have already happened. It is important to engage in mitigation efforts to lessen future climate impacts and ensure those impacts do not overwhelm our ability to adapt. Taking action to adapt to climate impacts that are already happening, and will continue to happen, is also critically important.

Projected local impacts of climate change include significantly decreased snowpack in the Sierra Mountains (the source of most of Oakland's potable water supply); rising Bay and Delta waters; increased fire danger; greater frequency and intensity of heat events; added stress on infrastructure; higher prices for goods; lower quality of life for residents; and ecological impacts. The National Research Council has predicted that sea levels off the California coast are likely to rise 36 inches by the end of this century, and could rise as much as 66 inches.^{ix} A set of climate scenarios prepared for the California Energy Commission project that mean sea level along the California coast could rise by as much as 4.5 feet by 2100.^x According to maps produced by the Bay Conservation and Development Commission (BCDC), the Oakland-based Pacific Institute, and the National Oceanic and Atmospheric Administration, many low-elevation areas of Oakland would be vulnerable to flood events under these scenarios.^{xi}



Climate change vulnerability is a function of exposure to climate impacts, sensitivity to those impacts, and the capacity to adapt and recover. All members of the Oakland community could be affected by some of these impacts (e.g., water use restrictions), and certain population segments may be especially vulnerable. For example, more frequent and severe heat events could exacerbate existing public health problems related to poor air quality, especially affecting the elderly and those living or working in areas with high concentrations of air pollutants. Increased fire danger is likely to affect those living in the Oakland hills, while increased flooding danger in low-lying areas is of additional concern near land or facilities containing hazardous materials. Vulnerable communities already at higher risk of housing displacement and struggling to meet basic needs are likely to be hardest hit by some of these changes, and will have the hardest time bouncing back in the aftermath of catastrophic events such as wildfires and floods. The City of Oakland will continue to work with local and regional partners to explore adaptation strategies to ensure that climate impacts are minimized.

The following climate adaptation and increasing resilience priority actions are supported by existing resources. Some were completed as one-time actions, while others will require ongoing investment. Although funds have already been allocated, implementation of these priority actions will cost an average of 0.3 FTE per year and \$129,000 for expenses throughout the next three years. Following are descriptions of each of these actions, along with information on implementation status

Priority Actions

PA 14. Participate in Regional Climate Adaptation Discussions

(AD-1) Participate in discussions on climate adaptation and resilience issues with local governments and other experts.

Description: The City will continue to develop capacity around climate adaptation and resilience by exploring relevant issues with local partners and other experts. Where possible, the City will collaborate with local organizations such as BCDC, the Pacific Institute, Climate Bay Area, and other local governments, to enhance understanding of projected local impacts of climate change, how those impacts will affect Oakland, and potential strategies for moving forward to advance climate adaptation and increase community resilience. The City will monitor and advise major climate

adaptation efforts of neighboring cities and entities operating within city boundaries as resources permit with consideration of impacts to Oakland neighborhoods and infrastructure. The City will also collaborate with other local governments to advocate for consideration of urban issues and coastal city issues in the context of regional adaptation discussions. Existing resources will enable the City to participate in occasional meetings of ongoing regional climate adaptation discussions.

Responsibility: Planning and Building Department - Strategic Planning, Economic Development, Engineering

Status: The City participates in discussion with the Bay Conservation and Development Commission, the Local Government Sustainable Energy Coalition, ICLEI, SPUR, the Association of Bay Area Governments, and the Urban Sustainability Directors Network on climate adaptation programs. The City also administers a Resilience Program through the 100 Resilient Cities grant from the Rockefeller Foundation. The City will continue to identify local governments and other experts (including community groups with relevant expertise where appropriate) to engage in ongoing climate adaptation discussions.

Costs: 180 hours staff time per year
Cost Total: \$35,000 annually

PA 15. Include Measures to Reduce the Urban Heat Island Effect in Planning Documents

(AD-8) Update planning documents and building codes to include requirements for high albedo (reflective) surfaces where possible to reduce the urban heat island effect and mitigate public health impacts of extreme heat events.



Description: The urban heat island effect is a phenomenon where temperatures in many dense urban areas are elevated relative to the surrounding area due to several factors that include heat-producing activities (such as energy generation and auto use), an absence of trees and other flora that would have a cooling effect, and a predominance of heat-trapping surfaces such as dark roofs and asphalt. This effect exacerbates not only the warming effect of greenhouse gases, but also many of the negative impacts of climate change, such as extreme heat. Installing highly reflective surfaces, such as on roofs and pavement, can mitigate this effect. In the course of updating the City's Residential Green Building Ordinance (see Action BE-1), the City will include requirements for high-albedo (reflective) surfaces where possible to reduce the urban heat island effect and mitigate public health impacts of extreme heat events.

Responsibility: Environmental Services

Status: This item was added to the Priority List in 2017. No action has been taken.

Costs: See required resources for BE-1.

PA 16. Provide Staff Training on Climate Impacts and Adaptation

(AD-14) Provide training for City staff on projected climate impacts, vulnerability issues, and adaptation strategies.



Description: Building on the City's ongoing Environmental Lecture Series (see Action BE-47), the City will provide staff training on immediate and long-term projected effects of climate change, including disaster events such as extreme heat and flooding, as well as anticipated secondary effects such as housing displacement. Training will also address the unique vulnerability issues facing specific populations in Oakland, such as the disabled community or seniors, as well as neighborhoods that are particularly vulnerable due to their geographic location, lack of access to resources, or compounding factors such as poverty. Internal and external presenters will address adaptation and mitigation strategies, including those already being implemented such as the City's Green Streets program, as well as planned or innovative measures such as restored marshlands, on-site blackwater treatment and reuse, etc.

Responsibility: Environmental Services

Status: The City has conducted the monthly Environmental Lecture Series since 1998. Over 100 lectures have occurred through the program to date, primarily focusing on climate change mitigation measures (transportation sustainability, energy efficiency, etc.). Content on climate Impacts, vulnerability, and adaptation can be added to the training schedule relatively easily.

Costs: See Action BE-47.

Priority Actions Requiring New Resources

Putting Oakland on a steady path of progress toward achieving a 36% reduction in GHG emissions by 2020 will require the implementation of additional actions during the end of the ECAP period (2017-2020), beyond those recommended for completion under existing and anticipated resources described in the last chapter. The City should continue pursuing resources to enable implementation of all Priority Actions.

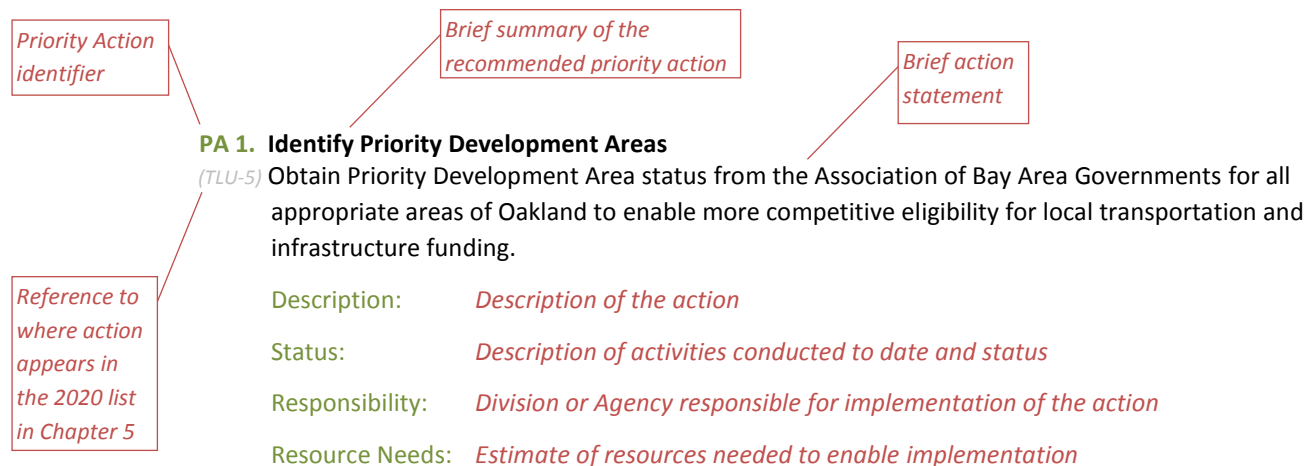
The actions below will move forward if new resources can be found. One important source of grant funding for the City and its partners is the Greenhouse Gas Reduction Fund (GGRF), which is supported by revenues from California's Cap and Trade system. The City has already applied successfully for several GGRF grants, particularly to support the sustainability-related aspects of affordable housing. These grants require deep partnerships for implementation, and pursuing them can strengthen the relationships among various community leaders and the City in the pursuit of our common climate and resilience goals.

The recommendations in this section were initially developed based on Council-approved criteria used to assist with evaluation and prioritization of potential GHG reduction actions within the ECAP:

- GHG Reduction Potential
- Implementation Cost and Access to Funding
- Financial Rate of Return
- GHG Reduction Cost Effectiveness
- Economic Development Potential
- Creation of Significant Social Equity Benefits
- Feasibility & Speed of Implementation
- Leveraging Partnerships
- Longevity of Benefits

How to Read This Section

Each action is presented through a standard format containing each of the following elements.



The star icon indicates Priority Actions that were newly prioritized during the 2017-18 ECAP Update. These actions were included in the 2012 ECAP, but were not in the list of original list of Three Year Priority Actions.

Resource Requirements

Resource needs are summarized for each recommended action. The total cost associated with implementing all proposed Three Year Priority Actions requiring new resources is projected to be approximately 24.9 staff FTE per year, 2.1 fellows per year, and an additional \$179 million for related expenses (e.g., consultant support). The City will continue to pursue fundraising opportunities for unfunded priority actions.

Transportation and Land Use

The following Transportation and Land Use priority actions are proposed for implementation by the end of the ECAP period. Some can be accomplished as one-time actions, while others will require ongoing investment. Implementation of each of these priority actions will require new resources. Implementing all Transportation and Land Use priority actions is projected to require an average of approximately 17.7 FTEs per year and an additional \$170.6 million over the next three years, including \$8.6 million per year for fleet replacement and \$131.6 million for the implementation of the Bicycle and Pedestrian Master Plans.

PA 17. Increase Multi-Income Housing near Transit Hubs

(TLU-9) Actively promote the construction of housing, at a range of price levels, near transit hubs and corridors in balance with local employment opportunities to meet the needs of Oakland's workforce.



Description: The City will seek resources to increase housing at a range of price levels near transit hubs to reduce the need for personal automobiles, preserve affordable housing in the city, and ensure that all facets of Oakland's workforce have the option to live within the city and near the services they need. This action may include the adoption of zoning changes, impact fees, and a transit-oriented development affordability policy.

Status: This action was added to the priority list in 2017. In 2016, City council approved new development impact fees on market rate housing to fund affordable housing and related amenities. The fees went into effect in late 2016, and will increase until 2020. A community engagement process is currently ongoing for Plan Downtown, a specific plan that aims to address the need for more housing at all price levels near the downtown BART stations, the Amtrak station, and the Ferry terminal. The plan is projected to be complete by 2019, and will provide additional policy guidance linking land use, transportation, economic development, housing, public spaces, cultural arts, and social equity. In order to ensure that social equity is adequately addressed, the City contracted with the Institute for Sustainable Economic, Educational and Environmental Design (I-SEED), to develop a social equity strategy that will guide policy and institutional change to address structural inequality through land use and other mechanisms, focusing specifically on Plan Downtown. The Planning and Building Department also plans to work with the new Department of Race and Equity to integrate the Plan Downtown process as part of Oakland's Citywide equity initiatives. As resources become available, additional similar efforts to engage the community in transit-oriented equitable planning and development may be pursued. The City has also promoted affordable housing in numerous individual developments in recent years, including with the support of GGRF funding from the State Affordable Housing and Sustainable Communities (AHSC) program. Developments have included MacArthur Station (108 affordable units), and two affordable developments that received AHSC funding in 2014-15 located in East Oakland's Fruitvale neighborhood and in Downtown (72 affordable units). For the latter projects, funds are supporting both development and transit-related amenities, including safe pedestrian and bicycle travel and safe connections to nearby transit stops.

Responsibility: Planning and Building Department - Strategic Planning, Housing and Community Development Department

Resource Needs: 48 hours staff time per year
Cost Total: \$7,000 annually



PA 18. Accelerate Completion of Bicycle and Pedestrian Plans

(TLU-16) Accelerate the completion of bicycle and pedestrian networks as noted in the Bicycle and Pedestrian Master Plans and other General Plan policies to provide safe, healthy transportation choices for all residents.

Description: The City is seeking resources to accelerate the completion of bicycle and pedestrian networks as noted in the Bicycle and Pedestrian Master Plans and other General Plan policies to provide safe, healthy transportation choices for all residents.

Improvements that would increase access to transit, transportation linkages, jobs, and commercial activity in disadvantaged neighborhoods are prioritized. The Pedestrian and Bicycle Plans already include processes for updating priorities to include new infrastructure opportunities.

Project development and personnel costs are largely funded by external grants. Additional external grants are available to support additional FTEs. The level of increased staff capacity recommended below would enable the City to double the amount of bicycle facilities it currently produces annually.

Over time, full implementation of the Bicycle Master Plan is projected to cost approximately \$38 million.^{xii} Full implementation of the Pedestrian Master Plan is projected to cost approximately \$109 million.^{xiii}

Status: As of late 2016, over 150 miles of bike lanes have been completed in Oakland, and nearly four percent of Oaklanders commute to work primarily by bicycle. The City is also welcoming the East Bay expansion of Bay Area Bike Share, with the installation of bike share stations and 850 bikes installed in Oakland in spring and fall 2017. The Draft Pedestrian Master Plan was released in April 2017, with Council adoption expected in June 2017. The City will initiate an update to the 2007 Bicycle Master Plan in 2017.

Responsibility: Department of Transportation

Resource Needs: Creation of 2.5 FTE positions offset by external funds to accelerate implementation, \$22,576,750 for the Bicycle Master Plan implementation through the end of 2019, and \$109,000,000 for Pedestrian Master Plan implementation
Cost Total: \$520,000 annually plus \$131,600,000 for implementation of the Bicycle Master Plan and the Pedestrian Master Plan

PA 19. Optimize Street Design to Support Transit, Bicycling, and Walking

(TLU-17) Optimize the design of streets to support transit, bicycling, and walking (e.g., via bulb outs, traffic signal synchronization, transit and emergency signal priority)



Description: The City will implement Oakland's Complete Streets Policy through a corridor development program that prioritizes pedestrians, bicyclists, and transit riders, to improve the safety and livability of key corridors across the city. This program will be cross-functional, including both planners and engineers, to develop, design, and implement complete streets projects. Supporting these efforts, the City will develop design guidelines and technical guidance on optimizing street design for transit, bicycling, and walking, including policy guidance on mode shift goals. The City will also establish a Signal Operations Unit and create a signal operations plan that prioritizes safety for all modes, including implementing pedestrian signal policy

To complete this item, a multidisciplinary team of six planners and engineers is needed to oversee planning, outreach, and project development. Additionally, four traffic engineering staff dedicated to managing the operations of traffic signals in Oakland to prioritize transit, biking, and walking will be needed.

Status: This action was added to the priority list in 2017. A project development team is proposed as part of the FY 17-19 Department of Transportation budget. The Department has initiated the development of design guidelines and anticipates completion by the end of 2017. A signal operations unit is also proposed as part of the Department's FY 17-19 budget.

Responsibility: Department of Transportation

Resource Needs: 10 FTE per year
Cost Total: \$1,740,000 annually

PA 20. Expand and Enhance Public Transit Service and Amenities

(TLU-19) Collaborate with regional partners to expand and enhance public transit service, interconnections, vehicle amenities, and associated facilities.



Description: In partnership with regional transit agencies (e.g., AC Transit, BART, shuttles, Amtrak, taxis, San Francisco Bay Ferry), the City will seek resources to expand and enhance public transit services and amenities. This may include smaller transit shuttles to underserved areas of the community, improved connection timing, and more.

Status: This action was added to the priority list in 2017. The City is already pursuing several projects that will enhance and/or improve linkages with regional public transportation infrastructure, including the Free Downtown Shuttle (see PA-2 / TLU-13), Bus Rapid Transit (PA-3 / TLU-14), and enhanced amenities along key BART stops. In 2016, the City's new Department of Transportation published its Strategic Plan, which lays out goals for a sustainable, responsive, and equitable transportation ecosystem including ensuring that Oaklanders feel safe walking and waiting for the bus at all times of day or night, creating a Complete Streets Corridor system, and planning and implementing fast, frequent and reliable transit.

Responsibility: Department of Transportation

Resource Needs: 240 hours staff time per year
Cost Total: \$33,000 annually

PA 21. Expand Car Sharing

(TLU-25) Explore potential strategies for increasing the availability of car share vehicles throughout the city (e.g., consider providing priority car share locations in high trafficked areas to car share companies willing to make car share vehicles available and accessible in less trafficked or underserved areas).



Description: The City of Oakland is working with car sharing organizations to make the public right of way and municipally owned parking lots and garages available for car sharing services as the City deems appropriate and in a manner that balances all modes of transportation. The City has established basic requirements to operate a car sharing service, and monitor feedback from Oakland residents about car sharing services. In planning and permitting car sharing services, the City has considered current and projected parking and accessibility conditions in both residential and commercial districts. The goal is to ensure that all residents, including seniors, people with disabilities, and disadvantaged residents, are served by this environmentally beneficial mode of transportation. The City intends to work with car sharing organizations so that all neighborhoods and communities have equitable access to car sharing services. The financial impact of administering a car sharing program should be cost neutral to the City.

Status: Oakland City Council amended the Municipal Code to include car share permits in support of the pilot program. The first free-floating car share operation was launched in April 2017, with the introduction of 250 car share vehicles by American Automobile Association's new Gig Car Share venture.

Responsibility: Department of Transportation

Resource Needs: 1 FTE per year plus \$439,769 in grant funding from MTC
Cost Total: \$210,000 annually plus \$450,000

PA 22. Impose Parking Maximums and Develop Strategies to Minimize Parking Need

(TLU-30) Impose parking maximums on new development and assist developers, lenders, property owners, and tenants in preparing strategies to minimize parking demand and encourage shifts to transit and other transportation modes.



Description: The City will continue to seek resources and study possible strategies to expand the areas where parking maximums are imposed, and work with multiple stakeholders to identify additional strategies to reduce the need for parking.

Status: This action was added to the priority list in 2017. In 2016, the City imposed parking maximums in Downtown of 1.25 spaces per residential unit. A suite of additional strategies have been applied in Downtown to reduce the need for parking, including requiring building owners to provide transit passes for tenants in all new developments, unbundling the cost of parking from residential rent, and requiring car share spaces in all new residential parking facilities. Parking minimum requirements were also lowered throughout the City, particularly in Downtown and along major transit corridors.

City Council asked staff to study the effects of the parking reductions on parking behavior, including how residential neighbors are being impacted by the changes. Council also directed staff to update the residential parking permit program, which does not currently address spillover from major corridors resulting from the new policies. In addition to pursuing these directives, the City will continue to explore ways of reducing the need for personal transportation, and the need for parking, throughout the City, including through parking regulations, incentives for alternate transportation modes, and enhancing strategic partnerships with regional transit agencies and others.

Responsibility: Planning and Building Department - Strategic Planning, Department of Transportation

Resource Needs: 0.08 FTE for two years plus 2 hours staff time per year
Cost Total: \$32,000 plus \$250 annually

PA 23. Call for Climate Action by Port of Oakland Tenants

(TLU-39) Call upon the Port of Oakland to establish GHG inventories and reduction goals associated with tenant activities, and plans for achieving those goals with appropriate tenant commitments, potentially including requiring specific high-impact GHG reduction measures (e.g., electrification of land-based aviation equipment and low-carbon electricity purchase for leased spaces).

Description: Beyond the Port's own operations, GHG emissions associated with tenant activities at the Port can be significant. Through relationships with its tenants (e.g., lease agreements), the Port can advance additional GHG reductions associated with tenant activities.

Status: The City and Port maintain dialogue on these issues via the City-Port Liaison Committee and peer-to-peer staff level discussions. While discussions have occurred at the staff level, no formal goal has been established.

Responsibility: City Council members and Departmental Staff

Resource Needs: 16 hours staff time
Cost Total: \$3,000

PA 24. Develop an Urban Forestry Master Plan

(TLU-45) Develop an urban forestry master plan outlining how the City will protect, develop and maintain diversified and appropriate tree plantings on City right-of-ways.

Description: The City will seek resources to develop an urban forestry master plan outlining how the City will protect, develop, and maintain diversified and appropriate tree plantings on City right-of-ways in a manner consistent with Bay Friendly Guidelines. This plan will include: the criteria and process for planting of new trees; an annual tree planting goal based on the results of an urban tree inventory; a citywide canopy coverage goal and canopy coverage goals for specific disadvantaged neighborhoods; carbon sequestration goals for the urban forest; approved species for streetscapes and parklands; an economic analysis of the value of the urban forest; maintenance priorities and process for existing trees; a long-term funding plan; and clear roles for the City and community partners.



Status: In 2017, the City applied for a \$999,999 grant from CAL FIRE, through the Statewide Greenhouse Gas Reduction Fund, to conduct a street and park tree inventory (see PA 25), conduct broad community engagement, craft an urban forestry master plan, and conduct limited demonstration tree planting in partnership with local nonprofits. While the application was not successful, the City will build on the work conducted through the creation of the application to continue seeking funds from other sources.

Responsibility: Environmental Services; Parks and Tree Services

Resource Needs: 2 FTE for one year plus \$110,000 of expenses
Cost Total: \$525,000

PA 25. Conduct a Robust Urban Tree Inventory

(TLU-46) Develop a robust urban tree inventory of all trees in proximity to sidewalks, medians, public buildings, parks, and other public rights-of-way.



Description: The City will employ an inventory method that will have the capacity to include data for private property. To promote public-private partnerships and community engagement, the method will be usable by both the public and City staff for inventorying, assessment, and planning, and the City will work with nonprofit partners to explore ways of engaging the public in the data collection process. If possible, the data platform should be shared outside of Oakland and used for larger data collection and analysis.

Status: This action was added to the priority list in 2017. Conducting a complete street and park tree inventory was part of the City's 2017 unsuccessful application to CAL FIRE. The City is continuing to explore funding opportunities for a complete urban tree inventory.

Responsibility: Environmental Services; Parks and Tree Services

Resource Needs: 1 FTE for one year plus up to \$340,000 of expenses
Cost Total: \$540,000

PA 26. Update City Tree Ordinances

(TLU-47) Revise the City Street Trees and Shrubs Ordinance (Municipal Code 12.32) and the Protected Trees Ordinance (Municipal Code 12.36) to include the provision of preventative maintenance and management of trees in City rights-of-way, to ensure the continued health of all parks and forested land within the city and encourage tree planting on private land throughout the community, and to include effective enforcement provisions.



Description: The revised ordinances should be based on the Street Tree Inventory and the Urban Forestry Master Plan, and reference the Energy and Climate Action Plan. They should also include, by reference, professional standards such as ISA (International Society of Arboriculture) and/or ANSI A300 for planting, pruning, and species selection. The revised Street Trees and Shrubs Ordinance should include regulations for mature tree care and tree protection at/near construction sites. Both ordinances should be amended to include effective enforcement provisions.

Status: This action was added to the priority list in 2017. The City has not identified recommendations for the updating of these Ordinances, and funding has not been identified for the needed implementation associated with updates.

Responsibility: Environmental Services; Parks and Tree Services

Resource Needs: 500 staff hours
Cost Total: \$70,000

PA 27. Implement Street Tree Planting Pilot

(TLU-48) Implement a street tree planting pilot project with local partners utilizing advanced planting techniques.



Description: Since the City's tree planting program was ended in 2008 due to budget cuts, the program has not been reinstated. A robust urban tree planting program is essential to make up for trees that are lost due to disease or other reasons, and to build canopy coverage in disadvantaged areas and other parts of the city where canopy coverage is particularly low. The City will seek resources to reinstate the tree planting program and, in the interim, to conduct tree planting pilots in partnership with local organizations.

Status: This action was added to the priority list in 2017. Implementing a street tree planting pilot through demonstration planting of 300 street trees in key disadvantaged neighborhoods was part of the City's unsuccessful 2017 application to CAL FIRE. The City is continuing to explore funding opportunities for this activity.

Responsibility: Environmental Services; Bureau of Infrastructure and Operations

Resource Needs: 0.25 FTE for 1 year plus \$45,000 of expenses
Cost Total: \$100,000

PA 28. Accelerate City Fleet Vehicle Replacement

(TLU-52) Increase the rate of fleet vehicle replacement to retire older inefficient vehicles and continue to replace vehicles with fuel efficient and alternative fuel models.

Description: The City will seek resources to accelerate the rate at which it replaces fleet vehicles, creating increased opportunities to improve fuel efficiency and reduce GHG emissions associated with the municipal vehicle fleet. While proper maintenance can help to preserve vehicle fuel economy, the greatest technological opportunity to reduce GHG emissions associated with the City's vehicle fleet is at the point of purchasing new vehicles. The City's adopted Clean Fleets policy requires that vehicles achieving superior fuel efficiency and/or operated on alternative fuels (e.g., compressed natural gas, electric and plug-in hybrid vehicles, trucks with anti-idling controls) be given preference in the procurement of new vehicles. However, the recent pace of vehicle replacement has not offered many opportunities to improve overall fleet fuel efficiency.

According to the April 2009 Public Works Department Performance Audit, the City should “Prepare a five-year equipment replacement plan for the City’s fleet for a review by the operating departments and the Budget Office. The City should increase its funding for the replacement of the equipment fleet by \$5.5 million annually.”^{xiv} The Performance Audit recognizes that the City does not currently have funding to meet these needs.

Status: As of 2017, the City municipal fleet consists of 1,200 vehicles and an additional 300 units of equipment (wheeled machinery). Of this total, 569, or 38 percent, are alternative fuel or advanced technology. These include 366 on- and off-road renewable diesel vehicles, 99 CNG light- and medium-duty vehicles, 10 CNG heavy-duty vehicles, 63 Hybrid electric sedans, 26 Battery Electric Sedans, and five neighborhood electric vehicles. Since 2002, 100% of non-Law Enforcement sedan purchases have been alternative fuel or hybrid. The City has increased its alternative fuel or advanced technology non-law enforcement sedans from 28 percent in 2003, to 63% in 2017. In addition, all diesel-powered solid waste collection trucks used in Oakland under the former contracts, approximately 140 vehicles, have been replaced by low-emissions natural gas-powered trucks. Most of these trucks use locally produced natural gas made from landfill methane.

During the end of the ECAP period, the City will continue to seek funds to continue replacing the oldest fleet sedans to battery electric or hybrid; replacing the older street sweeper, refuse truck, cargo vans with CNG-powered vehicles; and converting all remaining conventional diesel vehicles to renewable diesel. The City also plans to expand the use of shared pool vehicles, and explore other advanced fuel technologies, including hydrogen fuel cell-powered sedans.

Responsibility: Equipment Services

Resource Needs: \$9,830,000 per year

PA 29. Subsidize Transit and Transportation Alternatives for City Employees

(TLU-53) Provide subsidized transit passes and/or other alternative transportation benefits to City employees to encourage alternatives to driving.

Description: The City will seek resources to provide subsidized transit passes and/or other alternative transportation benefits (e.g., bicycle commuter allowances) to City employees to encourage alternative modes of commuting. The City already participates in the Commuter Check program, offering employees the opportunity to make pre-tax purchases of transit passes for rides on BART and AC Transit. Providing additional transit incentives can encourage more employees to use transit for commuting to work. For example, unlimited use subsidized transit passes can be provided to City employees through participation in the AC Transit Easy Pass program. Likewise, the City could provide additional benefits to employees who choose to bike or walk to work, such as bicycle commuter or shoe allowances.

Status: The City offers a pre-tax set asides for transit passes for all employees. In 2016, approximately 800 employees affiliated with the IFPTE Local 21 Union became eligible to receive free AC Transit EasyPass as part of the current labor contract. The passes are a pilot program, which the City and the union will revisit in the next round of labor negotiations. By purchasing EasyPasses for all IFPTE Local 21 members, the City received a 95% discount off the value of the passes. To date, 489 Local 21 members have signed up for an EasyPass. During the month of March, 2017 (most recent available data), 155 unique individuals used the pass for a total of 2,319 boardings (93 average daily trips and 21 average weekend trips).

Responsibility: Human Resources – Benefits

Resource Needs: 0.25 FTE in Transportation Services and 0.25 FTE in Human Resources personnel for 1 year plus \$120,000 of expenses for participation in the Easy Pass program
Cost Total: \$225,000

Building Energy Use

The following Building Energy Use priority actions are proposed for implementation by the end of the ECAP period. Some can be accomplished as one-time actions, while others will require ongoing investment. Implementation of each of these priority actions will require new resources. Implementing all Building Energy Use priority actions is projected to require an average of approximately 7 FTEs per year, 1.6 fellow time, and an additional \$6.0 million for expenses over the next three years.

PA 30. Seek Resources to Support Energy Programs

(BE-6) Pursue funding to augment existing, and create new residential and commercial energy programs to reduce energy consumption throughout the community.

Description: The City will continue to seek resources to augment existing, and create new programs to foster a reduction in energy use throughout Oakland's residential and commercial properties. This may include opportunities offered by PG&E, California State Energy Program, Bay Area Air Quality Management District, and others. For example, the City may pursue funding to promote energy retrofits, offer free or subsidized energy audits, provide technical assistance, or provide targeted incentives.

Existing resources are sufficient for responding to a limited number of potential funding opportunities on an annual basis. Additional resources would augment the City's capacity to submit a greater number of competitive proposals.

Status: Since the ECAP was adopted, the City has worked with the Association of Bay Area Governments to secure CPUC funding for BayREN programs, and obtained additional grants for energy efficiency, renewables, and other energy programs from a variety of sources, including technical assistance and ongoing incentives from PG&E. With the 2018 launch of East Bay Clean Energy, the county-wide community choice aggregation program, additional opportunities will likely arise for locally-determined clean energy and efficiency programs.

Responsibility: Environmental Services

Resource Needs: 240 hours staff time per year
Cost Total: \$45,000 annually

PA 31. Encourage Citywide Energy Conservation and Efficient Product Purchasing

(BE-7) Encourage all businesses and residents to conserve electricity, natural gas, and water, and to choose energy- and water-efficient replacement products.

Description: The City will seek resources to create or support a marketing campaign and offer technical assistance in coordination with local partners to encourage all businesses and residents to reduce their energy consumption through conservation and energy efficient product purchasing. The campaign will provide information about conservation opportunities to all households and businesses, in collaboration with outreach performed by PG&E, EBEW, EBMUD, trade groups, and community-based organizations. All households will be encouraged to reduce energy use in their homes, and demonstrate the environmental and health benefits of electricity over natural gas appliances and systems. The campaign will also encourage the purchase of energy-efficient products and appliances to help residents and businesses reduce energy use.

Implementation of this Action Item will be coordinated with local and regional providers of energy efficiency and conservation programs, including the Bay Area Regional Energy Network, East Bay Community Energy, and PG&E.

Responsibility: Environmental Services

Resource Needs: 50 hours staff time per year for 4 years, 80 hours staff time per year, and 0.5 fellow time per year
Cost Total: \$40,000 plus \$26,000 annually

PA 32. Engage Largest Electricity Consumers in Energy Retrofits

(BE-14) Offer technical assistance to help Oakland's most energy intensive businesses achieve superior energy efficiency results by participating in programs offered by PG&E and other organizations.

Description: The City will seek resources to create a new program that guides the approximately 400 businesses that consume 50% of the electricity used in Oakland into existing energy auditing, water conservation, and rebate programs offered by PG&E and other organizations. These 400 firms represent approximately 10% of Oakland's medium-to-large businesses, with 30 of them consuming over 25% of total citywide electricity. This program will engage each targeted business to create an energy efficiency and demand reduction strategy, or roadmap, tailored to that business' opportunities and circumstances, aiming at average annual energy savings of at least 20%. Estimated collective energy costs savings are \$28 million per year.

Implementing this program will require extensive outreach to Oakland's ~400 biggest energy users. The program will aim to secure participation from property owners, tenants, and building management companies. The program will create customized roadmaps encouraging businesses to participate in all applicable PG&E energy efficiency and conservation programs and EBMUD water conservation programs, to perform comprehensive energy and water audits, and to implement all cost-effective retrofit opportunities. Property owners would pay for implementing the improvements, factoring in the benefits of rebate programs from PG&E and others. PG&E, East Bay Energy Watch, StopWaste and EBMUD will be among the organizations invited to collaborate and coordinate closely on this program. Some projects may take advantage of property based clean energy financing (see PA 8).

Status: While the City has engaged with PG&E to identify and work with the City's largest energy users, data rules set by the California Public Utilities Commission, and interpreted and enforced by the State's Investor Owned Utilities, including PG&E, limit the City's ability to accomplish this action. In addition to actively seeking funding to support this action, the City is also working with regional and statewide partners, as well as directly with PG&E, to identify solutions to the data access issues that currently prevent most municipal governments from accessing energy data regarding their jurisdictions' industrial facilities.

Responsibility: Business Development, Environmental Services

Resource Needs: 20 hours staff time per year for 4 years and 10 hours staff time per year
Cost Total: \$16,000 plus \$2,000 annually

PA 33. Consider Energy Benchmarking Requirements for Commercial Buildings

(BE-15& BE-16) Consider requiring energy benchmarking of commercial sector buildings by a certain date.

Description: The City will seek resources to research and develop options for requiring energy benchmarking of commercial sector buildings. Benchmarking energy use can yield insights into energy performance and opportunities to save energy and money through improved efficiency and conservation. Energy benchmarking tools are available to help private building owners gain additional perspective on the relative energy use of their buildings, and where opportunities for efficiency improvements may exist. In developing options for requiring energy benchmarking, the City will consider issues associated with building types, level of effort needed by the building owner or operator, verification, related educational tools, and the availability, privacy and automation potential of energy data.

Status: The City has applied for funding to research and develop commercial benchmarking requirements, but has not received funding to date.

Responsibility: Planning, Building Services, Environmental Services

Resource Needs: 0.75 FTE for three years plus 150 hours staff time
Cost Total: \$490,000

PA 34. Launch the Weatherization and Energy Retrofit Loan Program

(BE-23) Create the Weatherization and Energy Retrofit Loan Program (WERLP) to provide zero-interest loans to help low-to-moderate income residents improve energy efficiency and reduce energy costs, supported by \$1.8 million of ARRA Community Development Block Grant (CDBG) funds.

Description: The WERLP offers loans of \$6,500 to \$30,000 to owner-occupied low-income and moderate-income households. Loan funds can only be used for energy efficiency-related improvements such as attic insulation, caulking, weather-stripping, water heater insulation, energy-efficient light fixtures, furnace maintenance, energy saving appliances, and systems rehabilitation and replacement. Eligible systems include the furnace, windows, doors, water heater and roof. Loans are interest free and repaid upon sale of property without any periodic payments.



At its inception in 2009, the program expected to serve 75 homes by the end of 2012, with a goal of reducing energy bills by 30% on average, while generating 108 jobs and connecting with trainees from the Oakland Green Jobs Corps. The WERLP was introduced as an expanded offering of the City's Lending and Rehabilitation Services.

Responsibility: Housing and Community Development Department

Status: This program is ongoing, and a total of 98 properties have been served since its inception. The City coordinates with local building performance professionals to ensure that training opportunities are available to local contractors. The City also works to ensure that energy retrofits are performed to industry standards. After ARRA funds were exhausted in 2012, the City continued the program using Community Development Block Grant (CDBG) funding. As of 2017, it is funded through a combination of CDBG and loan repayments. The current level of funding allows the program to serve approximately 20 properties per year.

Resource Needs: 3.6 FTE per year plus \$2,400,000 of expenses
Cost Total: \$715,000 annually plus \$2,400,000 of expenses

PA 35. Create a Renter-Occupied Residential Energy Retrofit Program

(BE-24) Create a new energy retrofit program to facilitate energy efficiency and water conservation improvements in existing renter-occupied residential properties by supporting outreach as well as assistance designing model tenant-landlord agreements so that all parties equitably share the costs and benefits of energy efficiency.

Description: The City will seek resources to develop new tools and assistance to foster energy retrofits of renter-occupied properties. This will include engaging stakeholders to provide recommendations on how to ensure that both owners and tenants can be protected and receive benefits from energy efficiency retrofits so that both have an incentive to support energy improvements.

Status: Since the ECAP was adopted, the Bay Area Regional Energy Network (BayREN) was formed, with leadership from Oakland. One of the BayREN's signature programs is the Bay Area Multifamily Building Enhancements Program, or BAMBE, which provides incentives and technical assistance to multifamily building property owners and managers to implement energy efficiency projects. The program assists in planning energy saving improvements designed to save 15% or more of a building's energy and water usage, and provides \$750 per unit in rebates to help pay for the upgrades. The City assists in marketing this program to Oakland property owners and managers. California Youth Energy Services (CYES), which operates during the summer months, serves residents of approximately 250 Oakland homes per

year, including renters, providing energy efficiency and water conservation education and limited measure installation. Additional resources are needed to provide an in-depth energy retrofit program to single-family home renters throughout Oakland. The City lacks plans and staff capacity to undertake income review and monitoring for single family rental properties.

Responsibility: Housing and Community Development, Environmental Services

Resource Needs: 0.5 FTE for 3 years
Cost Total: \$270,000

PA 36. Adopt and Implement a Residential Energy Conservation Ordinance

(BE-25) Adopt an ordinance requiring cost-effective residential energy- and water-related improvements at time of sale, or under other appropriate conditions with consideration of affordability and equity.

Description: The City will seek resources needed to research and develop options for adopting a residential energy conservation ordinance (RECO). A RECO can be an effective tool for increasing energy efficiency of Oakland's existing housing stock. The RECO can be designed to require cost-effective energy- and water-related improvements at time of sale or under other appropriate conditions, fostering continuous energy improvement of Oakland's building stock in a manner that is beneficial for residents. Lessons can be drawn from years of RECO implementation in Berkeley. Issues of affordability and equity must be considered in the process of developing an effective and appropriate RECO. The RECO can also be designed to require disclosure of home energy performance based on past utility bills in a prescribed manner, helping to raise the profile of energy use in home buying decisions and spur additional retrofit action.

Status: The City has applied for funding to research and craft a RECO, but has not received funding to date.

Responsibility: Planning, Building Services, Environmental Services

Resource Needs: 1 FTE for one year and 1 fellow for one year
Cost Total: \$230,000

PA 37. Facilitate Community Solar Programs

(BE-28) Encourage and collaborate with local partners to launch a community solar program to increase local use of renewable energy, including solar-thermal energy to produce heat and hot water.

Description: The City will seek resources to encourage and collaborate with local partners to offer a community solar program(s) promoting increased use of renewable energy. Such a program may perform outreach to residents and businesses about opportunities to utilize solar energy; provide technical assistance including opportunity assessment and procurement support; connect residents to property-secured and other financing opportunities; offer to coordinate collaborative purchasing for local installation of solar energy systems; and/or offer free energy opportunity audits and technical assistance for this purpose.



- Status:** Community solar programs are traditionally administered by utilities. PG&E launched a community solar program available to Oakland residents beginning in October 2015. Additionally, the City ran Sunshares, a solar group buy for Oakland residents and their families in Fall 2014 and again in Spring/Summer 2016 in partnership with Vote Solar. The second group buy included options for residents without solar access on their own roofs. More work is needed to complement PG&E's offerings to address the needs of small and disadvantaged communities, and to link PG&E's program with additional external and non-traditional resources. With East Bay Community Energy, the county-wide community choice aggregation program, launching in 2018, additional opportunities will arise to design and co-market innovative, community-based renewable energy opportunities.
- Responsibility:** Environmental Services
- Resource Needs:** 0.5 FTE per year
Cost Total: \$145,000 annually

PA 38. Encourage Rainwater Harvesting

(BE-35) Encourage the installation of rainwater harvesting through water collecting cisterns in new development to capture water during the rainy season for outdoor uses and/or indoor uses.



Description: The City will seek resources to encourage residents, developers, and building owners to install rain barrels and water collecting cisterns in new developments to capture rainwater for outdoor and/or indoor uses. In the last ten years, California has seen one of the most severe droughts in recorded history. Capturing rainwater is a relatively easy way to increase a community's resilience to drought, providing for a potentially significant portion of water needs during the dry season. Rain barrels help to protect our creeks and the Bay by reducing urban runoff, and reduce the need for homes to use treated potable water for outdoor use.

Status: In 2010-2012, the City ran a successful Rain Barrel Program, a three-year initiative funded by the Clean Water State Revolving Fund and the Federal Stimulus program. The program provided subsidized rain barrels to Oakland residents, schools, churches and nonprofits. It also provided educational workshops, green job training for youth and interns, and cistern demonstration projects to public entities including Chabot Space and Science Center, Skyline High School, and Merritt College. Nearly 1,400 Oaklanders purchased and installed 2,708 rain barrels and cisterns, for a total of 400,545 gallons of new rainwater storage. The City will seek external funding to reinstate this program, and will explore ways of encouraging rain barrel or cistern installation in new development.

Responsibility: Watershed Protection, Environmental Services

Resource Needs: 40 hours staff time plus 10 hours per year
Cost Total: \$7,000 plus \$2,000 annually

PA 39. Increase Public Landscaping with Drought-Resistant Plants and Trees

(BE-40) Increase the amount of public space landscaped with drought-resistant plants and trees meeting Bay Friendly Landscaping Guidelines.



Description: The City of Oakland uses drought-resistant plants and trees when replacing those that are dead, dying, or diseased. The City follows Bay Friendly Guidelines when considering new plantings or capital improvement projects. The City has replaced nearly five acres of ornamental/passive lawns through lawn conversion projects. This includes installation of drip irrigation, use of cardboard and mulch to suppress weeds, compost to add nutrients to the soil, and drought resistant native grasses and trees. These projects have been made possible through grants from StopWaste and rebates from EBMUD. In addition, the City follows the Water Efficient Landscape Ordinance (WELo), which requires retrofitting of all overhead irrigation spraying in new landscape or construction projects.

Responsibility: Oakland Public Works, Parks and Tree Services Division

Status: The 2011-2016 drought and lack of resources has made it necessary to follow best landscape maintenance practices when considering new landscaping. The City continues to use innovative ideas to conserve water, reduce maintenance costs, and pursue sustainable landscape practices. Oakland Public Works has eliminated lawn areas where feasible to reduce water and resource demands. The City continues to follow the Water Efficient Landscape Ordinance (WELO) to retrofit all overhead irrigation spraying in new landscape or construction projects. The City will continue to do lawn conversions to conserve water and resources, as funds become available.

Costs: 96 hours per year
Cost Total: \$12,000 annually

PA 40. Install water Efficient Fixtures and Equipment in Municipal Facilities

(BE-41) Create standard operating procedures for installing water efficient fixtures and equipment in municipal buildings, landscapes, ballfields and swimming pools at regular replacement schedules, and proactively when cost-effective.



Description: The City will seek resources to reduce the water consumption in municipal buildings, landscapes, and recreational areas by installing water efficient technologies such as faucet aerators, low flow toilets and urinals, low flow showerheads, drip irrigation systems, irrigation control systems, and monitoring systems. The City will seek to incorporate supportive water reduction features such as improved onsite water retention, water storage, and other installations into site improvements to cost effectively minimize water usage at municipal sites.

Responsibility: Oakland Public Works

Status: The City has incorporated a variety of these measures in parks and buildings, and will continue to implement this action as facilities are modernized and projects undertaken.

Costs: 96 hours per year
Cost Total: \$12,000 annually

Material Consumption and Waste

The following Material Consumption and Waste priority actions are proposed for implementation by the end of the ECAP period. Some can be accomplished as one-time actions, while others will require ongoing investment. Implementation of each of these priority actions will require new resources. Implementing all Material Consumption and Waste priority actions is projected to require an average of 0.7 FTE per year and an additional \$1.32 million for expenses over the next three years.

PA 41. Study Options for Advancing Next-Level Waste Reduction

(MW-6) Study options for advancing the next level of waste reduction activities to help achieve the City's adopted Zero Waste Goal.

Description: The City will seek resources to study and support additional actions that may be needed in the coming years to help Oakland progress toward its Zero Waste goal. These may include actions to further increase rates of recycling and composting, target particular problem materials, etc. The City will continue to collaborate with StopWaste in considering potential actions to further reduce waste toward achieving Zero Waste.

Status: In July 2015, Oakland launched new trash, compost, and recycling collection services for residents and businesses under new contracts with Waste Management of Alameda County (WMAC) and California Waste Solutions. New services include compost collection at multi-family buildings, bulky item collection and recycling for all residents, increased illegal dumping cleanup, more choices of compost and recycling cart sizes, and ongoing zero waste outreach. The contracts advance Oakland each year toward its Zero Waste goal to keep all recyclable and compostable material out of landfills through progressive annual diversion requirements. New recycling and material processing facilities, including a composting facility at the Altamont Landfill in Livermore, will divert discards from landfill. With this new facility, the first in Alameda County, Oakland's organic materials will be locally composted for the first time.

Responsibility: Environmental Services

Resource Needs: 0.5 FTE per year plus \$1,000,000 of expenses
Cost Total: \$90,000 annually plus \$1,000,000 of expenses



Photo: Matt Southworth

PA 42. Promote Waste Reduction through Enhanced Producer Responsibility

(MW-13) Promote reduction of product waste and better management of hard-to-recycle and toxic products by encouraging producers to manufacture and distribute products using materials and processes that minimize toxics, reduce harmful environmental impacts, and facilitate reuse and recycling. Support statewide producer responsibility legislation. Support



the creation of convenient and cost-effective product take-back opportunities for the public through existing retail distribution systems.

- Description:** The City is a founding member and continues to support the California Product Stewardship Council (CPSC), which advocates for the better management of hard-to-recycle and toxic products through producer responsibility, producer responsibility legislation, and the creation of product take-back opportunities. The product stewardship movement is organized at the state level, with cities and communities support that effort through advocacy. The City will seek resources to increase support for and participation in the CPSC.
- Status:** This action was added to the priority list in 2017. Producer responsibility standards have led to improved recycling rates for prescription medications, mattresses, carpeting, and other materials.
- Responsibility:** Environmental Services, Economic Development
- Resource Needs:** 0.10 FTE per year
Cost Total: \$12,000 annually

PA 43. Encourage Local Reuse and Repair

(MW-15) Foster local reuse and repair opportunities, including by expanding community outreach efforts promoting re-use of buildings materials, and “buy local” programs focusing on goods made from recycled materials.



- Description:** Our communities are awash in goods that have been intentionally manufactured to be disposable in relatively short time periods. Many products, and a majority of packaging materials, are designed to be used just once and then discarded. And as this “planned obsolescence” has become the norm, even items that can be repaired or repurposed are often simply disposed of in favor of new, cheap replacements. As a result, repair professionals (such as cobblers and blacksmiths) – once a thriving sector of the US economy – are rapidly dwindling from the urban landscape. Not only is it harder to find professionals to repair common household goods, but the very skills to conduct simple repairs are taught less and less frequently in schools.
- The City will seek resources to create and encourage local reuse and repair opportunities for a wide range of products, including supporting the work of partners engaged in these activities. This may include supporting local “repair fairs;” supporting businesses that use locally recycled or repaired materials, or businesses that offer repair as a service; and encouraging the purchase of reusable or repairable goods over disposable alternatives. It may also include working with local makers and vocational programs to encourage the development of skills useful for repairing common household goods, or for making use of reused materials.
- Status:** This action was added to the priority list in 2017. The City’s Environmental Services Division promotes the recovery and reuse of building materials by building permit holders when it provides C&D debris recycling requirements technical assistance. Repair professionals and businesses have been included in the City’s EarthEXPO.
- Responsibility:** Environmental Services, Economic and Workforce Development
- Resource Needs:** 0.10 FTE per year
Cost Total: \$12,000 annually

Community Engagement

The following Community Engagement priority actions are proposed for implementation by the end of the ECAP period. Some can be accomplished as one-time actions, while others will require ongoing investment. Implementation of each of these priority actions will require new resources. Implementing all Community Engagement priority actions is projected to require an average of approximately 0.5 FTE per year, 0.5 fellow time per year, and an additional \$390,550 for expenses over the next three years.

PA 44. Community Climate Action Guide

(CE-3) Develop and distribute a community climate action guide and targeted educational materials in collaboration with local organizations to inspire all members of the Oakland community to take action to reduce GHG emissions.

Description: The City will seek resources to accelerate local action throughout the community by developing and distributing new online and hardcopy materials such as a community climate action guide and other materials targeted at specific actions (e.g., why and how to adjust your water heater temperature). The City can collaborate with local organizations to distribute these materials in an effort to inspire all members of the Oakland community to take action to reduce GHG emissions.



Status: In 2014, the Oakland Climate Action Coalition, in coordination with the City and with support from the San Francisco Foundation, East Bay Community Foundation, and the Local Sustainability Matching Fund, authored the Oakland Community Climate Action Guide to inform and motivate residents to reduce GHG emissions and better prepare for the effects of climate change. The guide remains available online, but could be more effectively marketed throughout the community. The City and its partners will seek to publicize this work throughout the community.

Responsibility: Environmental Services

Resource Needs: 20 hours staff time plus \$50,000 of expenses
Cost Total: \$55,000

PA 45. Support Local Climate Workshops

(CE-4) Establish a mini-grant program to provide financial and other support to local organizations to convene neighborhood-scale or issue-based community climate action workshops.

Description: The City will seek resources to accelerate community action by supporting local workshops and events dedicated to education and raising awareness about opportunities to address energy and climate issues and create co-benefits through climate action. These workshops can leverage the existing roles and relationships of collaborating organizations, and can be tailored to geographically, demographically or topically-focused segments of the community. In the process, the City can develop new understanding of how to target new programs and policies to engage all members of the Oakland community effectively and appropriately. Providing information through in-person delivery channels and forums

fostering community dialogue about energy and climate issues will be critical to accelerating voluntary climate actions.

Status: The Oakland Climate Action Coalition and its grassroots members have convened several forums addressing climate action, environmental justice, and resilience through various grant funded initiatives. In 2017, through its Sustainability and Resilience efforts, the City is seeking new ways to partner with community groups to promote climate action and resilience, including by a community engagement process focused on Sea Level Rise in West Oakland, and through the pursuit of grant funding to support a community-driven project prioritization process for Priority Conservation Areas. The City secured \$15,000 from the Rockefeller Foundation as part of the Resilient Oakland Initiative for the West Oakland Environmental Indicators Project (WOEIP) to conduct workshops related to sea level rise impacts in 2016.

Responsibility: Environmental Services

Resource Needs: 0.25 FTE for three years, 48 hours staff time per year, 48 hours fellow time per year, plus \$300,000 in expenses
Cost Total: \$7,100 annually plus \$300,000 in expenses

PA 46. Facilitate Community Input on Climate Issues

(CE-11) Establish and highlight opportunities for the community to provide suggestions to City staff and policy makers regarding how the City can augment its climate protection efforts through adjustments to local planning, policies and programs.



Description: The City will seek resources to create new opportunities, and enhance existing opportunities, for community members and organizations to participate in the policy process for climate action and resilience. This may include enhancing community forums (see CE-4 and CE-10), building out web and social media tools, and leveraging existing avenues for innovative community engagement such as City Camp Oakland and Open Oakland.

Status: This is a new Priority Action in 2017. The City can build on a number of existing resources to develop and highlight tools for meaningful community engagement. Such activities, as well as allocating staff time to collecting, assessing, and acting on feedback, will require additional resources. The City is currently carrying out a pilot project in equitable community engagement in West Oakland in conjunction with the Resilience Oakland Initiative. Pilots can also occur through City Camp Oakland and similar venues.

Responsibility: Environmental Services

Resource Needs: 400 hours fellow time to establish forum design and materials plus 60 hours fellow time per year to implement
Cost Total: \$5,000 plus \$750 annually

PA 47. Develop an Oakland Climate Action Model Practices Campaign

(CE-16) Develop a local climate action model practices campaign collaborating with local organizations to document and promote examples of local climate actions to the community.

Description: The City will seek resources to aid local organizations in promoting local model practices and encouraging widespread adoption of affordable energy and climate-friendly behaviors throughout the community. This campaign would utilize multimedia approaches to make it easier for members of the community to promote do-it-yourself actions and teach each other to implement them. Low-cost multimedia technology could be provided to local organizations to document personal and neighborhood climate actions and share them with the larger community.

Examples of actions that might be demonstrated include replacing faucets and showerheads with low-flow devices; lowering the water heater thermostat temperature; installing water heater insulation; repairing windows; installing a clothesline; repairing a bicycle; maintaining proper air pressure in car

tires; using web-based tools to plan trips on BART and AC Transit; identifying materials that can be recycled; building garden boxes and compost bins; prioritizing the potential to repair or reuse an item when making purchasing choices; repairing common household items; and sorting kitchen food scraps for composting.

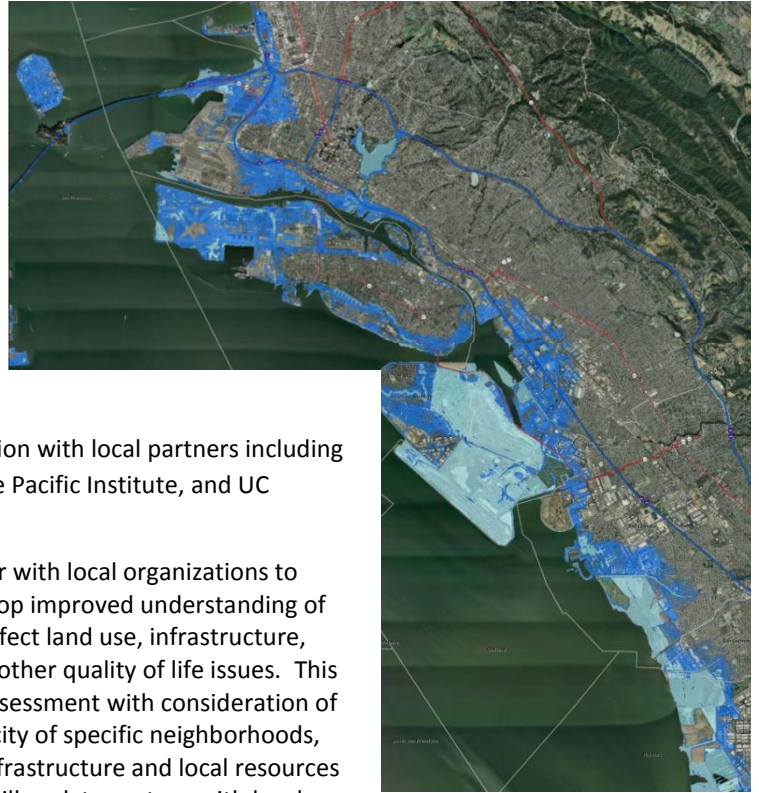
Status: Various elements of model practices exist, but have not been pulled together into a single document or campaign.

Responsibility: Environmental Services

Resource Needs: 40 hours staff time and 100 hours fellow time
Cost Total: \$7,000

Climate Adaptation and Improving Resilience

The following priority actions are proposed for implementation by the end of the ECAP period. Some can be accomplished as one-time actions, while others will require ongoing investment. Implementation of each of these priority actions will require new resources. Implementing all Climate Adaptation priority actions is projected to require an average of 0.3 FTE per year, 0.6 fellow time per year, and an additional \$1.04 million for expenses throughout the next three years to study and communicate with the community about climate impacts.



PA 48. Study Potential Local Climate Impacts

(AD-2) Conduct a study of all local climate impacts in collaboration with local partners including the Bay Conservation and Development Commission, the Pacific Institute, and UC Berkeley.

Description: The City will seek resources to partner with local organizations to study local climate impacts and develop improved understanding of how these impacts are expected to affect land use, infrastructure, public health, the local economy and other quality of life issues. This study would include a vulnerability assessment with consideration of both projected impacts and the capacity of specific neighborhoods, population segments, and affected infrastructure and local resources to adapt to those impacts. The City will seek to partner with local experts at BCDC, the Pacific Institute, and UC Berkeley to study climate impacts and translate impacts in a meaningful way that can help to inform future planning decisions in Oakland. Resource needs assume that local and regional partners will act in a lead capacity for the study of climate impacts under separate funding.

Status: BCDC, through the Adapt to Rising Tides (ART) program, completed its Oakland Alameda Resilience Study in 2015, assessing long term climate risks to Oakland properties. Additional analysis is being conducted regionally. In October 2016, as part of the City's Resilience Strategy, the City began drafting a Preliminary Sea Level Rise Road Map, drawing heavily on the ART findings. In the final years of the ECAP period, the City will work with community partners and others, including grassroots nonprofits in vulnerable neighborhoods throughout Oakland, to finalize the Road Map using locally-generated data and locally-identified metrics.

Responsibility: Environmental Services, Planning and Building Department - Strategic Planning

Resource Needs: 200 hours staff time plus \$530,000 of expenses
Cost Total: \$550,000

PA 49. Communicate Climate Impacts to the Community

(AD-3) Communicate information about local climate impacts to the Oakland community to develop shared understanding, the will for personal and collective action, and local capacity to participate in development of climate adaptation strategies.

Description: The City will seek resources to develop new educational materials and perform outreach to inform the Oakland community about projected climate impacts and to better understand the communities' key concerns and understanding of local resources. Developing a greater shared understanding of potential impacts will be critical to generating the will for personal and collective action that may be needed to implement future adaptation strategies, as well as the capacity of Oakland community members to

engage in adaptation planning efforts. This will include developing content that could be delivered through existing channels such as the City's Citizens of Oakland Respond to Emergencies (CORE) program, planned Community Climate Forums (see PA 26), partners that deliver similar services such as Bay Area Red Cross and Alameda County Health Department, and local organizations interested in communicating about climate impacts within their networks. Content will be developed with consideration of opportunities to address identified community vulnerabilities, and tailored to specific audiences. This action will be most effective if local organizations have capacity to assist with development of messaging and delivery of content, which is outside the scope of the proposed budget.

- Status:** As part of the City's community engagement to finalize the Preliminary Sea Level Rise Road Map (see PA 59), the City is launching a deep engagement project in West Oakland in 2017 in partnership with the West Oakland Environmental Indicators Project and others. Additional resources are needed to carry out this project effectively. In addition to informing the City's planning, the results of this project are intended to inform future and ongoing engagement around climate change impacts throughout Oakland, beginning with those populations most vulnerable to the threats from climate change.
- Responsibility:** Planning and Building Department - Strategic Planning, Marketing, Economic Development
- Resource Needs:** 145 hours staff time (one time) plus 108 hours staff time per year
Cost Total: \$25,000 plus \$17,000 annually

PA 50. Identify and Act on Opportunities to Improve Resilience in City Plans and Policies

(AD-4) Identify potential adaptation strategies to improve community resilience to climate change, and to integrate these with City planning and policy documents and processes where appropriate.

- Description:** The City will seek resources to research, analyze, and recommend adaptation strategies to improve community resilience to projected impacts of climate change and integrate these with City planning and policy documents and processes where appropriate. Example adaptation strategies may include:
- Considering vulnerability to flood events during the project approval process
 - Storm/sewer infrastructure design criteria and upgrades in major projects and the City's Capital Improvement Program
 - Design requirements for new buildings in flood prone areas
 - Water efficiency and conservation indoors and outdoors
 - Requirements for highly reflective surfaces where feasible (e.g., rooftops, pavement) and urban forest management strategies to reduce heat island effects
 - Green infrastructure and adaptive design to minimize impacts from sea level rise and flood events
 - Preparedness systems for vulnerable residents
 - Development of buffer zone wetlands
 - Revise codes and processes to facilitate resilience and sustainable redevelopment and retrofits
 - Community engagement processes to develop resilient social systems and prevent housing displacement

The City will seek to identify planning projects such as new area planning processes that could serve as opportunities to pilot appropriate adaptation strategies and development requirements to help inform future adaptation planning efforts.

- Status:** In 2014, the City joined the 100RC network, an international effort to expand the consideration of resilience in cities' plans, policies, and programs. As part of its goals through 100RC, Oakland published its Resilience Playbook in 2016 to formalize its strategy for many areas of resilience, including climate change adaptation. In 2016, the City began drafting a Preliminary Sea Level Rise Roadmap to provide uniform direction to City departments on how the City will assess the effects of sea level rise in Oakland, and to develop the policies needed to reduce the effects of Sea Level Rise. The City expects to release the Roadmap in Spring 2017. Additionally, as part of the ongoing development of Plan

Downtown, a 20-year specific plan for downtown Oakland and Jack London Square, the Bureau of Planning will address the potential effects from Sea Level Rise on the shoreline between Jack London Square and the Bay Bridge terminus.

Responsibility: Public Works, Planning and Zoning, and other departments based on strategies

Resource Needs: 40 hours staff time (one time), 0.625 fellow time (one time), and 5 hours staff time per year
Cost Total: \$21,000 plus \$1,000 annually

PA 51. Participate in Development of a Regional Climate Adaptation Strategy

(AD-6) Encourage and participate actively in efforts of regional partners including BCDC to engage in the development of a

★ regional climate adaptation strategy informed by climate impact modeling, scenario analysis and development of adaptation strategies to advance regional climate adaptation capacity and resilience. Collaborate with local partners to ensure that the actions (e.g., construction of sea walls) of neighboring jurisdictions or other agencies do not indirectly exacerbate impacts to Oakland neighborhoods.

Description: As part of the its Resilience efforts, the City will participate in regional discussions to develop multi-jurisdictional adaptation strategies to address impacts related to rising sea levels in San Francisco Bay. Collaboration in this area will include partners such as BCDC, Bay Area Regional Council (BARC), San Francisco Estuary Institute, and others.

Status: City staff participate in several regional efforts to develop climate adaptation strategies to lessen impacts from sea level rise and changing weather conditions. Oakland's Chief Resilience Officer serves on the Executive Committee of Resilient by Design: Bay Area Challenge, an effort of the nine-County region to bring integrated design solutions to waterfront challenges along the Bay. The Challenge will connect local, national, and international experts with local communities, to find creative solutions to make the Bay Area more resilient after disasters and in the face of the ongoing threat of sea level rise. Staff has also worked with the Bay Conservation and Development Commission to improve regional sea level rise mapping, integrating impacts from sea levels, storm surges, and tidal influences into projections that can better inform local planning and adaptation efforts. The City also participates in regional planning discussions with organizations focused on climate adaptation. Finally, the Bay Area passed Measure AA in 2016, creating a \$250 million revenue stream for regional adaptation projects.

Responsibility: City Administrator (Resilience), Planning and Building Department - Strategic Planning, Environmental Services

Resource Needs: 150 hours staff time per year and 50 hours fellow time per year
Cost Total: \$30,000 annually

PA 52. Develop a Resilience-Based Climate Adaptation Plan

(AD-7) Develop a climate adaptation plan for Oakland identifying strategies to improve community resilience to climate change in collaboration with state, regional and local stakeholders.

★ **Description:** The City has developed a draft Preliminary Sea Level Rise roadmap to prioritize next steps in designing climate adaptation strategies for Oakland. As part of its Resilience efforts, and building on the City's Local Hazard Mitigation Plan and Preliminary Sea Level Rise Roadmap, the City will create a comprehensive strategy to address climate adaptation needs. While the form and depth of the Plan are not yet determined, adaptation planning will be developed by balancing resource availability with the potential for guiding development and infrastructure investments. Additional funding needs to be

secured to study Sea Level Rise vulnerability zones and impacts in greater depth, and to integrate findings with key City planning documents, such as the General Plan.

Status: The City has completed its Local Hazard Mitigation Plan in 2016, and expects to complete its Preliminary Sea Level Rise Roadmap in 2017. The Adaptation Plan has not been scheduled to date.

Responsibility: City Administrator (Resilience), Planning and Building Department - Strategic Planning, Environmental Services

Resource Needs: \$125,000 of expenses
Cost Total: \$125,000

PA 53. Promote the Development of Oakland's Urban Forest

(AD-9) Promote the development of Oakland's urban forest



Description: The urban forest has numerous climate and adaptation benefits, which include carbon sequestration, stormwater mitigation, neighborhood beautification and calming, habitat restoration, and even energy conservation in cases where trees are strategically planted near buildings. Oakland was formerly home to a wide diversity of tree species, but over time the city has lost a large portion of its urban forest due to development and loss of maintenance funding. Today, some areas of Oakland – largely concentrated in neighborhoods with higher rates of poverty, poor health outcomes, and elevated pollution – have as little as 6.5 percent tree canopy coverage, while other Oakland neighborhoods have as high as 47.4 percent coverage. Growing the city's urban forest can have an immediate impact on reducing socioeconomic disparities.

The City is seeking resources to conduct an urban tree inventory and develop an urban forestry master plan outlining how the City will protect, develop, and maintain diversified and appropriate tree plantings on City rights-of-way in a manner consistent with Bay Friendly Guidelines. The urban forestry master plan will include criteria and processes for planting new trees; citywide canopy coverage goals and goals for specific disadvantaged neighborhoods; carbon sequestration goals for the urban forest; a realistic annual tree planting goal based on the results of an urban tree inventory; approved species for streetscapes and parklands; an economic analysis of the value of the urban forest; the maintenance priorities and process for existing trees; a long-term funding plan; and clear roles for the City and community partners for community engagement and education. See PA-24/TLU45.

Status: The City is continuing to seek funds through the Statewide Greenhouse Gas Reduction Fund and other sources to conduct a robust community engagement process and craft an urban forest master plan, as well as to restart the City's tree planting program, in partnership with local nonprofits.

Responsibility: Public Works, Planning and Zoning, Economic and Workforce Development, and other departments based on strategies

Resource Needs: See PA-24/TLU-45.

PA 54. Promote Water Conservation and Efficiency

(AD-10) Promote indoor and outdoor water conservation and efficiency



Description: California experienced an historic drought between 2011 and 2016. Although the winter of 2016-2017 brought plentiful rain along the West Coast, climate scientists and meteorologists agree that as climate change increases, extreme weather events will also increase, and both flooding and droughts will become more severe and frequent. Under these conditions, the need to conserve water in all uses, and to shift the ways in which all sectors of our community use indoor and outdoor water, have become all the more critical. The ECAP highlights a number of actions to conserve water, including development and enforcement of specific policies (see Completed/Fully Underway Actions BE-1 and BE-32); ongoing marketing and outreach (see BE-33 and BE-34); and incentivizing or otherwise encouraging the

utilization of specific technologies (see BE-35 and BE-36). These and other Actions range from funded and under development, to planned and/or needing further resources, to complete or fully underway.

Status: See specific Action Items BE-1, BE-21, and BE-32 through BE-41.

Responsibility: Multiple Departments including Planning and Building Department - Strategic Planning and Environmental Services

Resource Needs: See BE-1, BE-21, and BE-32 through BE-41.

PA 55. Promote Measures to Reduce the Impact of Floods

(AD-11) Promote measures to reduce the impact of flood events by encouraging stormwater catchment and diversion through use of rain barrels, bio-swales, permeable surfaces, and green roofs.



Description: Flood events that become more frequent and more severe over time are expected due to climate change. Sea level has already risen eight inches in the last century, and is projected to increase an additional 36 to 66 inches by 2100. Progressively intense storms and regular tidal events will exacerbate those levels, and make flooding an increasing threat to the low-lying communities in East and West Oakland. The City will continue to seek resources to both mitigate and better prepare for these events. These efforts are encapsulated in several other ECAP actions, including encouraging the installation of cisterns and rain barrels to harvest rainwater (see BE-35 and BE-36), increasing green infrastructure in public landscaping to mitigate Stormwater and absorb flood waters (see BE-40).

Status: See specific Action Items BE-1, BE-21, and BE-32 through BE-41.

Responsibility: Planning and Building Department - Strategic Planning, Environmental Services, and Bureau of Infrastructure and Operations

Resource Needs: 36 hours staff time per year
Cost Total: \$7,000 annually

PA 56. Encourage Recycled Water Delivery and Use

(AD-12) Encourage the efforts of the East Bay Municipal Utility District to develop infrastructure to deliver recycled water to Oakland properties for appropriate uses, reducing dependence on external water supplies.



Description: The U.S. lags several other countries in building out infrastructure to deliver recycled water for appropriate uses, including outdoor landscaping and toilet flushing. The East Bay Municipal Utility District (EBMUD) has begun building out its recycled water system, which the City is already using in a number of locations, including for the landscaping at Lake Merritt. The City will continue working with EBMUD to encourage the expansion of the recycled water network, and with large and small customers, particularly developers, to encourage the use of recycled water.

Status: This is a new Priority Action in 2017. EBMUD is creating a Recycled Water Master Plan in 2017 to guide the expansion of recycled water infrastructure investment and delivery for the next 20 years. The City is engaging EBMUD in this planning process, including in conjunction with the EcoBlock demonstration project in North Oakland.

Responsibility: Planning and Building Department - Strategic Planning, Environmental Services, and other departments

Resource Needs: 12 hours staff time per year
Cost Total: \$2,300 annually

Priority Actions Complete or Fully Underway

The City of Oakland and its many partners have long been recognized as climate leaders, even before the Energy and Climate Action Plan was written. By the time the ECAP was formally adopted by City Council in December 2012, implementation of key Action Items had already begun. As of early 2017, the City and its partners have completed or fully instituted 27 items of the 61 initially identified as Priority Actions, and an additional five actions that were not part of the original three-year priority list. While more work is clearly needed, these actions have provided a strong foundation for achieving a 36% reduction in GHG emissions by 2020.

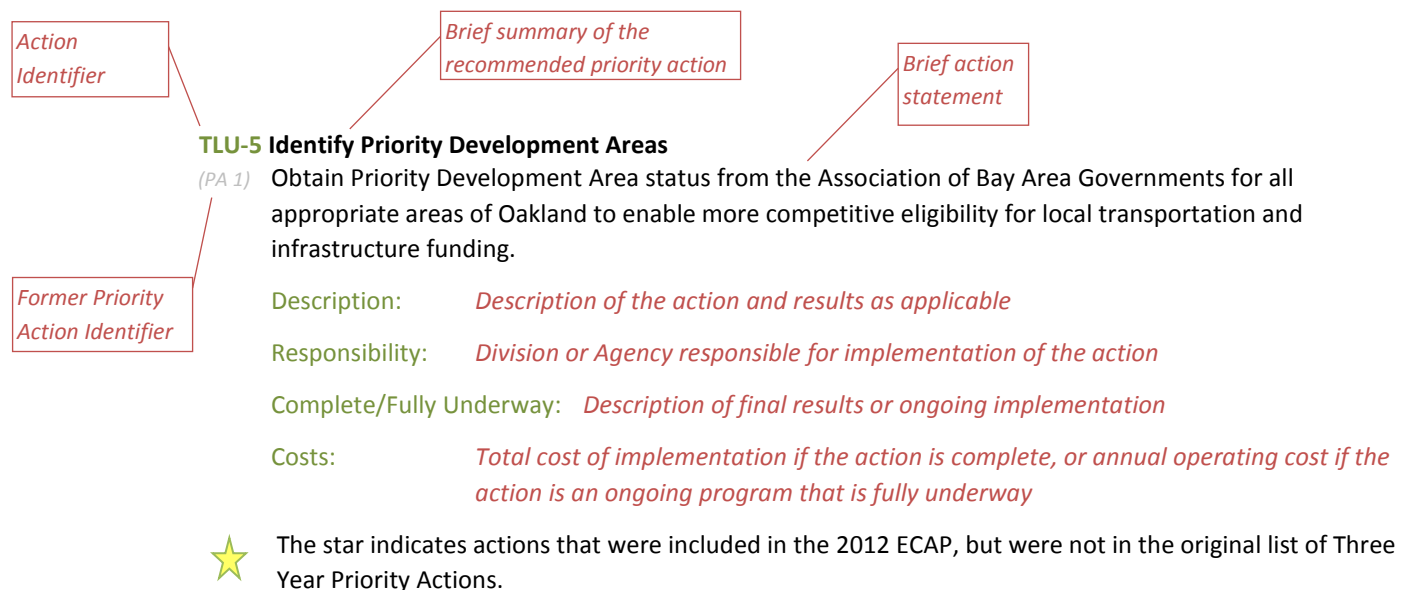
This section lists the ECAP items that have been completed or are fully underway. In many cases, the City needs to continue implementing the projects, monitoring policy, or updating strategies to build on the work completed to date. Even where items are indicated as “completed,” the implication is not to close the book on them; these items can and should be revisited to identify additional opportunities based on new technologies, financing mechanisms, and the like. For example, a building that is fully retrofitted for optimum energy efficiency today should be reassessed for energy savings potential in five or ten years, when new technologies may enable further savings.

For each item in this section, a description is provided of the work that has been completed, or the policy or program that has been institutionalized, and any next steps that are currently planned.

Community Engagement items are not included in this section; Community Engagement Priority Action items can be found in the [Supporting by Existing Resources](#) and [Requiring New Resources](#) sections, and the complete list of items is included in Chapter 5. Community engagement is considered an ongoing, imperative strategy to facilitate the achievement of the action items in the other sections. Further, given the ever-evolving nature of Oakland’s diverse community, engagement strategies must constantly be under scrutiny for relevance, broad reach, and effectiveness. As such, community engagement cannot be considered “complete” or even “fully institutionalized.”

How to Read This Section

Each action is presented through a standard format containing each of the following elements.



Resources Committed

Supporting resources are summarized for each Priority Action. The total resources committed to all proposed Three Year Priority Actions complete or fully underway is approximately 50 staff FTE per year, 0.1 fellows per year, and an additional \$38.86 million for related expenses (e.g., consultant support).

Transportation and Land Use

The following Transportation and Land Use priority actions have been implemented or are fully underway. Some were completed as one-time actions, while others will require ongoing investment. Although funds have already been allocated, implementation of these priority actions will cost an average of 11 FTE per year, 120 fellow hours, and \$8.30 million for expenses throughout the next three years.

TLU-1 Participate in Quarterly SB 375 Discussions

(PA 4) Participate in development of the Bay Area Sustainable Community Strategy for reducing vehicle travel in compliance with SB 375, including defining Oakland's role in achieving regional jobs-housing balance, land use and transportation system integration, and infrastructure funding advocacy.

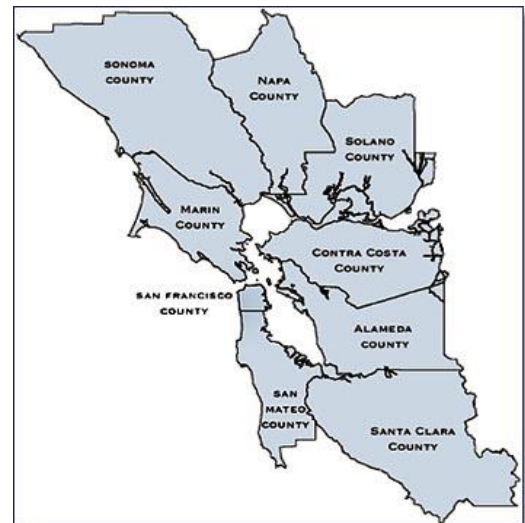
Description:

Senate Bill 375, adopted in 2008, established a new framework for reducing California's GHG emissions through attention to land use and transportation planning issues. SB 375 requires each metropolitan region to each develop a Sustainable Community Strategy (SCS) demonstrating how it will reduce vehicle miles traveled. The SCS also presents an opportunity to improve coordination between regional transportation and housing planning.

Under the leadership of the Metropolitan Transportation Commission (MTC) and

Association of Bay Area Governments (ABAG), a SCS for the Bay Area ("Plan Bay Area") was developed and adopted in 2013 in compliance with SB 375 mandates. After two years of public discussion and technical work, a limited and focused update of Plan Bay Area ("Plan Bay Area 2040") was recently released for public review. This document discusses how the Bay Area will grow over the next two decades and identifies transportation and land use strategies to enable a more sustainable, equitable and economically vibrant future. Starting with the current state of the region, this document describes the goals of Plan Bay Area 2040, a proposed growth pattern for land use and development, and supporting transportation investment strategy, and key actions needed to address ongoing and long-term regional challenges. Oakland's participation in this process has helped to ensure that outcomes reflect the housing and transportation needs of the city's residents and businesses, and that future regional planning and infrastructure funds are allocated in proportion to the amount of growth directed to Oakland and other regional centers.

Staff currently has the resources to participate in quarterly conference calls to stay up to date on how the process of developing the Bay Area SCS is unfolding. Further engagement or action would require additional staff resources.

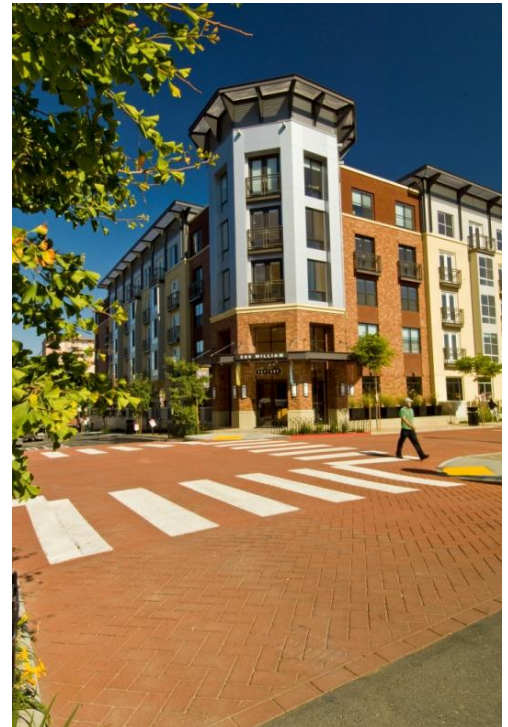


- Responsibility:** Transportation Services, Planning and Building Department - Strategic Planning, Housing and Community Development
- Fully Underway:** Staff is currently able to participate in quarterly conference calls to follow regional action related to SB 375 and development of the Bay Area Sustainable Community Strategy.
- Costs:**
 Committed Resources: 96 hours staff time per year for four years
 Required Resources: 48 hours staff time per year
 Cost Total: \$83,000 plus \$11,000 annually

TLU-2 Develop a Comprehensive Transportation Policy Plan

(PA 30) Prepare a comprehensive, integrated Oakland Transportation Plan in close collaboration with regional agencies, local service providers, and the community.

- Description:** The City will seek resources to prepare a comprehensive Oakland Transportation Plan in close collaboration with regional agencies and local service providers (e.g., MTC, AC Transit, BART, AMTRAK), which:
- Provides a new comprehensive vision of how transportation systems throughout Oakland will be developed to meet the needs of people and business, and addressing all modes of travel, while minimizing greenhouse gas emissions and air pollutants associated with the transportation sector;
 - Plans for transportation infrastructure management under the City's control (e.g., roadways, development around existing transit hubs, alternative transportation infrastructure) in a manner that updates and reinforces the City's existing Land Use and Transportation Element (LUTE) and "Transit First" policy; and,
 - Creates a public transit master plan that recommends process, program and policy changes designed to significantly increase transit utilization throughout the community, including establishment of transit-oriented land use planning criteria, policies that ensure safe walking and biking access to transit, transit service performance goals, and agency implementation responsibilities.



A comprehensive transportation plan will lay a critical foundation for effective transportation planning that ensures resources are allocated effectively and efficiently to ensure the best delivery of transportation options and services to all members of the community, while reducing GHG emissions and other pollutants. This plan will enhance applications for funding, increase the City's ability to work with transit agencies on planning and problem solving, and support Oakland's economic development.

Responsibility: Department of Transportation

Complete: In October 2016, the Oakland Department of Transportation released its Strategic Plan for Transportation, identifying a new comprehensive vision for mobility in Oakland, including one-year and three-year benchmarks corresponding to more than 200 actions. One action item in the Strategic Plan is to establish a transit action plan, which the Department of Transportation will be initiating in Spring 2017.

Costs: Committed Resources: 4 FTE for three years
 Required Resources: None
 Cost Total: \$2,500,000

TLU-3 Improve Transportation & Land Planning Integration in Every Planning Effort

(PA 31) Require the integration of land use and transportation planning and consideration of GHG reduction opportunities in every planning, major project, and redevelopment effort undertaken by the City.

Description: In addition to creating a citywide comprehensive transportation plan, the City will seek resources to reduce long term vehicle miles traveled (VMT), and associated GHG emissions, by ensuring that all City planning efforts fully integrate concerns for land use and transportation. Multiple planning and policy documents (e.g., specific plans for geographic areas) affect land use, transportation and development decisions. Where appropriate, the City can ensure that each such process results in projects that encourage dense, transit-oriented, mixed-use development that includes housing, retail services and/or employment opportunities centered on transit hubs and corridors.

New development in Oakland, including transit-oriented development, has the potential both to benefit communities (e.g., via economic revitalization, reduction in VMT), and to adversely impact communities (e.g., via displacement, local environmental impacts). The City will make efforts to plan for new development with consideration of these impacts.

Integrated planning will include establishing transportation performance goals (e.g., vehicle miles traveled per service population, citywide mode share) for planning efforts and projects, consistent with citywide transportation performance goals. Other process improvements may include new requirements for analysis, reporting, and a public review process that addresses not only land use, but the transportation impacts and opportunities to reduce GHG impacts of projects. These changes can also assist the City in clarifying regional funding priorities in relationship to local projects and support evaluation of local and regional transportation planning and funding processes.

Fully Underway: The integrated planning of land use and transportation has been a centerpiece of all Specific and Area Plans completed to date, and will be a similar centerpiece of the Downtown Specific Plan that is currently underway.

Responsibility: Department of Transportation, Planning and Building Department - Strategic Planning, Economic Development

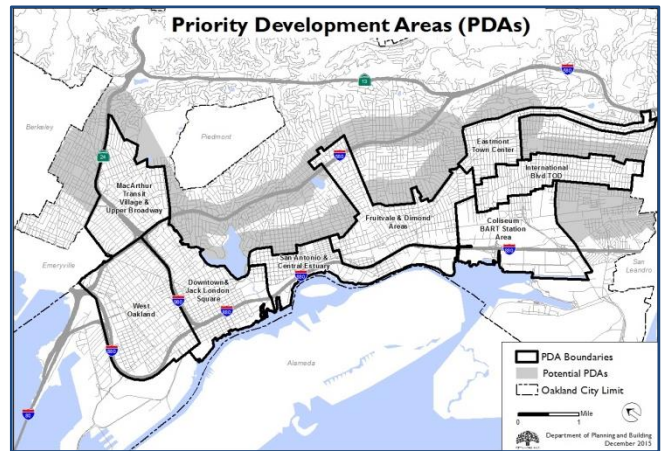
Resource Needs: Committed Resources: 0.35 FTE per year plus \$130,000 of expenses
 Required Resources: None
 Cost Total: \$66,000 annually plus \$130,000 of expenses

TLU-6 Identify and Adopt Priority Development Areas

(PA 1) Obtain Priority Development Area (PDA) status from the Association of Bay Area Governments for all appropriate areas of Oakland to enable more competitive sites for local transportation and infrastructure funding.

Description:

Identifying Priority Development Areas in Oakland will help the City secure resources for local transportation and infrastructure improvements. PDA designation is awarded through the FOCUS Program (a regional development and conservation strategy), led by four regional agencies: Association of Bay Area Governments (ABAG), Metropolitan Transportation Commission (MTC), Bay Area Air Quality Management District (BAAQMD), and Bay Conservation and Development Commission (BCDC). The FOCUS Program and the PDA designation have the primary goal of encouraging growth near transit, and in the existing communities that surround transit, by enhancing existing neighborhoods and providing good housing and transportation choices to all residents. This includes an explicit focus on promoting housing that will be affordable to low-income residents, and attempts to minimize the displacement of existing residents. The City should continue to plan for and approve new development in conformance with current CEQA guidelines.



Designated PDAs are eligible to receive planning and technical assistance as well as capital funding from various sources, including the Station Area Planning Grant Program, the Regional Transportation Plan (Transportation 2035), the Transportation for Livable Communities Program, Environmental Justice grants, Green Infill - Clean Storm water grants, the Proposition 1C: Transit Oriented Development Housing Program and Infill Infrastructure Grant Program, the Transportation Fund for Clean Air grant program, and other State and regional programs. Designated and planned PDAs include areas focused on infrastructure, transportation, and housing for a range of income levels for transit-oriented development areas and corridors.

An additional 0.25 FTE for a grant writing professional would augment Oakland's capacity to apply for, and chances of receiving, more above-mentioned future funding.

Responsibility: Department of Transportation, Planning and Building Department - Strategic Planning Division

Complete: City Council approved staff recommendations regarding the identification of Corridor and Station Area PDAs, which were subsequently approved by ABAG in 2015. Staff is now working to align proposals to make Oakland competitive for future transportation, infrastructure and housing funding streams, and pursuing funding to support equity advancements in PDA implementation. The City and its partners may consider incorporating the Equity Checklist, developed by a coalition of Oakland's community environmental and social justice organizations, in the designation of future PDAs and in subsequent project planning in designated PDAs.

Costs: Committed Resources: 150 hours staff time
Resources Required: None
Cost Total: \$20,000

TLU-7 Create and Adopt a Transportation Impact Fee to Support Implementation

(PA 32) Adopt a transportation impact fee to support new local low-carbon transportation infrastructure and planning.

Description: The City will seek resources to conduct the necessary research and analysis to enable the adoption of a Transportation Impact Fee (TIF) to support low-carbon transportation infrastructure and

planning. A TIF can be used to assign the costs of added vehicle trips to new development, enabling the City to enhance its existing transportation systems and support the development of key infrastructure for future systems. It can also better connect City policy to the City budget and Capital Improvement Program. Adopting a TIF can also align City policy with neighboring jurisdictions.

- Complete:** A TIF was adopted by Council in May 2016 and implemented in September 2016 as part of an impact fee program that includes a fee to support transportation, capital investments, and affordable housing. . The transportation impact fee funds improvements and expansion to city transportation infrastructure to manage the additional transportation demands generated by new developments, with a focus on infrastructure that connects residential, retail, and employment centers. The transportation impact fee applies to new housing units, new nonresidential projects, nonresidential projects with additional floor area, and nonresidential projects with an intensification of use.
- Responsibility:** Department of Transportation, Planning and Building Department - Strategic Planning, Engineering, Building Services
- Resource Needs:** Committed Resources: 1,260.5 hours staff time, \$151,468 of expenses, and 135.5 hours staff time per year
Resources Required: None
Cost Total: \$375,000 plus \$22,000 annually

TLU-11 Increase Density near Transit to Improve Livability



Engage the community, through the zoning update process and other appropriate mechanisms, to develop a strategy for increasing density adjacent to transit in ways that improve neighborhood livability.

- Description:** The City will seek resources to increase density adjacent to transit in ways that will benefit the whole community. For example, the City may update design review standards for high-density multi-family buildings, encouraging design that is aesthetically pleasing, highly functional, and practical. The City can also insist on the creation of vibrant, safe, and attractive public spaces as a part of every development.
- Fully Underway:** Since 2012, all the City's zoning amendment efforts have supported this action, including the City's 2016 reduction in minimum parking requirements in Downtown and along major transit corridors. Oakland's most recent Housing Element of the General Plan, adopted in 2014, lists four specific policies that will directly affect the provision of affordable housing near transit hubs and corridors: Policy 1.1, "The City will target development and marketing resources in PDAs, and in areas for which Specific Plans have been completed or are underway;" Policy 1.3, "Appropriate locations and densities for housing Policy;" 2.3; "Density Bonus Program Policy;" and Policy 7.3, "Encourage development that reduces carbon emissions." A community engagement process is ongoing for Plan Downtown, a specific plan that aims to ensure continued growth and revitalization to benefit both Downtown residents and the larger community. The plan will provide policy guidance on development, linking land use, transportation, economic development, housing, public spaces, cultural arts, and social equity. Alongside the development of Plan Downtown, the City is working with BART on a Transit-Oriented Development pilot. Finally, the City is actively working with regional and state agencies to secure funding for future housing development projects for a range of income levels (see PA-??/TLU-9) in keeping with the goals of Plan Bay Area and the City's adopted Priority Development Area map (see TLU-6). These plans specify the need to concentrate housing and new development along major transit corridors and hubs to reduce GHG emissions, among other benefits.
- Responsibility:** Planning and Building Department - Strategic Planning, Department of Transportation

Resource Needs: Committed Resources: 1.75 FTE for one year plus \$4,118,904 of expenses
 Resources Required: 1.45 FTE per year
 Cost Total: \$400,000 annually plus \$4,260,000, of expenses

TLU-15 Update Local CEQA Standards to Reduce Emphasis on Congestion Impacts

(PA 33) Update the process for evaluating local environmental impacts resulting from new development to prioritize consideration of vehicle miles traveled (VMT) impacts above congestion impacts.

Description: The City will seek resources to update the process for evaluating local environmental impacts resulting from new development as required under CEQA. These updates will prioritize consideration of VMT impacts above congestion impacts.

CEQA regulations that have required local jurisdictions to analyze and emphasize reductions in traffic congestion are a significant, but hidden, basis for our ever-expanding auto-oriented transportation network. When new plans or projects are required to perform an environmental review, invariably the proposed growth leads to additional auto trips. These trips then must be mitigated, if possible. Often this mitigation takes the form of road widening, expanding lanes, adding turn lanes, and finding other ways to speed up traffic and avoid delays. Mitigation actions may encourage more driving, with associated emissions and pollution.

State CEQA regulations were updated shortly before the ECAP was adopted to give local jurisdictions the option of developing new criteria for assessing trip impacts. The changes provided a money-saving incentive to developers, encouraging the design of projects to reduce auto dependence and rely on transit, bicycle and pedestrian networks. Clarification and simplification of the City's CEQA guidelines will enable a faster and more streamlined review process for economic development that is consistent with the policies of the Land Use and Transportation Element of the General Plan.

Responsibility: Department of Transportation, Planning and Building Department - Strategic Planning

Complete: In 2016, the City updated its CEQA Thresholds of Significance to reflect state guidance identifying vehicles miles traveled (VMT) as the primary measure for transportation-related environmental impacts. The City's CEQA checklist and EIR evaluations consider VMT as a primary environmental impact under transportation, as well as in air quality under GHG emissions considerations.

Costs: Committed Resources: 0.2 FTE for 9 months, 1 hour staff time per week for 9 months, and \$300,000 in expenses
 Required Resources: None
 Cost Total: \$560,000

TLU-23 Promote Bicycle Safety Training, Transit System Use, and Other Non-Auto Transportation



Partner with and promote community based organizations that provide knowledge and skills such as bicycle safety training, transit system use, etc. to help Oakland residents shift trips to non-auto modes.

Description: The City will establish and staff a transportation demand management (TDM) program, monitoring private development TDM commitments and engaging on citywide encouragement campaigns to shift vehicle trips to non-auto modes. The City will also conduct shared mobility campaigns to educate and solicit feedback from individuals and neighborhoods about the possibilities for using types of shared mobility, and aim to develop shared mobility financial incentives for low-income and underrepresented users of shared mobility.

Responsibility: Department of Transportation

Fully Underway: The City's Bicycle Facilities Program promotes bicycle safety training courses implemented by local advocacy organizations. The City has received grant funding to efforts to perform outreach encouraging bike share and car share use. The Department of Transportation has proposed

developing a “mobility management” team that would oversee the development and implementation of new transportation demand management programs citywide.

Costs: Committed Resources: 1.5 FTE per year
Resources Required: 1.5 FTE per year
Cost Total: \$315,000 per year

TLU-24 Encourage the Creation of Local Bike Sharing Programs



Encourage the creation of local bike sharing programs.

Description: Bike share is a membership-based transportation program that deploys publicly available bicycles at stations located throughout the city to facilitate short trips (less than 30 minutes), and helps solve many of the first/last mile commute problems.

Responsibility: Department of Transportation

Fully Underway: In partnership with the largest bike share operator in the US (Motive), the City announced the expansion of the Bay Area Bike Share program into Oakland, to include 850 bikes and 70 stations. The program is expected to launch in summer 2017. The bike share program in Oakland is fully funded by a title sponsorship from the Ford Motor Company, rebranding the program to Ford GoBike. The City has contributed staff time to coordinate the planning efforts around bike share including legislation and a permitting structure.

Costs: Committed Resources: 2 FTE for 2 years plus \$25,000 in expenses
Resources Required: 0.5 FTE per year plus \$25,000 in expenses
Cost Total: \$300,000 plus \$91,000 annually

TLU-29 Conduct a Citywide Dynamic Parking Pricing Study

(PA 36) Conduct a citywide dynamic parking pricing study to develop a strategy for creating adjustable parking rates at City meters and garages that can: influence drivers to reduce vehicle trips; provide adequate parking supply; encourage economic development; and fund alternative transportation improvements.

Description: The City secured a \$200,000 technical assistance grant from the Metropolitan Transit Commission to conduct a study of innovative parking pricing and policy approaches for public facilities (on city streets and in City-owned garages) in Downtown Oakland. More resources will be necessary in order to implement a similar study citywide.

Formerly, City policy did not recognize differential parking demand between areas of the city, and applies a uniform parking pricing system. The completed study recommended adjusting prices based on supply and demand to maximize parking performance. Pricing can be an effective tool for reducing trips and maximizing alternatives to driving, and can help to encourage economic development as well as create new revenue for alternative transportation improvements and neighborhood improvements.

Responsibility: Department of Transportation, Planning and Building Department - Strategic Planning, Finance

Fully Underway: Parking policy reform was completed in 2016 in support of these recommendations of the Downtown parking study. With initial parking policy reform completed, the City is supporting a three-year grant-funded initiative focused on downtown and the Montclair commercial district. That initiative will consider potential impacts and scalability of dynamic parking pricing in Montclair.

Costs: Committed Resources: 0.10 FTE for one year, 58 hours staff time, 120 hours fellow time plus \$200,000 in expenses
Resources Required: \$2,437,000 for staff time and other expenses for demand-responsive parking and mobility management
Cost Total: \$2,670,000

TLU-38 Call for Port of Oakland GHG Reduction Targets and Plans

(PA 5) Call upon the Port to establish GHG reduction goals associated with Port operations in alignment with the City's GHG reduction target of 36% below 2005 emissions by 2020, and to create plans for achieving those goals.

Description: The Port of Oakland can demonstrate leadership in advancing GHG reductions by establishing GHG reduction goals associated with Port operations, and developing plans for achieving those goals. The Port has developed GHG emission inventories for its own operations, and has taken a number of actions toward reducing those emissions. By establishing a comprehensive GHG reduction plan based on a goal in alignment with the City's GHG reduction target of 36% below 2005 emissions by 2020, the Port can continue to demonstrate its leadership, and provide a model of operational improvements for its tenants.

The Port of Oakland is a department of the City of Oakland. However, the Charter of the City of Oakland vests the Board of Port Commissioners with exclusive control and management of the Port Department. Port Commissioners are nominated by the Mayor and appointed by the City Council.

The City has sufficient existing resources to call upon the Port as described above. The Port would require separate resources to take the actions described here.

Responsibility: Elected Officials

Fully Underway: The Port of Oakland has accomplished a wide range of GHG reduction activities as part of its Maritime Air Quality Improvement Plan (MAQIP) implementation. These include installing shore power at 11 deep-water berths, requiring diesel particulate filters on all drayage trucks, and greening fleet operations at the sea port. These changes resulted in a 76% reduction in black carbon emissions from trucks between 2009-2013, and a 55% reduction in CO₂ and a 99% reduction in black carbon from berths with shorepower. While a comprehensive GHG reduction from Port improvements has not been calculated, these programs are sufficient to conclude that the effort is fully underway.

Costs: Committed Resources: \$4,000 in staff time
Required Resources: \$2,000 in staff time
Cost Total: \$6,000

TLU-54 Discontinue Subsidizing Parking for City Employees

(PA 41) Discontinue the practice of providing parking to City employees based in transit-served locations.

Description: The City will seek resources to discontinue the practice of providing parking to City employees based in transit-served locations. Granting employees parking spaces and additional parking subsidies fosters automobile reliance and use. The City can demonstrate leadership by reducing the number of employees receiving subsidized parking in transit-rich areas of the City. This action could also increase the number of parking spaces available for public use. Prior to adopting such a policy, the City would need to satisfy any obligations it may have to meet unions representing affected employees. This change is projected to save approximately \$450,000 per year in reduced parking subsidies.

Responsibility: Human Resources, Department of Transportation, OPW Equipment Services

Complete: The City discontinued parking subsidies for downtown employees in 2010, though subsidized parking is still available to elected officials.

Costs: Committed Resources: \$5,000 in staff time
Resources Required: \$0
Cost Total: \$5,000

Building Energy Use

The following priority actions have been implemented or are fully underway. Some were completed as one-time actions, while others will require ongoing investment. Although funds have already been allocated, implementation of these Building Energy Use priority actions will cost an average of 33 FTE per year, 0.05 fellow time per year, and \$26 million for expenses throughout the next three years.

BE-1 & BE-3 Adopt a Green Building Ordinance (GBO) for Private Development

(PA 7) Adopt a green building ordinance for residential and commercial private development new construction projects requiring high levels of energy performance. Include all significant renovation projects in the proposed GBO for residential and commercial private development projects requiring high levels of energy performance.

Description: By adopting a green building ordinance for private development, Oakland has the opportunity to ensure that new construction and major renovation projects are constructed in a manner that reduces future operational energy and water use, transportation and waste disposal impacts, and associated GHG emissions. Such a policy can build from the City's existing Civic Green Building Ordinance and adopted green building standards for new affordable housing developments receiving funds through the annual housing Notice of Funding Availability.

Development of a draft green building ordinance for private development has been underway for more than a year. A number of workshops have been held to gather public and targeted industry input on the proposed ordinance, including affected building types, thresholds and requirements, and implementation process. Existing staff resources continue to be sufficient for development of the ordinance, though implementation may require additional training for select City staff, as well as the creation of new compliance guidance documents and process adjustments.



Once the ordinance is adopted, implementation tasks will include: updates to related content on the City's website (e.g., the ordinance, FAQs, links to helpful information); updates and maintenance of application forms and process documents; creation of a how-to manual for the public and training manual for City personnel; and development of compliance monitoring and enforcement procedures. All Planning and Building Department staff will need to receive additional training to supplement green building code training provided recently with ARRA funding support. Building inspectors will also receive training tailored for energy "raters" to maximize understanding of how to work with third-party raters. Refresher courses are expected to be available from third-party organizations (e.g., StopWaste.Org) at no cost to the City.

Responsibility: Planning, Building Services

Complete: The City adopted the Green Building Ordinance in October 2010. Due to continuous improvement to energy performance associated with building construction practice, a revision to the GBO should be scheduled at regular intervals. A revision is anticipated in the next three years.

Costs: Committed Resources: 0.75 FTE for two years plus 1,100 hours staff time
Resources Required: 1 FTE for 1 year
Cost Total: \$630,000

BE-4 Offer Property-Based Energy Financing

(PA 8) Offer property-based financing and associated outreach for energy efficiency and solar improvements to residential and commercial property owners in Oakland, supported by ARRA funding.

Description: Starting in 2010, Oakland building owners will have a new way to pay for energy and water efficiency and solar energy improvements to their commercial and residential properties. Property owners who enroll in the voluntary CaliforniaFIRST program will be able to receive upfront financing for authorized energy upgrades through a loan that stays with the property. Participants will repay the loan over a 10-to-20 year period as a line item on their property tax bill. By choosing cost-effective energy upgrades, property owners may be able to reduce their utility bills by an amount greater than the loan repayment obligation, creating a net positive cash flow while greening their facilities.

The California FIRST financing program will help to enhance the effectiveness of other commercial and residential energy efficiency and solar programs. Property-based financing is anticipated to expand the number of retrofit projects and to encourage many projects to seek deeper levels of energy savings. California FIRST will be augmented during the next three years by an anticipated grant from the California Energy Commission's (CEC) State Energy Program. This grant will cover program setup costs and buy down interest rates to make the financing more attractive to property owners.

The City has no formal role in the administration of the CaliforniaFIRST financing program. City staff will however continue to advise development of the program and will assist in marketing and outreach with partner agencies.

Responsibility: Environmental Services, Planning, Building Services

Complete: Following approval by the State of California for PACE programs to operate, City Council approved the operation of five PACE programs in Oakland in September 2015. The City markets these programs to the community through available channels including the City website, targeted marketing campaigns, and through contractors.

Costs: Committed Resources: 150 hours staff time plus 0.05 fellow time
Resources Required: None
Cost Total: \$30,000

BE-5 Encourage the Creation of On-Bill Financing for Energy Retrofits

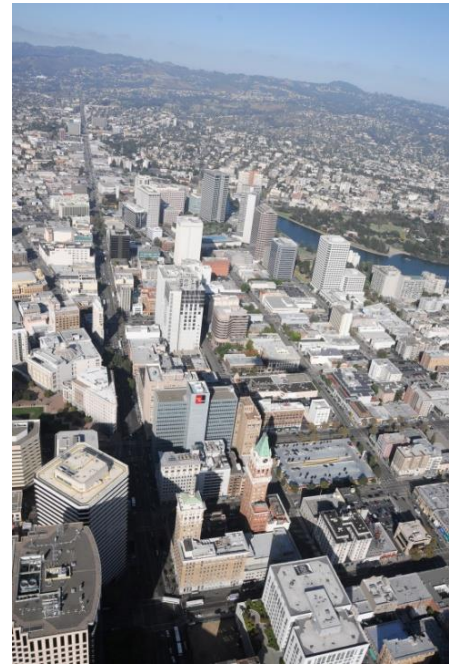
(PA 47) Engage local utilities (e.g., PG&E, EBMUD) to develop on-bill financing options for energy efficiency improvements to increase energy retrofits in tenant-occupied and other properties.

Description: The City will seek resources to participate in collaborative efforts aimed at encouraging local utilities to offer on-bill financing for building energy improvements. An effective on-bill financing option is critical to facilitating energy retrofits in large numbers of renter-occupied properties that comprise approximately half of Oakland’s housing. On-bill financing may also be a valuable tool for accelerating and deepening energy retrofits in owner-occupied properties throughout the city.

Responsibility: Environmental Services

Complete: With City encouragement, PG&E began offering on-bill financing for commercial properties and municipal facilities, with plans to extend to residential buildings.

Costs: Committed Resources: 30 hours staff time per year
Resources Required: 30 hours staff time per year
Cost Total: \$5,600 annually



BE-12 Launch a Downtown Commercial Retrofit Program

(PA 9) Offer enhanced incentives and technical assistance through the “Oakland Shines” program to help downtown commercial property owners improve energy efficiency, supported by ARRA funding.

Description: Oakland’s 120-block downtown area is targeted for energy upgrades through concentrated outreach, technical assistance and hefty rebates for energy efficiency improvements. “Oakland Shines” will emphasize improvements to Class B buildings as part of its goal to reach 80% of businesses in downtown Oakland. Energy efficiency upgrades can help building owners reduce energy use and costs, and make their buildings more attractive to tenants.

“Oakland Shines” is funded by a \$5.1 million ARRA grant. It will be administered by a team of local energy consulting firms.

Responsibility: Economic Development, Environmental Services

Complete: Completed in 2012, Oakland Shines leveraged Stimulus funding to perform more than 600 free energy audits and complete energy upgrades in nearly 200 commercial buildings, achieving annual energy savings of more than 4.5 million kWh and 55,000 therms.

Costs: Committed Resources: \$5,102,180 in staff time, grant funding, and other expenses
Resources Required: None
Cost Total: \$5,105,000

BE-13 Encourage Participation in Local Energy Efficiency Programs

(PA 10) Encourage local small businesses and residents to participate in local energy efficiency programs offered through the East Bay Energy Watch regional collaboration between PG&E and East Bay cities and by the Bay Area Regional Energy Network.

Description: The City is encouraging businesses to improve building energy performance by an average of 20% by enrolling in local energy efficiency programs such as the East Bay Energy Watch (EBEW) and

taking advantage of other PG&E programs and incentives for energy improvements. EBEW is a collaborative partnership program offered by PG&E and the cities of Alameda and Contra Costa counties. It's Direct Installation and technical assistance programs facilitate cost-effective lighting and other efficiency improvements for retail and small businesses in Oakland, offering expert advice and coordinating retrofit implementation.

EBEW also supports youth training in energy efficiency and offers entry-level residential energy efficiency services through its work with California Youth Energy Services.

The Bay Area Regional Energy Network (BayREN) is a collaboration among the nine Bay Area Counties, PG&E, and the Association of Bay Area Governments, delivering innovative and targeted energy efficiency services such as Advanced Home Upgrade and the Bay Area Multifamily Building Enhancements (BAMBE) program. The City of Oakland was instrumental in successfully advocating for the BayREN program to launch and now supports the program through enhanced local outreach and additional coordination.

Responsibility: Environmental Services

Fully Underway: The City collaborates with East Bay Energy Watch and BayREN, working directly with program implementers and PG&E to enhance local program delivery, and participates on the East Bay Energy Watch Strategic Advisory Committee. The City works directly with CYES each year to provide Oakland youth vocational building energy training, and to ensure that at least 200 Oakland homes receive energy efficiency and conservation measures. The City encourages residents and businesses to participate in energy efficiency programs offered through EBEW, PG&E, BayREN, and other special opportunities.

Costs: Committed Resources: 12 hours staff time per year
Resources Required: 12 hours staff time per year
Cost Total: \$2,000 annually

BE-13 Market Energy Retrofit Opportunities to All Oakland Businesses

(PA-43) Develop a marketing campaign to encourage 30% of businesses to improve building energy performance by 20% and reduce water consumption by enrolling in programs and taking advantage of incentives offered by PG&E and other organizations.

Description: The City will seek resources to create a marketing campaign and offer technical assistance to encourage 30% of Oakland's businesses to implement energy retrofits achieving 20% energy efficiency improvements. Businesses will be encouraged to participate in all applicable programs offered by PG&E and others to receive further assistance and rebates.

Responsibility: Business Development

Fully Underway: The City has created or participated in multiple small business programs, including Oakland Shines, SmartLights, PG&E small and medium business programs, and other campaigns through the East Bay Energy Watch. As part of the EBEW leadership, Oakland has been instrumental in arguing for improved data from PG&E on small business incentive programs. In 2017, EBEW restructured its small business programs to more efficiently serve customers and to maximize customer incentives. The new program will continue providing high-quality energy audits, direct installations of energy efficiency hardware, and financial incentives and rebates through the existing local providers (DNV GL and Community Energy Services



Corporation). The City works to enhance EBEW's outreach through Oakland-focused campaigns and by connecting EBEW service providers to local business outlets, such as the Chamber of Commerce and the Business Improvement Districts.

Costs: Committed Resources: 12 hours staff time per year
Resources Required: 12 hours staff time per year
Cost Total: \$2,000 annually

BE-22 Conduct a Multi-Family Affordable Housing Retrofit Pilot

(PA 12) Create an energy retrofit pilot program targeting multi-family affordable housing by providing funds to reduce risk and enable the acquisition of private investment capital to implement energy savings projects, supported by ARRA funding.

Description: This innovative pilot program will provide forgivable loan funds to be repaid from anticipated energy savings to reduce risk and encourage investment of private capital in multi-family affordable housing energy retrofits. Reduced risk is expected to encourage private capital investment which, when combined with other existing incentives, will support new energy retrofits of multi-family affordable housing properties.

This pilot program will move forward with anticipated funding from a CEC State Energy Program grant. Oakland partnered on a proposal with the San Francisco Mayor's Office of Housing to develop and launch this pilot program. The program will foster energy retrofits of an estimated 400 units in Oakland by the close of 2012, improving average energy efficiency of participating units by approximately 20%. In the process, the City will participate in State and regional efforts to develop programs and protocols for implementing and evaluating energy retrofits in multi-family housing.

Responsibility: Housing and Community Development, Environmental Services

Fully Underway: The pilot Bay Area Multifamily Fund, an energy upgrade and lending program, was carried out in San Francisco and Oakland in 2010-2012. The program was designed to work in conjunction with the ARRA WAP programs in both cities (see BE-23) and was successful in establishing the state's first multifamily performance-based energy efficiency program. It identified significant energy efficiency upgrade opportunities in affordable multifamily properties in both cities. However, only one Oakland property (comprising 98 units) participated in the full program, and the pilot was not continued. The participating property received nearly \$400,000 in funding through the pilot, and retrofits were expected to yield an annual energy utility bill savings of \$65,469.

The City is a participant in the Bay Area Multifamily Building Enhancements Program (BAMBE), a BayREN program that has served a total of 166 buildings as of February 2017. BAMBE provides incentives of \$750 per unit for multifamily buildings (with no income requirements) that complete energy upgrades yielding at least 10% overall energy savings. A related pilot, the Bay Area Multifamily Capital Advance Program (BAMCAP), provides low-cost financing for multifamily building upgrades. Implemented locally by StopWaste, BAMCAP launched in 2014 and engages local lenders to test whether loan buy-downs can expand the scope of planned but limited energy upgrade projects or facilitate projects that otherwise would not occur. The program provides up to \$5,000/unit or \$500,000/project. To date, the pilot has five participating lenders; four multifamily projects have closed, and another two are in the pipeline. Finally, the California Youth Energy Services program (CYES), offered to Oaklanders every summer through the East Bay Energy Watch program, focuses on energy efficiency and water conservation services, and serves primarily low-income residents and renters, including those in multifamily buildings.

Costs: Committed Resources: 20 hours staff time per year
Resources Required: 20 hours staff time per year
Cost Total: \$3,000 annually

BE-23. Expand Weatherization Program Delivery

(PA 13) Augment delivery of the existing federal Weatherization Assistance Program with supplemental ARRA funds designated for retrofitting additional homes in Oakland over the next three years.

Description: The City will expand the number of homes in Oakland receiving energy- and cost-saving weatherization services during the next three years. Several hundred low-income homes already receive Program (WAP) as well as targeted PG&E programs. The American Recovery and Reinvestment Act has recently made approximately \$1.6 million of additional funding available to Oakland through 2012 for weatherization services. These funds will be used to enhance and expand delivery of weatherization services to implement energy retrofits of approximately 250 multi-family and single family homes occupied by low-income households.

Weatherization services currently offered through existing WAP programs administered by Spectrum Community Services, Inc. and the Low Income Energy Efficiency program administered by PG&E will also continue to operate.

Responsibility: Housing and Community Development

Complete: In 2010, the City received over \$4 million in ARRA Weatherization Assistance Program (WAP) funding to provide weatherization to low-income households in Alameda County. When the program concluded in 2012, 1,146 housing units occupied by low-income households had been weatherized and an additional 414 households had received diagnostic testing and client education, for a total of 1,560 households served countywide; 74 percent of these, or 1,154 units, were in Oakland. The City ultimately completed nearly 3 times the number of units originally projected, and the program created 55,000 job hours for local residents. The 13 multifamily weatherization projects completed in Oakland alone are projected to reduce carbon dioxide emissions by over 600 metric tons per year. Over the lifetime of the improvements, the projected reduction is 8,000 metric tons of CO₂ emissions, the equivalent of taking 1,571 cars off the road for a year.

Costs: Committed Resources: \$4,000,000
Resources Required: None
Cost Total: \$4,000,000

BE-29 Encourage PG&E to Offer Green Power Options

(PA 51) Negotiate with PG&E to offer green power options to local customers.

Description: The City will seek resources to participate in collaborative efforts aimed at encouraging PG&E to offer green power options to local customers. The City will engage directly with PG&E and encourage PG&E to make meaningful local green power offerings available on a voluntary basis. In addition, the City will participate in the public comment process of the California Public Utilities Commission (CPUC), encouraging California utilities to offer green power options to all of their customers.

Responsibility: Environmental Services

Complete: The City is participating in the Alameda County's Community Choice Aggregation program, known as East Bay Community Energy, which is expected to launch in Spring 2018. That program will increase the green power options for local residents. The City continues to be supportive of proposals to increase the renewable mix in PG&E energy.

Costs: Committed Resources: 10 hours staff time
Resources Required: None
Cost Total: \$2,000

BE-30 Monitor Community Choice Energy

(PA 52) Continue to monitor the feasibility and utility of implementing community choice energy aggregation (CCA) in Oakland.

- Description:** The City will continue to monitor the feasibility and utility of implementing a CCA program in Oakland, and will seek resources to enable additional analysis of CCA if warranted. CCA may offer a powerful tool for increasing the renewable energy content of electricity consumed in Oakland. However, a number of technical, financial, legal and political issues must be addressed before moving any CCA proposal forward. New information is likely to be gained from observing early CCA efforts underway in Marin County and San Francisco. If CCA is demonstrated as a successful model, the City will revisit program design and needed resources under revised objectives. The City encourages continued study of this issue by other partners.
- Responsibility:** Environmental Services, Finance
- Complete:** The City is participating in the Alameda County's Community Choice Aggregation program, known as East Bay Community Energy, expected to launch in Spring 2018.
- Costs:** Committed Resources: 1,000 hours staff time
Resources Required: 0.10 FTE per year
Cost Total: \$200,000 plus \$30,000 annually

BE-32 Create an Oakland-Specific Water-Efficient Landscaping Ordinance

(PA 15) Create an Oakland-specific Water Efficient Landscape Ordinance (WELO) to address water conservation.

- Description:** Oakland City Council passed the Civic Bay Friendly Landscape Ordinance in 2009 to require water efficiency in all public landscaping projects. The ordinance provides citywide standards for public space that ensure stormwater retention and water conservation features are incorporated into landscaping. The Oakland-specific WELO will be designed to implement California's new model WELO and align with Bay Friendly Landscaping Guidelines.
- Responsibility:** Planning and Building Department - Strategic Planning
- Fully Underway:** The City follows the State WELO for private developments, reports regularly on compliance and progress directly to the State.
- Costs:** Committed Resources: 100 hours staff time plus 4 hours per year
Resources Required: None
Cost Total: \$13,000 plus \$550 annually

BE-43 Improve Energy Performance of New City Facilities

(PA 17) Modify the City's Civic Green Building Ordinance to increase energy efficiency standards for new construction and major renovation of City facilities.

- Description:** The City will modify energy efficiency requirements within the Civic Green Building Ordinance to increase energy efficiency for new construction and major renovations of municipal facilities. Enhanced requirements may include controls for limiting demand for electricity and natural gas during periods of high pricing or low power availability.
- Responsibility:** Environmental Services
- Fully Underway:** The Civic Green Building Ordinance requires higher levels of energy efficiency in all new construction. Additional projects occur as opportunities arise to improve performance. The City has also created a Standard Operating Procedure (SOP) for all city facilities, which includes a requirement to either construct new facilities as zero-net energy, or to explicitly justify why zero-net energy cannot be achieved. In 2016, Oakland voters passed Measure KK, which provided an

additional \$20 million for improvements to seismic, water, and energy systems in municipal buildings.

Costs: Committed Resources: 1.5 FTE per year plus \$150,000 per year
Resources Required: None
Cost Total: \$465,000 annually

BE-46 Upgrade to Energy-Efficient Streetlights



Replace streetlights with energy-efficient advanced technology models in all appropriate locations during the course of normal technology replacement schedules.

Description: The City will replace all cobra-head streetlights with advanced technologies where feasible and as funds are available improve energy efficiency, reduce operating costs, and improve light quality.

Responsibility: Oakland Public Works - Electrical Services Division

Complete: Approved by Council in 2013, the City finished converting all 30,500 high-pressure sodium cobra-head street lights to more energy-efficient, US-made LEDs in June of 2014. The new streetlights save the City an estimated \$1.4 million in annual energy costs. With a total project cost of \$15 million, project financing is being repaid entirely through PG&E rebates and energy savings. In addition to enhancing public safety with better light quality, the new fixtures use half the energy and have a longer lifespan than the old technology, thereby reducing maintenance and utility costs. The change eliminated over 400 metric tons of CO2 per year through energy efficiency alone.

Costs: Committed Resources: \$15,700,000
Resources Required: None
Cost Total: \$15,700,000

BE-47 Provide City Employee Staff Training on Climate Issues.



Develop and provide training to City employees on targeted energy and climate issues.

Description: To extend the benefits of the City's climate efforts and improve cross-departmental coordinate on sustainability issues, the City will continue to provide staff with cutting-edge trainings through the Environmental Lecture Series (ELS) to assist staff in better recognizing and understanding that the choices they make impact the quality of our environment, including climate change. The lectures will combine forty-five minute presentations and fifteen minute discussions about various sustainability issues including climate protection. Presentations will be provided by sustainability experts including staff and outside experts.

Responsibility: Environmental Services Division

Fully Underway: The City has conducted the ELS since 1998 on the first Wednesday of each month from October through June. Over 100 lectures have been provided to date. Topics addressed have include water and energy efficiency, and pollution, alternative vehicle technologies, policy and planning issues, and waste reduction. The target audience is City and Port staff, and average lecture attendance is 50-60 participants per month.

Costs: 132 hours staff time per year plus \$5,000 in materials
Cost Total: \$23,000 annually

Material Consumption and Waste

The following priority actions have been implemented or are fully underway. Some were completed as one-time actions, while others will require ongoing investment. Although funds have already been allocated, implementation of these Material Consumption and Waste priority actions will cost an average of 6 FTE per year and \$4.52 million for expenses throughout the next three years.

MW-1 Restructure Solid Waste Management System

(PA 19) Restructure Oakland’s municipal code, garbage franchise agreement, and residential recycling service contracts and rates structure to provide comprehensive incentives for residents, businesses, and collections service providers to reduce waste.

Description: The City has the ability to foster significant progress toward its Zero Waste goals and reduce GHG emissions in how it structures Oakland’s solid waste management system, which includes the municipal code, rate structure, and agreements for collection, processing, and landfill. The system it designs can provide comprehensive incentives for residents, businesses, and collection service providers to compost and recycle more and reduce waste. These changes will help Oakland comply with anticipated future statewide mandatory recycling requirements.

Responsibility: Environmental Services

Complete: On July 1, 2015, Oakland launched new trash, compost, and recycling collection services for residents and businesses under new contracts with Waste Management of Alameda County (WMAC) and California Waste Solutions. New services include compost collection at multi-family buildings, bulky item collection and recycling for all residents, illegal dumping cleanup, more choices of compost and recycling cart sizes, and ongoing zero waste outreach. The contracts advance Oakland each year toward its Zero Waste goal to keep all recyclable and compostable material out of landfills through progressive annual diversion requirements. New recycling and material processing facilities, including a composting facility at the Altamont Landfill in Livermore to be completed and operational in 2017, will divert discards from landfill. With this new facility, the first in Alameda County, Oakland’s organic materials will be locally composted for the first time. All diesel-powered collection trucks used in Oakland under the former contracts, approximately 140 vehicles, have been replaced by low-emissions natural gas-powered trucks. Most of these trucks use locally produced natural gas made from landfill methane.

Continuous promotion of participation in the bulky pick-up services provided under the franchise agreement with WMAC and in residential and commercial waste diversion services is still needed.

Costs: Committed Resources: 3.8 FTE per year for 4 years plus \$1,700,000 of expenses
Resources Required: 4.5 FTE per year plus \$225,000
Cost Total: \$4,235,000 plus \$690,000 annually

MW-2 Refine Implementation of C&D Recycling Ordinance

(PA 20) Refine implementation of Oakland’s Construction and Demolition (C&D) Debris Waste Reduction & Recycling Ordinance (OMC 15.34) to capture greater amounts of materials for reuse, recycling, and composting.

Description: Following an exercise to identify opportunities for improving implementation of the City’s C&D Debris Recycling Ordinance, City staff implemented enhanced online submission of data, tracking, and evaluation. More effective implementation helps to capture greater amounts of materials for reuse, recycling, and composting. Potential adjustments include improving administrative procedures, creating new or enhanced data management systems, and increasing internal training and outreach. Additional improvements may be aimed at broadening the definition of “affected projects,” raising the diversion requirements for affected projects, and identifying and implementing creative incentive programs.



Photo: Matt Southworth

Responsibility: Building Services and Permit Center, Environmental Services

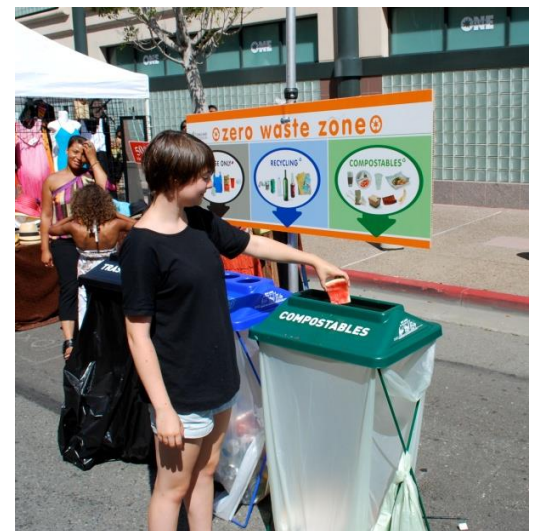
Fully Underway: The City has successfully improved administrative procedures, enhanced data management systems, and increased internal training and outreach to affected projects. Additionally, the Residential Green Building Ordinance (see Completed Action BE-1) includes verification requirements for proper C&D recycling. The City continues to make database modifications to improve program analysis of C&D Debris Recycling Ordinance implementation.

Costs:
Committed Resources: 0.05 FTE per year for 4 years
Resources Required: 0.15 FTE per year
Cost Total: \$60,000 plus \$45,000 annually

MW-3 Promote Waste Reduction at Community Events

(PA 21) Require development and implementation of waste reduction and recycling plans for all large venues and public events.

Description: The City will require waste reduction and recycling/composting plans as part of the event permitting process, and require recycling in agreements for City facility rentals. The City will develop and implement waste reduction and recycling plans for City-sponsored events. The City uses an event recycling guide and model contract to assist event producers and venue managers in complying with State law on large event/venue recycling, and provides technical assistance for compliance and event recycling equipment where appropriate. The City requires waste reduction and recycling/composting plans as part of event permitting.



Responsibility: Environmental Services

Fully Underway: The City coordinates zero-waste, City-sponsored events, including the annual Art & Soul Festival and Bike-to-Work Day events. The City uses its event permitting system to require recycling and composting at permitted events, provides technical assistance to event producers on request, and lends collection containers for recycling and compost collection.

Costs: Committed Resources: 0.10 FTE per year
Resources Required: 0.10 FTE per year
Cost Total: \$17,000 annually

MW-4 Enforce Mandatory Recycling

(PA 53) Enforce mandatory recycling and/or bans on the use, sale, or disposal of certain product types.

Description: The City will seek funds as necessary to enforce future mandatory recycling requirements or bans on the use, sale, or disposal of certain product types. It is anticipated that the State of California may mandate commercial recycling in the future, and that local governments would have a role in the enforcement of such mandates.

Fully Underway: The trash, compost, and recycling collection services for residents and businesses, under new contracts with Waste Management of Alameda County and California Waste Solutions, launched in July 2015 and now provide services ensuring that businesses and multi-family residential properties have the services necessary to meet current and anticipated future Alameda County and State of California recycling mandates. The City requires recycling space calculations to be completed for development projects. The City banned restaurants from using expanded polystyrene take-out containers in 2006. Alameda County banned the use of single-use plastic carry-out bags by retailers in 2013, and will extend the ban to restaurants on May 1, 2017.

Responsibility: Environmental Services, Building Services (Code Compliance)

Resource Needs: Committed Resources: 0.1 FTE per year
Resources Required: 0.2 FTE per year
Cost Total: \$43,000 annually

MW-5 Conduct Residential Social Marketing Campaigns and Business Outreach

(PA 54) Conduct new residential social marketing campaigns and increased outreach to businesses and other institutions regarding waste reduction and recycling programs.

Description: The City will seek resources to conduct new residential social marketing campaigns and increased outreach to businesses and other institutions to improve participation in available waste reduction and recycling programs. Reduction of material consumption and waste requires long-term behavioral change in purchasing and discard decisions. Outreach and marketing efforts to that end will require a sustained effort to connect participants to the social good of recycling and waste reduction. The City will coordinate with StopWaste.Org to leverage resources.

Responsibility: Environmental Services

Fully Underway: The City and its contractors have undertaken residential and commercial social marketing campaigns to promote recycling, compost, and bulky collection services, as well as in energy efficiency and renewable energy, led by the City's Environmental Services Division. The recycling and compost campaigns are conducted regularly as part of the City's Zero Waste efforts. Energy-related campaigns have been carried out in conjunction with specific programs including the City's ARRA-funded Oakland Shines program (see BE-12), and as part of regional programs such as SunShares, a regional solar power and electric vehicle group purchasing campaign, and the Bay Area Multifamily Building Enhancements Program (see BE-22).

Costs: Committed Resources: 1.5 FTE per year for 4 years
Resources Required: 3.5 FTE per year

Cost Total: \$1,200,000 plus \$690,000 annually

MW-17 Develop Regulations Enabling Urban Food Production

(PA 22) Develop regulations that allow for the use of urban land for food production.

Description: The City will study options and develop new regulations to better allow for and regulate urban agriculture in small scale forms, civic/community gardens, and industrial forms on urban land. This analysis will explore a variety of mechanisms to enable increased local food production. Consideration will be given to issues such as soil toxicity, water access and security. The City will collaborate with the Alameda County Health Department on this effort.



Responsibility: Planning and Building Department - Strategic Planning, Economic Development

Complete: Revised Urban Food provisions were added to the City's Zoning Ordinance in 2014, expanding opportunities for food production on urban lands. The regulations allow limited seasonal sales of produce from community gardens while prohibiting heavy machinery. The code amendments created two new land use designations: "Limited Agriculture" and "Extensive Agriculture" to replace the "Crop and Animal Raising" designation. The areas within "Limited Agriculture" zones may cultivate produce and keep three or fewer bee hives, allowing small-scale commercial crop growing and bee keeping. The areas within the "Extensive Agriculture" zone are permitted to keep animals and to keep more than three bee hives. The definition of a "Home Occupation," an area that shares the same lot as a living space, was also changed to allow small-scale beekeeping.

Costs: Committed Resources: 750 hours staff time
Resources Required: None
Cost Total: \$100,000

Chapter 5

Achieving a 36% Reduction in GHG Emissions: The 2020 Plan

Over 150 separate actions are recommended for implementation by the City by 2020. These actions will help to put Oakland in position to achieve a 36% reduction in GHG emissions from 2005 levels in each of the three primary GHG reduction categories (Transportation & Land Use, Building Energy Use, and Material Consumption & Waste) by 2020, and build resilience and climate equity throughout Oakland's diverse community. Most of the actions in the ECAP will require new resources to move forward.

This chapter includes all actions recommended for implementation to achieve a 36% reduction in GHG emissions. Actions recommended for priority implementation in Chapter 4 are included here, along with remaining actions needed to achieve the 2020 target.

As in Chapter 4, recommended actions are grouped into the three primary GHG reduction categories, along with a set of highlighted community engagement recommendations, and steps to assist Oakland in adapting to climate change, in the following order:

- Transportation & Land Use
- Building Energy Use
- Material Consumption & Waste
- Community Engagement
- Climate Adaptation & Increasing Resilience

In this chapter, the full list of actions recommended for implementation by 2020 is organized by thematic strategy. Targets have also been identified for key performance metrics, translating the 36% GHG reduction goal into a series of performance targets.

Further information regarding implementation coordination, monitoring, reporting, and evaluation is included in Chapter 2.

Actions to Achieve a 36% GHG Reduction

Many actions beyond those considered Priority (see Chapter 4) will need to be implemented to achieve a 36% reduction in GHG emissions by 2020.

The following pages summarize the actions envisioned for implementation by 2020 to achieve Oakland's GHG reduction goal. This list was updated in 2017 concurrent with the final 3 Year Priority Implementation Plan.

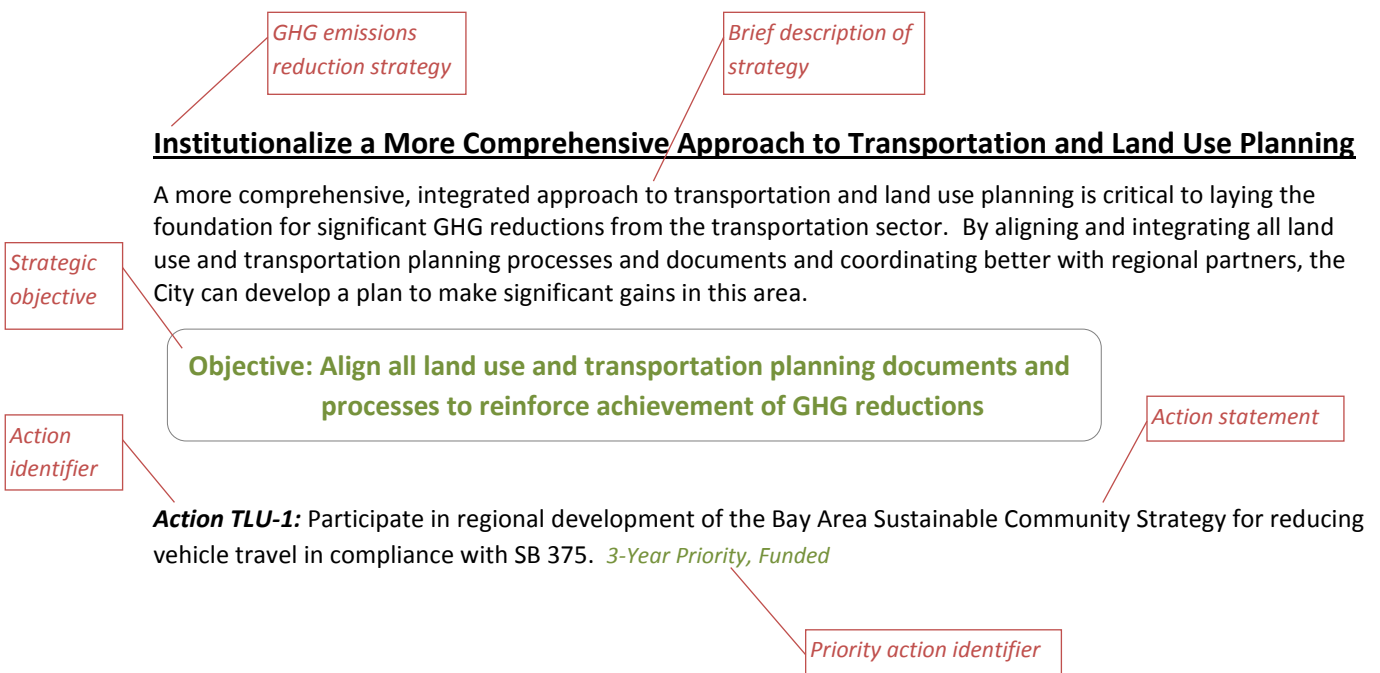
As is the case for actions recommended for priority implementation, existing resources are likely to be sufficient to enable implementation of some of the remaining actions on the 2020 list during the period of 2014-2020. Most actions in this chapter, however, will require new resources to move forward.

The City has benefitted from observing actions implemented during the first years of ECAP implementation, and will have the opportunity to learn more to improve plans going forward. Successful programs might be continued and expanded, while unsuccessful actions might be dropped or reconfigured for success. Other unforeseen changes in the world (e.g., technological advancements, energy price changes, economic growth rates, new climate models) also have the potential to spur adjustment of ongoing plans.

Actions listed in this chapter are expected to help Oakland achieve a 36% reduction in GHG emissions by 2020 and put Oakland on a strong path toward achieving strong climate action post 2020.

How to Read This Chapter

Each action below is presented through a standard format containing each of the following elements.



Transportation and Land Use

Combustion of fossil fuels, as well as biofuels, for transportation is a major source of GHG emissions. Transportation includes people moving to and from home, work, school, shopping, recreation, and other destinations, as well as the transport of goods. Other local air pollutants linked to increased incidence of health problems such as asthma, heart disease, and cancer, many of which disproportionately affect Oakland's low income and vulnerable populations, are attributable use of transportation fuels.

Addressing transportation emissions presents a tremendous opportunity to simultaneously reduce GHG emissions, and improve the health and safety of Oakland residents, while reducing dependence on foreign oil and local vulnerability to energy price fluctuations. Efforts to reduce GHG emissions from the transportation sector also present opportunities to create a more equitable, sustainable, affordable, and healthy Oakland, by addressing the interconnections between land use and transportation. How and where housing, jobs, shopping, and other land uses and activities are located has a fundamental effect on both GHG emissions and the options people have for meeting their daily needs.



Achieving a 36% reduction in GHG emissions associated with Transportation and Land Use will require unprecedented local action, including **reducing citywide driving by 20% and improving citywide vehicle fuel efficiency**. A number of strategies are available through which the City can help to reduce GHG emissions associated with Transportation and Land Use.

Key GHG Reduction Strategies:

- Institutionalize a More Comprehensive Approach to Transportation & Land Use Planning
- Advance Infill, Mixed-Use, and Transit-Oriented Development
- Advance the Use of Alternative Transportation
- Refine Parking Policies to Encourage Low-Carbon Mobility
- Foster the Use of Low-Carbon Vehicles and Fuels
- Engage the Port of Oakland and Related Industry in Reducing GHG Emissions
- Reduce Emissions Associated with City Operations

Develop Oakland's Urban Forest

Achieving the 2020 goal of reducing GHG emissions associated with Transportation and Land Use by 36% will require significant action in all of these areas. All members of the Oakland community, including residents, businesses, visitors, and the City, will need to make daily decisions to reduce the need for automobile trips. When purchasing new vehicles, members of the community will also need to prioritize fuel efficiency in their decisions wherever possible.

Transportation and Land Use 2020 Goals:

- 20 % reduction in vehicle miles traveled
- 24 million gallons of gasoline and diesel saved on local roads
- Fully integrated transportation and land use planning

Strategies to Achieve 2020 Goals

Institutionalize a More Comprehensive Approach to Transportation and Land Use Planning

A more comprehensive approach to transportation and land use planning is critical to laying the foundation for significant GHG reductions from the transportation sector. Because transit infrastructure can require substantial investment and have a profound impact on other land use and development decisions, proactive and integrated planning is key to creating the infrastructure and guiding development in a manner that will reduce the need to drive in Oakland. By aligning and integrating all land use and transportation planning processes and documents, and increasing coordination with regional partners, the City can develop a plan to make significant gains in this area.

Objective: Align all land use and transportation planning documents and processes to reinforce achievement of GHG reductions

Action TLU-1: Participate in regional development of the Bay Area Sustainable Community Strategy for reducing vehicle travel in compliance with SB 375, including defining Oakland’s role in achieving regional jobs-housing balance and land use and transportation system integration, and advocate for infrastructure funding to be provided. *Complete/ Fully Underway*

Action TLU-2: Prepare a comprehensive, integrated Oakland Transportation Plan in close collaboration with regional agencies, local service providers, and the community. *3-Year Priority, Resources Needed*

Action TLU-3: Require the integration of land use and transportation planning and consideration of GHG reduction opportunities in every planning, major project, and redevelopment effort undertaken by the City. *3-Year Priority, Resources Needed*

Action TLU-4: Identify opportunities to adjust the structure, function, and/or composition of the Planning Commission to advance integrated consideration of transportation and land use planning issues.

Action TLU-5: Prioritize GHG reduction opportunities in the City’s ongoing Zoning Update process.

Advance Infill, Mixed-Use and Transit-Oriented Development

Well designed, transit-oriented, dense, mixed-use, development providing access to goods and services can significantly reduce the use of fossil-fuel powered transportation. Reducing automobile trips can significantly reduce GHG emissions, local air pollution, and related health impacts, and improve neighborhood quality of life.

Objective: Plan new development to minimize dependence on fossil fuel-powered transportation

Action TLU-6: Obtain Priority Development Area status from the Association of Bay Area Governments for all appropriate areas of Oakland to enable more competitive eligibility for local transportation and infrastructure funding. *3-Year Priority, Funded*

Action TLU-7: Adopt a transportation impact fee to support new local low-carbon transportation infrastructure and planning. *3-Year Priority, Resources Needed*

Action TLU-8: Develop and require transit-oriented development performance criteria for all major new development plans and projects throughout the city, addressing vehicle miles traveled and mode share and emphasizing development proximate to transit hubs and corridors of all modes.

Action TLU-9: Actively promote the construction of housing at a range of price levels near transit hubs and corridors in balance with local employment opportunities to meet the needs of Oakland’s workforce, and study adoption of a transit-oriented development affordability policy, including preservation of existing affordability. *3-Year Priority, Resources Needed*

Action TLU-10: Develop a comprehensive infrastructure plan (e.g., utilities, sewer, water, storm drains) to support Oakland’s capacity to absorb planned infill development and to enable new green infrastructure and climate-related improvement (e.g., vegetated swales, recycled water, solar technology installation).

Action TLU-11: Engage the community, through the zoning update process and other appropriate mechanisms, to develop a strategy for increasing density adjacent to transit in ways that improve neighborhood livability. For example, update design review standards for high-density multi-family buildings, encouraging design that is aesthetically pleasing, highly functional, and practical. Insist on the creation of vibrant, safe, and attractive public spaces as a part of every development. *3-Year Priority, Resources Needed*

Action TLU-12: Engage the lending community on a shared strategy to improve the financial attractiveness of infill development in Oakland.

Advance the Use of Low-Carbon Transportation Modes

To achieve significant GHG reductions, transportation modes such as transit, bicycling and walking must increasingly become the preferred mode of moving about the city. To be effective, these modes must be available, accessible, safe, cost-competitive, and desirable relative to private automobiles.

Objective: Make transit, biking, and walking the preferred modes for local trips

Action TLU-13: Launch and sustain a downtown free shuttle to increase the ease of transit use in the downtown area. Explore options to expand the shuttle route along the Broadway corridor. *3-Year Priority, Funded*

Action TLU-14: Support bus rapid transit in Oakland along the Telegraph Avenue and International Boulevard corridors while minimizing short-term potential impacts to neighborhoods and businesses. *3-Year Priority, Funded*

Action TLU-15: Update the process for evaluating local environmental impacts resulting from new development (as required by the California Environmental Quality Act) to prioritize consideration of vehicle miles traveled impacts above congestion impacts. *Complete / Fully Underway*

Action TLU-16: Accelerate the completion of bicycle and pedestrian networks as described in the Bicycle and Pedestrian Master Plans and other General Plan policies to provide safe, healthy transportation choices for all residents. *3-Year Priority, Resources Needed*

Action TLU-17: Optimize the design of streets to support transit, bicycling and walking (e.g., via bulb outs, traffic signal synchronization, transit and emergency signal priority). *3-Year Priority, Resources Needed*

Action TLU-18: Encourage and assist employers and transportation funding agencies to offer support for alternative transportation strategies that can help reduce the need to drive. These strategies may include transit incentive programs (e.g., AC Transit Easy Pass), enabling telecommuting, flexible schedules, rideshare and car share programs, fuel-efficient workplace vehicles, youth bus passes, and enhanced bicycle access in order to reduce the need for employees to drive.

Action TLU-19: Collaborate with regional partners (e.g., AC Transit, BART, shuttles, train, taxis, ferry) to expand and enhance public transit service, interconnections, vehicle amenities, and associated facilities (e.g., smaller transit shuttles to



underserved areas of the community, connection timing). *3-Year Priority, Resources Needed*

Action TLU-20: Explore opportunities to implement major transit investments (e.g., streetcar) on the primary trunk lines of the city to improve the availability and reliability of transit service in areas where urban densities and activity centers exist.

Action TLU-21: Collaborate with community partners in developing and providing sustained community outreach and marketing about all available alternative transportation options (e.g., walking, biking, Safe Routes to School, car share programs, “Translink”).

Action TLU-22: Partner with 511.org and the city's largest employers, event venues, and other destinations to ensure that employees and visitors to Oakland have full information about the transportation choices.

Action TLU-23: Partner with and promote community based organizations that provide knowledge and skills such as bicycle safety training, transit system use, etc. to help Oakland residents shift trips to non-auto modes. *Complete / Fully Underway*

Action TLU-24: Encourage the creation of local bike sharing programs. *Complete / Fully Underway*

Action TLU-25: Explore potential strategies for increasing the availability of car share vehicles throughout the city (e.g., consider providing priority car share locations in high trafficked areas to car share companies willing to make car share vehicles available and accessible in less trafficked or underserved areas). *3-Year Priority, Resources Needed*

Action TLU-26: Enforce transportation demand management measures that are physically built into projects (e.g., car sharing spots, bike parking and showers, pedestrian-oriented elements).

Action TLU-27: Explore and revise City policies that make transit service difficult (e.g., analyze the true effect of transit on commercial districts, provide potential parking meter revenue if meters are removed), and consider transit-only lanes and amenities on significant thoroughfares.



Refine Parking Policies to Encourage Low-Carbon Mobility

Parking policies and pricing can have a significant impact on local transportation choices, especially in areas served by other transportation options such as public transit. Parking policies and pricing can be tailored to meet the needs of the Oakland community while fostering shifts from automobile use to other transportation modes. Parking pricing can also be used to support the development of alternative transportation options and other community benefits.

Objective: Meet parking needs while creating disincentives to drive

Action TLU-28: Develop regulations that would permit parking requirements to be met through alternative approaches demonstrated to reduce parking demand and GHG emissions (e.g., on-site car-sharing, bicycle parking, transit passes). *3-Year Priority, Funded*

Action TLU-29: Conduct a citywide dynamic parking pricing study and develop a strategy to set parking rates at City meters and garages that can reduce trips, favor transit, provide adequate parking supply, encourage economic development, and fund alternative transportation and neighborhood streetscape improvements. *Complete / Fully Underway*

Action TLU-30: Impose parking maximums on new development and assist developers, lenders, property owners, and tenants in preparing strategies to minimize parking demand and encourage shifts to transit and other transportation modes. *3-Year Priority, Resources Needed*

Action TLU-31: Develop a strategy to facilitate unbundling of the costs of renting parking from renting building space, where appropriate, to more explicitly charge for parking.

Action TLU-32: Review the process of establishing residential permit parking and consider opportunities to expand this program in appropriate locations.

Foster the Use of Low Carbon Vehicles and Fuels

A portion of transportation in the city will continue to be accomplished through the use of gasoline and diesel-powered automobiles. Improving vehicle fuel efficiency through purchasing decisions and maintenance activities and utilizing low carbon fuels (e.g., biodiesel from waste oils) can help to reduce GHG emissions associated with these vehicle trips.

Objective: Increase representation of low-carbon fuels and vehicles in the citywide fleet

Action TLU-33: Participate in regional electric vehicle infrastructure planning and develop new processes to support local use of electric vehicles. *3-Year Priority, Funded*

Action TLU-34: Collaborate with community partners to develop and provide sustained community outreach and marketing about fuel-efficient vehicles and low carbon fuels (e.g., biodiesels from waste oils).

Action TLU-35: Encourage the responsible local manufacture and production of low-carbon fuels (e.g., biofuels produced from recycled waste oil) through incentives and/or promotional support.

Action TLU-36: Work with large fleet operators such as taxi companies, along with the City's own fleet, to establish minimum GHG performance criteria for all new fleet vehicles and fleet-wide GHG performance goals.

Action TLU-37: Consider regulating the use of certain fuel-powered leaf blowers.



Engage the Port of Oakland and Related Industry in Reducing GHG Emissions

As a primary hub of goods movement, activities associated with the Port of Oakland and its tenants are a significant source of GHG emissions and other local air pollution. Oakland is fortunate to reap economic and employment benefits from its Port, but is also troubled with high levels of local air pollution and other problems created by this concentration of goods movement.

GHG emissions associated with the Port and its tenants include emissions associated with building energy consumption, Port-owned vehicles and equipment, harbor craft, cargo handling equipment, berthed vessels, trucks and



trains operating within Port property and within Oakland’s boundaries, and other stationary sources. Tenant activities create additional GHG emissions outside of Oakland in the form of fuel used to power airplanes, trucks, trains, and marine vessels. Emissions associated with these planes and vessels generally fall under the regulatory authority of the Federal Aviation Administration, the International Maritime Association, or State and Federal government. However, Oakland can help to reduce emissions associated with these sources through actions that reduce material consumption and waste, as described in Chapters 4 and 5. See the ECAP Appendix for further information on GHG emission sources related to the Port and its tenants.

Short of incorporating GHG reduction actions and/or performance requirements applicable to the Port of Oakland within the City’s General Plan, the City’s ability to influence these emission sources is generally limited. However, it is in the collective best interests of the City and the Port to continue collaborating to explore opportunities to reduce emissions associated with the Port and its tenants. The Port has a significant opportunity to play a leadership role in addressing local sources of GHG emissions and other air pollutants.

The Port has taken a number of steps in recent years to reduce emissions associated with Port operations and on-site tenant activities, including installing infrastructure for alternative fuel vehicles, advancing shoreside electrification for tenant vessels, retrofitting facilities, and installing solar energy systems. Many opportunities for additional progress remain, as indicated by measures contained in the Port’s Maritime Air Quality Improvement Plan that would reduce GHG emissions.

Objective: Reduce GHG emissions associated with the Port of Oakland and its tenants

Action TLU-38: Call upon the Port to establish GHG reduction goals associated with Port operations in alignment with the City’s GHG reduction target of 36% below 2005 emissions by 2020, and plans for achieving those goals. *Complete / Fully Underway*

Action TLU-39: Call upon the Port to establish GHG inventories and reduction goals associated with tenant activities, and plans for achieving those goals with appropriate tenant commitments, potentially including requiring specific high-impact GHG reduction measures (e.g., electrification of land-based, aviation and maritime vessels). *3-Year Priority, Resources needed*

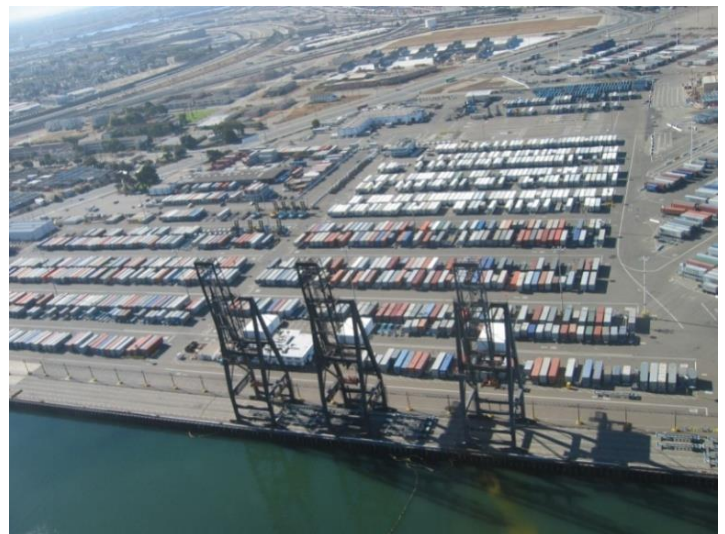
Action TLU-40: Offer to partner with the Port, where appropriate, in evaluating and developing GHG reduction strategies.

Action TLU-41: Collaborate with the Port to advocate that Port tenants be required to implement actions at Oakland’s ports in demonstrating compliance with statewide fleet emissions reduction targets (e.g., through electrification of docked vessels).

Action TLU-42: Conduct a study of potential options to implement truck re-routing in Oakland to reduce driving and parking of diesel trucks near residential neighborhoods, as well as increased enforcement of anti-idling restrictions.

Action TLU-43: Make land use and planning decisions (e.g., plans for the former Army Base) in a manner that minimizes GHG emissions and other air pollutants associated with the Port and related activities and travel without unduly compromising the economic value of the Port.

Action TLU-44: Identify opportunities to incorporate GHG reduction actions and/or performance requirements applicable to the Port of Oakland within updates to the City’s General Plan.



Grow Oakland's Urban Forest

Urban forestry can be both an effective GHG mitigation and climate adaptation strategy. Trees provide important benefits in helping to directly and indirectly cool nearby buildings, reducing energy demand. Tree canopies also help to reduce the urban heat island effect, reducing temperatures throughout the city and helping to mitigate air quality and health problems caused by extreme heat events. Urban forests can also help to provide animal habitat, create economic development benefits in commercial districts, and improve quality of life. However, urban forests require thoughtful and resourced management. Trees must be planted carefully with consideration of infrastructure, public safety and maintenance and other sustainability impacts. The development and maintenance of the urban forest requires an effective public-private partnership.



Objective: Develop Oakland's urban forest throughout the city

Action TLU-45: Develop an urban forestry master plan outlining how the City will protect, develop and maintain diversified and appropriate tree plantings on City right-of-ways. *3-Year Priority, Resources Needed*

Action TLU-46: Develop a robust urban tree inventory of all trees in proximity to sidewalks, medians, public buildings, parks and other public right-of-ways. *3-Year Priority, Resources Needed*

Action TLU-47: Revise the City Street Trees and Shrubs Ordinance (Municipal Code 12.32) and the Protected Trees Ordinance (Municipal Code 12.36) to : include the provision of preventative maintenance and management of trees in City right-of-ways, ensure the continued health of all parks and forested land within the city, encourage tree planting on private land throughout the community, and include effective enforcement provisions. *3-Year Priority, Resources Needed*

Action TLU-48: Implement a street tree planting pilot project with local partners utilizing advanced planting techniques. *3-Year Priority, Resources Needed*

Action TLU-49: Develop a plan to ensure the continued health of all parks and forested land within the city and encourage tree planting on private land throughout the community.

Action TLU-50: Convene community workshops to educate community members on proper tree maintenance.

Action TLU-51: Collaborate with local organizations where appropriate to advance local urban forestry efforts.

Reduce Transportation Impacts of City Operations

The City adopted a Green Fleets policy in 2003, committing to purchase vehicles powered by alternative fuels whenever possible. While efforts in accordance with this policy have been made since, many opportunities remain to improve fleet fuel efficiency and shift to alternative fuel vehicles. Fleet replacement has been significantly underfunded in recent years, resulting in an aging and fuel-inefficient fleet requiring significant maintenance investment. A number of City fleet vehicles now operate on compressed natural gas (CNG), but opportunities exist to convert hundreds of non-emergency vehicles to CNG and other fuel efficient alternatives (e.g., plug-in hybrid electric vehicles). Vehicle replacement with more fuel efficient vehicles continues to represent the largest opportunity to decrease GHG emissions associated with the City's fleet.

Objective: Achieve a 36% reduction in City-related fuel consumption by 2020

Action TLU-52: Increase the rate of fleet vehicle replacement to retire older inefficient vehicles and continue to replace vehicles with fuel efficient and alternative fuel models (e.g., CNG, electric and plug-in hybrid vehicles, trucks with anti-idling controls). *3-Year Priority, Resources Needed*

Action TLU-53: Provide subsidized transit passes (e.g., participate in the AC Transit Easy Pass program) and bicycle or shoe commuter allowances to all City employees. *3-Year Priority, Resources Needed*

Action TLU-54: Discontinue the practice of providing parking to City employees based in transit-rich locations. *Complete / Fully Underway*

Action TLU-55: Support employee commute trip reduction by enabling flexible work schedules and encouraging telecommuting where possible.

Action TLU-56: Explore opportunities to enable access to more City services online to reduce the need for customers to drive to City offices.

Action TLU-57: Continue efforts to reduce the size of the City's vehicle fleet by utilizing pool cars and car share programs and eliminating underutilized inefficient vehicles.

Action TLU-58: Perform regular preventive maintenance (e.g., tire inflation) of the City's vehicle fleet to ensure optimum fuel efficiency performance.

Action TLU-59: Expand employee education programs training staff on how to reserve pool cars and car share vehicles, planning practices for optimizing and reducing trips, and vehicle maintenance and driving habits that promote optimum fuel efficiency.

Action TLU-60: Expand the City's capacity to support the use of alternative fuel vehicles, such as through the installation of new electric vehicle charging infrastructure.

Action TLU-61: Integrate fuel-efficient and zero emission specialized vehicles (e.g., cargo trikes for park maintenance) into the City's fleet where appropriate.

Building Energy Use

Building Energy Use, including energy used to heat, light, and power Oakland's buildings and other stationary devices such as streetlights, as well as to pump and treat water consumed in Oakland, is a major direct source of greenhouse gas emissions.

Natural gas consumption represents the majority of GHG emissions from this sector, followed closely by electricity use. The combustion of natural gas, primarily to heat buildings, heat water and cook, results directly in GHG emissions. Electricity consumption results in the creation of GHG emissions at the power plant(s) generating and providing the electricity. Most electricity generation occurs outside of Oakland's boundaries, but those GHG emissions are included here given the direct relationship to electricity consumption occurring in Oakland.



Many strategies are available through which the City can help to reduce GHG emissions associated with Building Energy Use.

Key GHG Reduction Strategies:

- Optimize energy efficiency in new buildings
- Retrofit existing buildings to reduce energy consumption
- Promote energy and water conservation and efficiency
- Advance the use of renewable energy
- Improve the energy performance of municipal facilities

Achieving the 2020 goal of reducing GHG emissions associated with Building Energy Use by 36% will require significant action in all of these areas. Improving energy performance in existing buildings is especially important. A community-wide movement will be needed to reach all businesses and guide 30% of them through energy efficiency programs, encourage property owners to retrofit 30% of Oakland's homes, and foster dedicated energy conservation behaviors on the part of every member of the Oakland community.

Building Energy Use 2020 Goals:

- Construct all new buildings citywide to high energy standards
- Retrofit 30% of commercial space and homes between 2010 and 2020
- Achieve 32% electricity savings across all sectors
- Achieve 14% natural gas savings across all sectors
- Achieve a 33% renewable portfolio standard for grid electricity
- Generate 3% of building energy consumption from new local renewable energy

Strategies to Achieve 2020 Goals

Optimize Energy Efficiency & Consumption in New Buildings

Every year, new buildings continue to be constructed in Oakland. Achieving long term energy reduction starts by ensuring that all new buildings are constructed to high performance energy standards. Recent updates to the State's Title 24 building energy code and CALGreen, the statewide green building code, have raised the energy performance bar in California, but new buildings in Oakland can achieve even higher levels of energy efficiency.

Objective: Achieve 10% better energy performance than Title 24 in all new building stock

Action BE-1: Adopt a green building ordinance for residential and commercial private development new construction projects requiring high levels of energy performance and water efficiency. *Complete / Fully Underway*

Action BE-2: Ensure enforcement of building energy codes in accordance with all code requirements.

Retrofit Oakland's Existing Building Stock to Reduce Energy Consumption

There are more than 100,000 residential and commercial buildings in Oakland, built over many decades, many of which offer significant opportunities for improved energy performance. Reducing citywide energy consumption will require retrofitting all of these buildings to improve energy efficiency. Many energy efficiency improvements offer significant cost savings opportunities, and can also improve indoor occupant health, comfort, productivity and quality of life. Energy retrofits can reduce energy consumption and energy costs as much as 25-35% per building, often creating a net positive cash flow from day one. With a large and experienced pool of energy contractors, Oakland is well-positioned to become the energy retrofit capital of America.

All Building Types

Action BE-3: Include all significant renovation projects in the proposed green building ordinance for residential and commercial private development projects requiring high levels of energy performance.

Complete / Fully Underway

Action BE-4: Offer property-based financing and associated outreach for energy efficiency and solar improvements to residential and commercial property owners in Oakland. *Complete / Fully Underway*

Action BE-5: Engage local utilities (e.g., PG&E, EBMUD) to develop on-bill financing options for energy efficiency improvements to increase energy retrofits in tenant-occupied and other properties. *Complete / Fully Underway*

Action BE-6: Pursue funding to augment existing and create new residential and commercial energy programs to reduce energy consumption throughout the community. *3-Year Priority, Resources Needed*

Action BE-7: Encourage all businesses and households to use 16% less energy through conservation actions such as turning off unnecessary equipment and right-sizing the use of energized equipment. *3-Year Priority, Resources Needed*

Action BE-8: Coordinate with other jurisdictions in our region to explore the potential benefits, consequences and opportunities of enhancing local influence and control over public goods funding from the CPUC for energy efficiency



programs, and request an accounting of current guidelines, revenues, and expenditures from the public goods surcharge with intent to petition the CPUC for use of public goods surcharge funds.

Action BE-9: Engage the lending community in discussions about developing energy-related financing offerings, including an on-bill financing program.

Action BE-10: Develop and promote a suite of energy efficient upgrades specifically for historic buildings so that these buildings can be made energy efficient while retaining their historic status. Encourage energy retrofit training programs to include training on issues specific to historically significant older buildings.

Action BE-11: Promote the benefits of investing in energy efficiency in existing properties and provide guidance on getting started to property owners and tenants through a targeted marketing and outreach campaign in collaboration with local partners.

Commercial/Industrial Buildings

Objective: Perform efficiency retrofits in 30% of Oakland's commercial building stock by 2020, resulting in 20% less building-related electricity and natural gas consumption

Action BE-12: Offer enhanced incentives and technical assistance to help downtown commercial property owners improve energy efficiency. *Complete / Fully Underway*

Action BE-13: Encourage businesses to participate in local energy efficiency programs offered through the East Bay Energy Watch regional collaboration between PG&E and East Bay cities. *Complete / Fully Underway*

Action BE-14: Launch a program offering technical assistance to help Oakland's most energy intensive businesses to develop and implement energy efficiency and conservation strategies. *3-Year Priority, Resources Needed*

Action BE-15 & BE-16: Adopt an ordinance requiring energy benchmarking and/or energy-related improvements at time of lease or sale, or under other appropriate conditions of commercial sector buildings by a certain date, based on analysis of existing commercial retrofit programs. *3-Year Priority, Resources Needed*

Action BE-17: Develop analytical tools and invest in strategic planning to identify energy improvement opportunities and new initiatives to reduce energy use in commercial buildings.

Action BE-18: Encourage the use of building feedback systems to assist local building owners in identifying, implementing, tracking, and reporting on energy efficiency improvements over time.

Action BE-19: Enhance and expand existing small commercial energy retrofit assistance programs to help existing owner-occupied and rented small commercial properties reduce energy use and save money via energy audits, technical assistance, retrofit incentives, and/or continuous commissioning support.

Action BE-20: Create a community "Kilowatt Crackdown" challenge program in collaboration with BOMA and other partners pushing commercial office buildings to reduce energy use while competing for recognition based on energy performance and progress.



Residential Buildings

Objective: Retrofit 30% of Oakland's residential building stock by 2020, resulting in 10% less building-related electricity and natural gas consumption

Action BE-21: Launch a new energy retrofit program to improve energy efficiency of existing single-family and multi-family residential properties via promoting green improvements, providing green construction specs, certifying green contractors, connecting homeowners, landlords and tenants with financing options (e.g., new property-based financing), and providing quality assurance support. *3-Year Priority, Funded*

Action BE-22: Create an energy retrofit pilot program targeting multi-family affordable housing by providing funds to reduce risk and enable the acquisition of private investment capital to implement energy savings projects. *Complete/ Fully Underway*

Action BE-23: Expand, enhance, and promote delivery of weatherization and energy retrofit assistance services to help low-to-moderate income residents improve energy efficiency and reduce energy costs. *3-Year Priority, Funded*

Action BE-24: Develop new energy retrofit programs to facilitate energy efficiency improvements of existing renter-occupied residential properties by supporting outreach as well as assistance designing tenant-landlord agreements so that all parties equitably share the costs and benefits of energy efficiency. *3-Year Priority, Resources Needed*

Action BE-25: Adopt an ordinance requiring cost-effective residential energy-and water-related improvements at time of sale, or under other appropriate conditions with consideration of affordability and equity. *3-Year Priority, Resources Needed*

Action BE-26: Support local programs delivering entry-level residential energy efficiency services to Oakland neighborhoods (e.g., California Youth Energy Services).

Action BE-27: Support do-it-yourself home energy improvements by providing appropriate tools for home energy evaluation and improvement through Oakland's Tool Lending Library.



Increase the Use of Clean Energy

Even after conservation and significant improvements in energy efficiency, remaining energy consumption will need to be supported by more clean, renewable energy sources. In 2015, California extended its renewable portfolio standard (RPS), from 33% by 2020 to 50% by 2030. Oakland can go further toward achieving higher rates of renewable energy use through additional action to increase local renewable energy generation from solar, wind and other sources.

Objective: Achieve a minimum of 33% renewable energy on the electricity grid, along with new local renewable systems generating an additional 3% of Oakland's energy for buildings, by 2020

Action BE-28: Encourage and collaborate with local partners to launch a community solar program to increase local use of renewable energy, including solar-thermal energy to produce heat and hot water. *3-Year Priority, Resources Needed*

Action BE-29: Negotiate with PG&E to offer local green power options to Oakland customers. *Complete / Fully Underway*

Action BE-30: Continue to monitor the feasibility and utility of implementing community choice energy aggregation (CCA) in Oakland. *Complete / Fully Underway*

Action BE-31: Study potential local solar, wind, wave, combined heat and power, and anaerobic digestion opportunities, and develop strategic plans for increased clean energy use in Oakland.



Promote Water Conservation and Efficiency

The treatment and transport of water is energy and carbon intensive. By reducing potable water consumption, we can conserve a precious and limited resource, and reduce associated emissions from this activity. The City can continue collaborating with the EBMUD, StopWaste, and community organizations to promote water conservation and efficiency.

Objective: Reduce water use through water conservation and efficiency in buildings and infrastructure.

Action BE-32: Create an Oakland-specific Water Efficient Landscape Ordinance (WELO) to address water conservation. *Complete / Fully Underway*

Action BE-33: Expand promotion of water conservation and efficiency practices such as water-efficient landscaping and irrigation and lawn replacement. Continue promoting StopWaste publications titled “Bay Friendly Landscaping Guidelines: Sustainable Practices for the Landscape Professional” and “Bay Friendly Gardening: From Your Backyard to the Bay” through targeted outreach campaigns in partnership with local organizations.

Action BE-34: Participate in outreach campaigns by EBMUD, StopWaste, and others to encourage water monitoring, conservation, and efficiency by Oakland’s largest water consumers.

Action BE-35: Encourage the installation of rainwater harvesting through water collecting cisterns in new development to capture water during the rainy season for outdoor uses and/or indoor uses. *3-Year Priority, Resources Needed*

Action BE-36: Encourage the installation of rainwater and greywater systems where appropriate in accordance with State and local codes.

Action BE-37: Advocate for enhancing water metering practices (e.g., installation of smart meters, sub-meters for tenant-occupied spaces) to enable monitoring and evaluation of consumption patterns.

Action BE-38: Support the efforts of EBMUD to provide incentives and support to encourage water conservation and efficiency.

Action BE-39: Encourage the installation of water efficient fixtures and plumbing in private development, including products labeled under the EPA’s WaterSense program.

Action BE-40: Increase the amount of public space landscaped with drought-resistant plants and trees meeting Bay Friendly Landscaping Guidelines. *3-Year Priority, Resources Needed*

Action BE-41: Create standard operating procedures for installing water efficient fixtures and equipment in municipal buildings, landscapes, ballfields and swimming pools at regular replacement schedules, and proactively when cost-effective. *3-Year Priority, Resources Needed*



Optimize Energy Efficiency & Consumption in City Facilities

The City has built in energy efficiency or performed energy retrofits in over 100 of its largest buildings during the last twenty years. However, significant potential remains to reduce energy use and improve performance in existing City facilities.

Objective: Reduce GHG emissions from energy consumption in City buildings and streetlights by 36% by 2020, achieving 10% through conservation

Action BE-42: Enhance and implement standard operating procedures to improve energy conservation and efficiency in ongoing City facility operations. Require City facilities over a certain age to participate with the LEED O&M program.

3-Year Priority, Funded

Action BE-43: Modify the City's Civic Green Building Ordinance to increase energy efficiency standards for new construction and major renovation of City facilities. *Complete / Fully Underway*

Action BE-44: Perform energy efficiency upgrades to City facilities and operations. *3-Year Priority, Funded*

Action BE-45: Explore opportunities to install alternative energy technologies (e.g., via solar power purchase agreements) or purchase grid-based renewable energy for City facilities.

Action BE-46: Replace streetlights with energy-efficient advanced technology models in all appropriate locations during the course of normal technology replacement schedules. *Complete / Fully Underway*

Action BE-47: Develop and provide training to City employees on targeted energy and climate issues. *Complete / Fully Underway*

Material Consumption and Waste

Material production, consumption, and waste are major contributors to greenhouse gas emissions. In the City's 2013 consumption-based emissions inventory, emissions from this sector were shown to comprise 43% of the City's total emissions profile. The Oakland City Council adopted a Zero Waste goal in 2006, calling for a 90% reduction in waste sent to landfill by 2020. The City's Zero Waste Strategic Plan outlines strategies for meeting this goal, which prioritize "systems" solutions to reduce landfilled waste, and expand waste reduction, recycling, and composting programs. By pursuing the City's adopted Zero Waste strategies and addressing the entire lifecycle of consumption and waste, Oakland is creating GHG reductions on the same order of magnitude as those related to transportation and building energy use.



While many lifecycle emissions of consumption – GHG impacts associated with the manufacture, transport, use and disposal of material goods and food – do not occur within Oakland's geographic boundaries, consumption and disposal choices in Oakland can help to reduce GHG emissions across the globe.

A number of strategies are available through which the City can help to reduce GHG emissions associated with Material Consumption & Waste Reduction.

Key GHG Reduction Strategies:

- Expand and Improve Waste Reduction, Reuse, Recycling, and Composting
- Encourage Sustainable Consumption
- Promote Local Food

Achieving Oakland's adopted Zero Waste goal will require significant action in each of these areas.

The City can position Oakland to keep many more materials out of landfills by restructuring elements of Oakland's solid waste management system. This may include changes to Oakland's municipal code, garbage franchise agreement, residential recycling service contracts, and rate structure. Expanding and refining implementation of the City's Construction and Demolition Debris Recycling Ordinance can foster reuse and keep materials out of landfill. Other actions described in this section can also play important roles in reducing waste. All members of the community will need to make individual purchasing, consumption and disposal choices to help Oakland reach Zero Waste goals.

Material Consumption & Waste Goals:

- Achieve a 90% reduction (~375,000 tons) in waste sent to landfill by 2020
- Increase local food production

Strategies to Achieve 2020 Goals

Expand and Improve Waste Reduction, Reuse, Recycling, and Composting

Achieving Zero Waste will require expanded and improved waste reduction reuse, recycling, and composting systems. By structuring these systems to better reward behaviors that keep waste out of landfills, the City can foster significant GHG reductions associated with the lifecycle impacts of materials.

Objective: Reduce community-wide waste sent to landfill to 40,000 tons by 2020

Action MW-1: Restructure

Oakland's solid waste management system (municipal code, garbage franchise agreement, and residential recycling service contracts and rate structure) to provide comprehensive incentives for residents, businesses, and collection service providers to reduce waste and recycle more. These changes will help Oakland comply with statewide mandatory recycling requirements, including for multi-family residential properties. The outcome of this restructuring

exercise may recommend adjustments to the types of recycling, compost, and garbage services offered, collection frequency, and container sizes, and the implementation of mandatory recycling participation and/or disposal bans.

Complete / Fully Underway

Action MW-2: Refine implementation of Oakland's Construction and Demolition (C&D) Debris Recycling Ordinance to capture greater amounts of materials for reuse, recycling, and composting, and consider opportunities to expand the ordinance to include a broader range of projects with potential incentives for deconstruction and salvage. *Complete / Fully Underway*

Action MW-3: Require development and implementation of waste reduction and recycling plans for all large venues and public events. *Complete / Fully Underway*

Action MW-4: Enforce mandatory statewide and countywide bans on sale, use, or disposal of material types, and implement selected local bans. *Complete / Fully Underway*

Action MW-5: Conduct new residential social marketing campaigns and increased outreach to businesses and other institutions to improve the effectiveness of waste reduction and recycling programs. *Complete / Fully Underway*

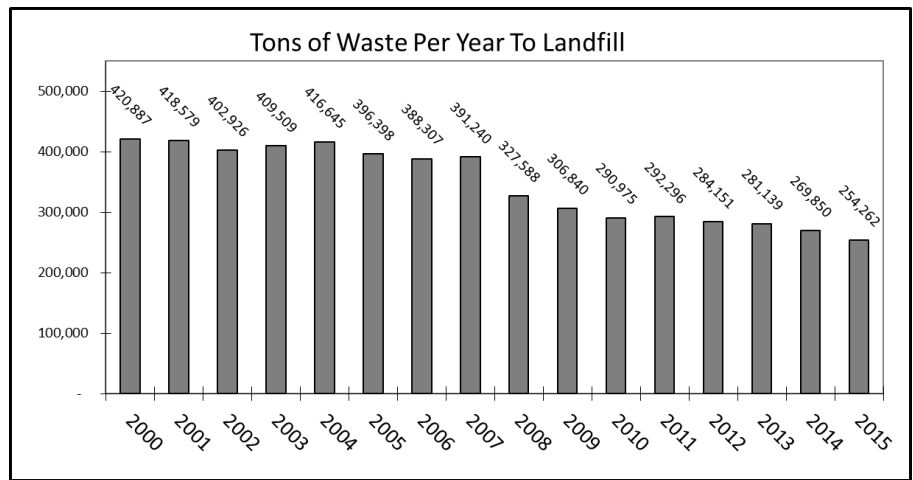
Action MW-6: Study options for advancing the next level of waste reduction activities to help achieve the City's adopted Zero Waste Goal, including consideration of commercial food scraps. *3-Year Priority, Resources Needed*

Action MW-7: Identify and retain sufficient industrially zoned lands through zoning and specific plans to support Zero Waste business development and infrastructure, and associated green jobs. Provide appropriate locations for new and existing recycling facilities.

Action MW-8: Adopt Zero Waste practices in City operations, facilities, capital improvement and maintenance practices.

Action MW-9: Require reporting on implementation of the City's Environmentally Preferable Purchasing Policy.

Figure 7. Oakland Citywide Waste Sent to Landfill



Action MW-10: Require reporting from state-recognized institutions in Oakland that are exempt from local waste reduction rules (e.g., public school systems, State/Federal offices, the Port, Oakland Housing Authority) to increase waste reduction and recycling at their facilities.

Action MW-11: Facilitate easier recycling of organic materials in multi-family buildings through revised design requirements.

Action MW-12: Promote Bay Friendly Landscaping practices to reduce excess plant debris from being sent to landfill and the need for nitrogen-based synthetic fertilizers.



Encourage Sustainable Consumption

Achieving Zero Waste begins with purchasing and material consumption choices that reduce the potential for waste generation, and that minimize the carbon-intensive processes that go into material extraction, manufacturing, and transporting of goods in the first place. By placing emphasis on reuse and repair opportunities, and purchasing new materials only when necessary, it is possible to reduce upstream GHG impacts associated with the manufacture and transport of goods, as well as downstream impact such as landfill gas creation.

Objective: Support Oakland's waste reduction goals through sustainable consumption practices

Action MW-13: Promote reduction of product waste and better management of hard-to-recycle and toxic products through producer responsibility. Support statewide producer responsibility legislation. Support the creation of convenient and cost-effective product take-back opportunities for the public through existing retail distribution systems. *3-Year Priority, Resources Needed*

Action MW-14: Promote members of the Alameda County Green Business Program and support program efforts to expand to include additional business types.

Action MW-15: Foster local reuse and repair opportunities, including through expanded community outreach efforts promoting re-use of buildings and materials, and “buy local” programs focusing on goods made from recycled materials. *3-Year Priority, Resources Needed*

Action MW-16: Encourage businesses capable of manufacturing needed products from existing waste streams and businesses utilizing low impact packaging techniques to locate in Oakland.

Promote Local Food

Globally, up to 32% of GHG emissions are related to food system activities including production, transportation, processing, and storage. A low-carbon food system emphasizes food that is produced with efficient use of resources, and food that is produced, processed and distributed near where it is consumed. Significant opportunities to reduce GHG emissions associated with the food system exist in decreasing consumption of meat and foods grown with intensive use of manufactured fertilizers. A local food system can help to reduce transportation-related GHG emissions and upstream use of GHG-intensive fertilizers, while creating local green jobs and strengthening the local economy.



The City recognizes that local food production can also create adverse impacts related to issues such as noise, trucking, lighting, odors, and air quality. Efforts to expand local food production should include consideration of both beneficial and adverse potential impacts.

Oakland is home to a range of innovative food system initiatives, including the Oakland Food Policy Council (OFPC). The OFPC was launched in 2009 to develop recommendations to support the development of Oakland's local food sector and increase community access to healthy foods. The City has an opportunity to promote, integrate, and build upon existing local food initiatives distinguishing Oakland.

Objective: Increase opportunities for urban agriculture in Oakland

Foster More Local Food Production

Action MW-17: Develop regulations that allow for the use of urban land for food production. *Complete / Fully Underway*

Action MW-18: Encourage local utilities, public agencies and other large land owners to offer commercial leases to local organizations for local food production and/or foraging. *3-Year Priority, Funded*

Action MW-19: Evaluate the potential of creating additional community gardens on City-controlled public land.

Action MW-20: Encourage the inclusion of food-producing gardens, including rooftop gardens, in private development where appropriate, with consideration of Bay Friendly principles.

Action MW-21: Provide information maintained by the City on brownfield sites to members of the public interested in exploring the potential for urban agriculture.

Action MW-22: Promote the efforts of local organizations that provide training on gardening and composting.

Action MW-23: Provide a portion of compost generated through the City's residential recycling program back to the community.

Action MW-24: Include a preference for inclusion of community gardens and sustainable local food production in evaluating applications for City funds and contracts.

Action MW-25: Encourage partnerships among private and non-profit sector organizations to create shared commercial kitchens in underserved areas of Oakland to stimulate local food microenterprises.



Develop Markets for Local Food

Action MW-26: Integrate consideration of local food procurement and food related impacts into processes for selecting food for City sponsored events and contracts.

Action MW-27: Work with partners to add consideration of local food procurement and food related impacts to green business certification criteria.

Action MW-28: Encourage efforts of local organizations to promote local food procurement and consideration of food related impacts to the community, focusing on large employers and other targeted venues.

Action MW-29: Advance economic development strategies that promote sustainable food production in Oakland.

Action MW-30: Review and align permit and other requirements for farmers markets, community supported agriculture programs and other local food distribution efforts.

Community Engagement

Oakland's success in meeting its GHG reduction goals will ultimately depend largely on the day-to-day decisions of all members of the Oakland community, including residents, businesses, and other institutions.

The City has an important role to play in educating and motivating all members of the Oakland community to join in the effort to reduce energy use and GHG emissions. By leveraging its leadership and existing communication channels, the City will help to spur the high levels of community participation needed to solve these challenges, and provide opportunities for new ideas from the community to further strengthen local efforts. In addition, the City will monitor and report on Oakland's progress in reducing energy use and GHG emissions, and promote local examples of leadership throughout the community.



The City can implement a number of strategies to engage the community to increase citywide climate action.

Key GHG Reduction Strategies:

- Encourage Community Energy and Climate Action
- Create New Opportunities for Community Engagement
- Track and Promote Community Action

Achieving Oakland's GHG reduction goals across Transportation & Land Use, Building Energy Use, and Material Consumption & Waste will require significant action in each of these areas. By collaborating with local organizations, the City can help to motivate local action that will be needed to reduce driving citywide by 20%, retrofit 30% of Oakland's housing stock with energy improvements, enroll 30% of businesses in local energy efficiency programs, and reduce waste sent to landfill by 90% by 2020. Actions to reach these goals can in turn help to create new local green job opportunities for Oakland residents.

Local organizations, including community-based organizations, business, labor, educational institutions, and others, can educate, motivate, and empower the Oakland community to participate in and benefit from local climate action. As champions connected throughout the Oakland community, these organizations can help to build a movement around local climate action.

Community Engagement Strategies

Encourage Community Energy and Climate Action

Working in collaboration with local organizations, the City can help to educate and motivate all members of the Oakland community to take individual action on energy and climate issues.

Action CE-1: Expand the City’s website, Green Building Resource Center, and other outreach channels to report annually on Oakland’s progress in reducing energy use and GHG emissions and provide more comprehensive and action-oriented information regarding opportunities to reduce energy use and GHG emissions. *3-Year Priority, Funded*

Action CE-2: Partner with community-based organizations, neighborhood associations, business associations, and others to promote local climate action throughout the community through new and traditional channels. *3-Year Priority, Funded*

Action CE-3: Develop and distribute a community climate action guide and targeted educational materials in collaboration with local organizations to inspire all members of the Oakland community to take action to reduce GHG emissions. *3-Year Priority, Resources Needed*

Action CE-4: Provide support to local organizations to convene neighborhood-scale or issue-based community climate action workshops. *3-Year Priority, Resources Needed*

Action CE-5: Create citywide and neighborhood scale opt in electronic listservs and other information sharing opportunities focused on targeted climate protection topics (e.g., community gardening, installing rooftop solar) to help interested residents and other parties connect with each other, share wisdom, etc.

Action CE-6: Promote climate-related volunteer events throughout the community in partnership with local organizations.

Action CE-7: Create a community climate challenge campaign and work with local business partners to identify and provide incentives for participation and achievement.

Action CE-8: Encourage OUSD and other organizations to provide educational opportunities on energy and climate issues to local youth, and to integrate energy and climate action within operational practices where possible (e.g., safe routes to school and green schools programs). *3-Year Priority, Funded*

Action CE-9: Engage the local philanthropic community to provide support for model projects with potential for replication throughout the community, especially in areas with the least resources and/or least engagement in local climate actions.



Create New Opportunities for Community Engagement

The City will provide ongoing opportunities for new community ideas on energy and climate action to further strengthen local efforts.

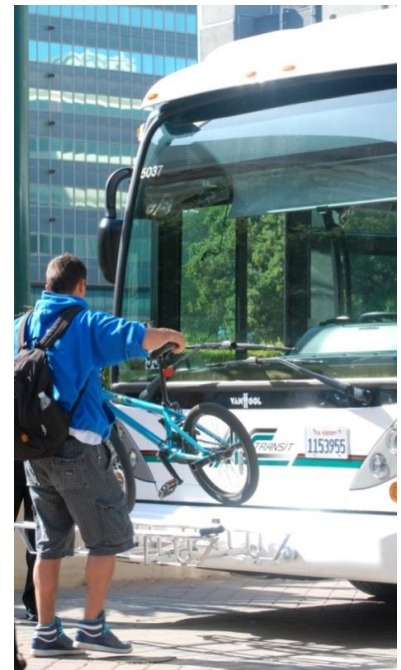
Action CE-10: Convene community climate forums to provide informal opportunities for members of the public and local community organizations to learn about local climate protection progress and opportunities, network, and provide suggestions. *3-Year Priority, Funded*

Action CE-11: Establish and highlight opportunities for members of the community to provide suggestions to City staff and policy makers regarding how the City can further augment its climate protection efforts through adjustments to local planning, policies and programs. *3-Year Priority, Resources Needed*

Action CE-12: Provide information through local organizations, community information channels, and the City’s website to assist the Oakland community in identifying opportunities to advance local climate action through planned updates to City planning documents, policies, and programs.

Action CE-13: Include content in regular community surveys conducted by the City to help inform future energy and climate action planning decisions, and engage local partners in additional surveying efforts where appropriate.

Action CE-14: Engage the community in visioning Oakland in 2050 to help identify steps toward achieving significant GHG reductions in the process of realizing that vision.



Track and Promote Community Action

The City will monitor and report on Oakland’s progress in reducing energy use and GHG emissions, and promote local examples of model practices throughout the community.

Action CE-16: Develop a local climate action model practices campaign collaborating with local organizations to document and promote examples of local climate actions to the community. *3-Year Priority, Resources Needed*

Action CE-17: Expand energy and climate content on the City’s website and other outreach tools to track progress and promote the GHG reduction achievements of the City and the Oakland community, as well as tools to support local action and opportunities to get involved. *3-Year Priority, Funded*

Action CE-18: Create a community climate leaders recognition program and promote model actions and performance through an annual recognition program.

Action CE-19: Promote green community events throughout the city.

Develop the Local Green Workforce to Support Local Green Businesses

The emerging green economy will continue to create new demand for trained professionals capable of delivering work such as building energy retrofits, development of bikeways, product repair, installation of solar panels, and construction debris collection for reuse. Oakland has an opportunity to build on its investment in local green jobs training programs to develop a local green workforce while providing employment opportunities for disadvantaged residents.

Objective: Train workers for new green jobs to support energy and climate actions

Action CE-20: Engage with local green jobs training providers to coordinate strategic planning and encourage programs to develop local workforce capacity and assess, train, and place local residents in jobs to perform energy retrofits and other green improvements. *3-Year Priority, Funded*

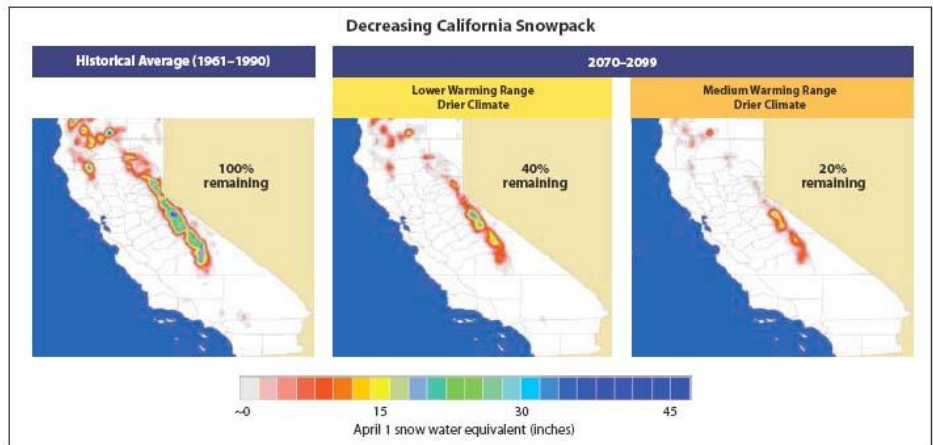
Action CE-21: Facilitate the hiring of green jobs program graduates through promotion and subsidized internship placement with local employers.

Action CE-22: Work with local partners to develop a community green jobs electronic bulletin board promoting local green job opportunities.



Adapting and Increasing Resilience to Climate Change

Some impacts of climate change are readily observed, while others remain likely to be part of Oakland's future. Additional impacts projected to occur during this century have the potential to significantly affect our community. In addition to taking action to reduce GHG emissions that cause climate change, Oakland must take simultaneous action to adapt to unavoidable local climate impacts.



Source: State Climate Action Team Report

Oakland is a large and diverse community; climate impacts will be experienced in many areas. Due to its location, Oakland is vulnerable to a number of climate impacts, including sea level rise, reductions in water supply due to shrinking snowpack in the Sierra Mountains, wildfires, extreme heat, flooding, added stress on infrastructure, ecological impacts, and other potential pricing and quality of life impacts. For example, a set of climate scenarios prepared for the California Energy Commission project that mean sea level along the California coast could rise by as much as 4.5 feet by 2100.^{xv} Many low-elevation areas of Oakland would be vulnerable to flood events under these scenarios.^{xvi} 2017 Reports from the State of California Ocean Protection Council present scenarios in which water levels in San Francisco Bay could rise by up to 10 feet by 2100, due to increased rates of ice melting in the Arctic and Greenland. While scenario projections continue to be refined with more data and measurements, it is clear that action is required to minimize Oakland's contribution to climate change, and to prepare for additional impacts that will impact the community and its people.

Key Adaptation Strategies:

- Study Potential Local Climate Impacts
- Communicate Climate Impacts to the Community
- Identify and Act on Opportunities to Improve Resilience

Adapting to future climate impacts will likely require significant action in each of these areas. Some adaptation measures, such as water conservation and urban forestry, can serve to minimize existing vulnerabilities and provide social, economic and environmental benefits regardless of the extent of potential climate impacts. A number of these actions also create mitigation benefits (e.g., water efficiency reduces energy needed to provide and treat water, urban trees reduce heat island effect and associated building cooling needs) and have been discussed elsewhere in the ECAP. Other adaptation measures can be more capital-intensive, including:

- Protecting and restoring Oakland's creeks and estuary;
- Upgrading sewer and stormwater infrastructure to accommodate sea-level rise and increased stormwater volumes;
- Augmenting water supply with seawater desalination;
- Armoring the coast against sea-level rise through levees and seawalls; and,
- Updating peak electrical transmission capacity for summer cooling to help reduce human health impacts.

The City will continue to develop its internal capacity around these issues and will work with local partners to explore adaptation strategies concurrently with efforts to reduce GHG emissions to ensure that climate impacts are minimized.

Strategies to Achieve 2020 Goals

Study Potential Local Climate Impacts

The first step in addressing climate adaptation is to study projected climate impacts and develop an understanding of how those impacts may affect important local issues such as land use, infrastructure, public health, the local economy and other quality of life issues. Opportunities exist to leverage the work of local partners and State agencies that have begun to study these impacts.

Action AD-1: Participate in discussions on climate adaptation and resilience issues with local governments and other experts. *3-Year Priority, Funded*

Action AD-2: Conduct a study of all local climate impacts in collaboration with local partners including the Bay Conservation and Development Commission, the Pacific Institute, and UC Berkeley. *3-Year Priority, Resources Needed*

Communicate Climate Impacts to the Community

As projected climate impacts are better understood, it is increasingly important to educate the Oakland community about these impacts to lay the foundation for public discussion of future planning decisions and adaptation strategies. Developing a greater shared understanding of potential impacts will be critical to generating the will for personal and collective action that may be needed to implement future adaptation strategies.

Action AD-3: Communicate information about local climate impacts to the Oakland community to develop shared understanding, the will for personal and collective action, and local capacity to participate in the development of climate adaptation strategies. *3-Year Priority, Resources Needed*



Figure 10. Projected area in danger of 100-year flood event based on 4.5 foot sea level rise. Courtesy of Pacific Institute

Identify and Act on Opportunities to Improve Resilience

Taking action to adapt to projected climate impacts will help to increase community resilience in Oakland, minimize vulnerabilities, and encourage sustainable development.

Action AD-4: Integrate climate adaptation strategies into City planning and policy documents and processes where appropriate. *3-Year Priority, Resources Needed*

Action AD-5: Update community emergency preparedness and recovery plans, infrastructure (e.g., consider community cooling centers), and communication networks as appropriate based on projected climate impact scenarios with consideration for vulnerable communities.

Action AD-6: Encourage and participate actively in efforts of regional partners including BCDC to engage in the development of a regional climate adaptation strategy informed by climate impact modeling, scenario analysis and development of adaptation strategies to advance regional climate adaptation capacity and resilience. Collaborate with local partners to ensure that the actions (e.g., construction of sea walls) of neighboring jurisdictions or other agencies do not indirectly exacerbate impacts to Oakland neighborhoods. *3-Year Priority, Resources Needed*

Action AD-7: Develop a climate adaptation plan for Oakland identifying strategies to improve community resilience to climate change in collaboration with State, regional and local stakeholders. *3-Year Priority, Resources Needed*

Action AD-8: Update planning documents and building codes to include requirements for high albedo (reflective) surfaces where possible (e.g., rooftops, pavement) to reduce the urban heat island effect and mitigate public health impacts of extreme heat events. *3-Year Priority, Funded*

Action AD-9: Promote the development of Oakland's urban forest (see pages PA 38, page 46). *3-Year Priority, Resources Needed*

Action AD-10: Promote indoor and outdoor water conservation and efficiency (see page 100). *3-Year Priority, Resources Needed*

Action AD-11: Promote measures to reduce the impact of flood events by encouraging stormwater catchment and diversion through use of rain barrels, bio-swales, permeable surfaces, and green roofs. *3-Year Priority, Resources Needed*

Action AD-12: Encourage the efforts of the East Bay Municipal Utility District to develop infrastructure to deliver recycled water to Oakland properties for appropriate uses, reducing dependence on external water supplies. *3-Year Priority, Resources Needed*

Action AD-13: Consider opportunities to raise revenue to support local climate impact modeling and planning at the local or regional level (e.g., water use fees, development impact fees).

Action AD-14: Provide training for City staff on projected climate impacts, vulnerability issues, and adaptation strategies. *3-Year Priority, Funded*

Action AD-15: Explore how the City can achieve dedicated land for urban agriculture within Oakland city limits.

Advocacy Recommendations

Achieving Oakland’s GHG reduction goals requires ongoing climate action at all levels by multiple partners. These include Federal, State and County government; regional agencies such as the Association of Bay Area Governments (ABAG), Metropolitan Transportation Commission (MTC), Bay Area Air Quality Management District (Air District), Bay Conservation and Development Commission (BCDC), Joint Policy Committee (JPC), and StopWaste.Org; and other partners such as the California Public Utilities Commission (CPUC), Pacific Gas & Electric (PG&E) and the East Bay Municipal Utility District (EBMUD). Energy and climate are gaining attention from each of these organizations.

Many actions that can help to reduce energy use and GHG emissions in Oakland would be most efficiently, effectively and appropriately implemented at a regional or State level by these partners. Local governments will continue to lack the resources to solve the climate challenge without policy, financial and other support from these partners. The City will seek to advocate for further action by these agencies that will help achieve Oakland’s GHG reduction goals. Examples of advocacy opportunities include:

Transportation and Land Use

- Increasing funding for local transit projects, and prioritizing transit relative to highway projects (MTC, State, Federal govt)
- Adopting indirect source rules to place fees on new development to support low carbon transportation (CARB)
- Imposing new revenue generating fees (e.g., gas tax, mileage tax) to fund regional transit upgrades (JPC, MTC, Air District)
- Developing better models to help local and regional planners quantify GHG impacts of land use and transportation scenarios (State, MTC, ABAG, CARB)
- Providing support for infrastructure upgrades needed to absorb additional development in urban areas (Federal govt, State, CPUC, ABAG)
- Requiring Port tenants to implement actions at Oakland’s ports in demonstrating compliance with statewide fleet emissions reduction targets (e.g., through electrification of docked vessels) (Federal govt, State)
- Providing support and requiring monitoring devices to reduce idling in trucks serving the Port (CARB)
- Placing a moratorium on regional freeway capacity expansion (State, Federal govt)
- Enforcing speed limits and anti-idling rules (State, CARB)

Building Energy Use

- Increasing the percentage of grid electricity that must be supplied from renewable energy sources, including applying this to all direct access contracts (State, CPUC)
- Improving feed-in tariff and net metering policies (e.g., single solar power systems serving multiple tenants) (State, CPUC)
- Increasing investment in developing advanced renewable energy technologies (Federal govt, State)
- Requiring utilities to offer on-bill financing programs, either directly or through third-party collaborations (State, CPUC)
- Authorizing utilities to provide better data to local governments for energy program strategic planning (State, CPUC)
- Revising California’s Building Energy Efficiency Standards to continue progress to zero net energy construction (State)
- Continuing an effective and equitable cap-and-trade system for reducing GHG emissions (State, Federal govt)

Material Consumption and Waste Reduction

- Imposing revenue generating fees (e.g., on GHG-intensive or non-durable goods) to support GHG reductions (State, JPC)
- Requiring manufacturer product responsibility for reducing product waste and problem materials (State)
- Requiring mandatory product impact labeling, commercial recycling and other waste reduction measures (State)
- Conducting regional social marketing campaigns to increase recycling and waste reduction (StopWaste.Org)

Adaptation and Resilience

- Advancing climate impacts modeling and developing local climate adaptation strategies (State, BCDC)

City of Oakland

Energy and Climate Action Plan

Appendix

This appendix contains supporting information related to the Energy and Climate Action Plan for Oakland, California.

Contents

Developing the Oakland Energy and Climate Action Plan.....	116
Oakland’s 2005 Energy Use and Greenhouse Gas Emissions	121
Oakland’s GHG Reduction Target.....	128
Achieving Oakland's 36% GHG Reduction Target.....	136
Glossary	137

Updates and Additional Information:

www.sustainableoakland.com

Developing the Oakland Energy and Climate Action Plan

Oakland has a long legacy of leadership on reducing energy use and greenhouse gas (GHG) emissions. Through the Oakland Energy and Climate Action Plan (ECAP), the City of Oakland (City) is developing a comprehensive, prioritized plan of action to enable Oakland to achieve aggressive and important GHG emissions reduction targets.



Development of the ECAP began in fall 2008 with the first of several public workshops held to gather community ideas on potential climate targets, actions, and the process to be used for developing the ECAP. Approximately 200 people attended these workshops, representing a variety of interests, including local nonprofit and advocacy organizations, government agencies, utilities, interest groups, private companies, and individual citizens.

The first two workshops (held in December 2008 and January 2009) provided an overview of the planned ECAP development process, gathered initial input on potential ways of reducing GHG emissions, and discussed issues to consider in the process of developing the ECAP. With assistance from ICLEI – Local Governments for Sustainability and CirclePoint, Inc., staff used input gathered at the workshops to identify and evaluate potential greenhouse gas (GHG) emissions reduction targets, and strategies for hitting those targets.

The next two workshops (held in April 2009) were used to gather input on target setting and GHG reduction actions to evaluate for potential inclusion in the ECAP. Input from these workshops also helped to inform the ECAP development process and the evaluative criteria used in considering actions for inclusion in the ECAP. Information from all four of these workshops, along with other project information, has been posted to the City's website at www.sustainableoakland.com. Additional public input was also gathered through this website, and at other meetings.

On July 7, 2009, the Oakland City Council directed staff to develop the ECAP using a preliminary planning target equivalent to achieving a 36% reduction from 2005 GHG emissions by 2020, and annual benchmarks for meeting the target. The target-setting staff report and accompanying City Council resolution are available on the City's website.

From summer 2009 through spring 2010, the City continued to identify and analyze potential GHG reduction actions through which the City could position Oakland to achieve a 36% reduction in GHG emissions. Ideas for GHG reduction actions were gathered from public input, existing City policy documents, adopted climate action plans from other jurisdictions, and various other sources (e.g., Oil Independent Oakland Action Plan, The 21st Century Energy Greenprint for the East Bay). The evaluative criteria outlined in Table 1 were used to inspire ideas for GHG reduction opportunities and to evaluate potential actions to help guide future planning and budgeting discussions. These nine evaluative criteria capture the range of issues expressed by the community at the first four public workshops held between December 2008 and April 2009. Based on this analysis, staff developed recommendations for a prioritized set of GHG reduction actions best suited to helping the City advance Oakland's GHG reduction efforts and achieve the identified target.

Following a special City Council workshop on energy and climate action issues, the first Draft Energy and Climate Action Plan was released on April 22nd, 2010 (Earth Day). Two more public workshops were held in May 2010 to provide an overview of the ECAP and gather community input. Public comments were also

accepted for several weeks via the City’s website. Local organizations helped to spread the word about the ECAP and to generate public review and comment.

From summer 2010 through fall 2010, staff proceeded to consider public input received about opportunities to improve the ECAP. A revised ECAP, accompanied by this appendix, was then developed for consideration of the Oakland City Council.

Table 1. Evaluative Criteria for Considering Potential Energy and Climate Actions

Evaluative Criteria	Issues to Consider
GHG Reduction Potential	<ul style="list-style-type: none"> • Magnitude of GHG reductions • Measurability of reductions
Implementation Cost and Access to Funding	<ul style="list-style-type: none"> • Cost to City budget • Cost to other stakeholders • Access to funding
Financial Rate of Return	<ul style="list-style-type: none"> • Return on investment to City and/or stakeholders implementing the action • Protection from future costs
GHG Reduction Cost Effectiveness	<ul style="list-style-type: none"> • Relative cost/benefit assessment in terms of estimated GHG reductions
Economic Development Potential	<ul style="list-style-type: none"> • Job creation potential • Business development and retention potential • Workforce development potential • Cost savings to community • Education benefits for community
Creation of Significant Social Equity Benefits	<ul style="list-style-type: none"> • Benefits to disadvantaged residents in the form of jobs, cost savings, and other opportunities • Reduction of pollution in heavily impacted neighborhoods • Equity in protection from impacts of climate change
Feasibility & Speed of Implementation	<ul style="list-style-type: none"> • Degree of City control to implement the action • Level of staff effort required • Resources required • Degree of stakeholder support • Amount of time needed to complete implementation • Time period during which implementation can begin
Leveraging Partnerships	<ul style="list-style-type: none"> • Leverage partnerships with community stakeholders • Leverage partnerships on a regional, state or national level • Facilitate replication in other communities
Longevity of Benefits	<ul style="list-style-type: none"> • Persistence of benefits over time • Opportunity to support future additional benefits



2017-18 ECAP Update

Beginning in 2016, staff initiated an update to the ECAP, consistent with the direction provided in Chapter 1. This Update included targeted engagement and outreach to community groups, as well as staff level review of the progress in implementing the 175 Action Items in the Plan. The Update was completed in 2017, and included changes based on progress in implementing actions, new technologies that may render some strategies obsolete and others newly feasible, changing community prioritization, and the identification of new resources to support particular actions.

Table 2. Changes in Priority Action Status in the 2017-18 ECAP Update

2012 Priority Action Designation	ID	Description	2017 Designation / Status
			<div>  = Supported by Existing Resources  = Requiring New Resources </div>
PA 1	TLU-6	Identify and Adopt Priority Development Areas	Complete
PA 2	TLU-13	Launch and Develop a Funding Plan for the Downtown Shuttle	PA 1
PA 3	TLU-14	Advance Bus Rapid Transit in Oakland	PA 2
PA 4	TLU-1	Participate in Quarterly SB 375 Discussions	Fully Underway
PA 5	TLU-38	Call for Port of Oakland GHG Reduction Targets and Plans	Fully Underway
PA 6	TLU-39	Call for Climate Action by Port Tenants	PA 23
PA 7	BE-1 & BE-3	Adopt a Green Building Ordinance for Private Development	Complete
PA 8	BE-4	Offer Property-Based Energy Financing	Complete
PA 9	BE-12	Launch a Downtown Commercial Retrofit Program	Complete
PA 10	BE-13	Encourage Participation in Local Energy Efficiency Programs	Fully Underway
PA 11	BE-21	Launch a Residential Green Retrofit Program	PA 5
PA 12	BE-22	Conduct a Multi-family Affordable Housing Retrofit Pilot	Fully Underway
PA 13	BE-23	Expand Weatherization Program Delivery	Complete
PA 14	BE-23	Launch the Weatherization and Energy Retrofit Loan Program	PA 34
PA 15	BE-32	Create an Oakland-Specific Water-Efficient Landscaping Ordinance	Fully Underway
PA 16	BE-42	Implement Advanced Operating Procedures for City Facilities	PA 6
PA 17	BE-43	Improve Energy Performance of New City Facilities	Fully Underway
PA 18	BE-44	Retrofit City Facilities to Improve Energy Performance	PA 7
PA 19	MW-1	Restructure Solid Waste Management System	Complete
PA 20	MW-2	Refine Implementation of C&D Recycling Ordinance	Fully Underway
PA 21	MW-3	Promote Waste Reduction at Community Events	Fully Underway
PA 22	MW-17	Develop Regulations Enabling Urban Food Production	Complete
PA 23	MW-18	Encourage Land Owners to Lease Space for Food Production	PA 8
PA 24	CE-1	Provide Additional Information on Energy and Climate Issues through Existing City Channels	PA 9 (merged with CE-15 and CE-17)
PA 25	CE-2	Expand Outreach on Energy and Climate Issues through Partnerships with Local Organizations	PA 10
PA 26	CE-10	Convene Community Climate Forums	PA 12
PA 27	CE-15	Report on Energy and GHG Reduction Progress	PA 9 (merged with CE-1 and CE-17)
PA 28	CE-20	Support Local Green Jobs Programs	PA 13
PA 29	AD-1	Participate in Regional Climate Adaptation Discussions	PA 14
PA 30	TLU-2	Develop a Comprehensive Transportation Policy Plan	Fully Underway
PA 31	TLU-3	Improve Transportation & Land Planning Integration in Every Planning Effort	Fully Underway
PA 32	TLU-7	Create and Adopt a Transportation Impact Fee to Support Implementation	Complete
PA 33	TLU-15	Update Local CEQA Standards to Reduce Emphasis on Congestion Impacts	Complete
PA 34	TLU-16	Accelerate Completion of Bicycle and Pedestrian Plans	PA 18
PA 35	TLU-28	Establish Alternative Mechanisms for Meeting Parking Requirements	PA 3
PA 36	TLU-29	Conduct a Citywide Dynamic Parking Pricing Study	Fully Underway

2012 Priority Action Designation	ID	Description	2017 Designation / Status
			<div>  = Supported by Existing Resources  = Requiring New Resources </div>
PA 37	TLU-33	Plan for Electric Vehicle Infrastructure	PA 4
PA 38	TLU-45	Develop an Urban Forestry Master Plan	PA 24
PA 39	TLU-52	Accelerate City Fleet Vehicle Replacement	PA 28
PA 40	TLU-53	Subsidize Transit and Transportation Alternatives for City Employees	PA 29
PA 41	TLU-54	Discontinue Subsidizing Parking for City Employees	Complete
PA 42	BE-14	Engage Largest Electricity Consumers in Energy Retrofits	PA 32
PA 43	BE-13	Market Energy Retrofit Opportunities to All Oakland Businesses	Fully Underway
PA 44	BE-24	Create a Renter-Occupied Residential Energy Retrofit Program	PA 35
PA 45	BE-25	Adopt and Implement a Residential Energy Conservation Ordinance	PA 36
PA 46	BE-15	Consider Energy Benchmarking Requirements for Commercial Buildings	PA 33 (merged with BE-16)
PA 47	BE-5	Encourage the Creation of On-Bill Financing for Energy Retrofits	Complete
PA 48	BE-6	Seek Resources to Support Energy Programs	PA 30
PA 49	BE-7	Encourage Citywide Energy Conservation and Efficient Product Purchasing	PA 31
PA 50	BE-28	Facilitate Community Solar Programs	PA 37
PA 51	BE-29	Encourage PG&E to Offer Green Power Options	Complete
PA 52	BE-30	Monitor Community Choice Energy	Complete
PA 53	MW-4	Enforce Mandatory Recycling	Fully Underway
PA 54	MW-5	Conduct Zero Waste Residential Social Marketing Campaigns and Business Outreach	Fully Underway
PA 55	MW-6	Study Options for Advancing Next-Level Waste Reduction	PA 41
PA 56	CE-16	Develop an Oakland Climate Action Model Practices Campaign	PA 47
PA 57	CE-3	Community Climate Action Guide	PA 44
PA 58	CE-4	Support Local Climate Workshops	PA 45
PA 59	AD-2	Study Potential Local Climate Impacts	PA 48
PA 60	AD-3	Communicate Climate Impacts to the Community	PA 49
PA 61	AD-4	Identify and Act on Opportunities to Improve Resilience in City Plans and Policies	PA 50
	TLU-9	Increase Multi-Income Housing near Transit Hubs	PA 17
	TLU-11	Increase Density near Transit to Improve Livability	Fully Underway
	TLU-17	Optimize Street Design to Support Transit, Bicycling, and Walking	PA 19
	TLU-19	Expand and Enhance Public Transit Service and Amenities	PA 20
	TLU-23	Promote Bicycle Safety Training, Transit System Use, and Other Non-Auto Transportation	Fully Underway
	TLU-24	Encourage the Creation of Local Bike Sharing Programs	Fully Underway
	TLU-25	Expand Car Sharing	PA 21
	TLU-30	Impose Parking Maximums and Develop Strategies to Minimize Parking Need	PA 22
	TLU-46	Conduct a Robust Urban Tree Inventory	PA 25
	TLU-47	Update City Tree Ordinances	PA 26

2012 Priority Action Designation	ID	Description	2017 Designation / Status
			<div>  = Supported by Existing Resources  = Requiring New Resources </div>
	TLU-48	Implement Street Tree Planting Pilot	PA 27
	BE-16	Consider Energy Benchmarking Requirements for Commercial Buildings	PA 33 (merged with BE-15)
	BE-35	Encourage Rainwater Harvesting	PA 38
	BE-40	Increase Public Landscaping with Drought-Resistant Plants and Trees	PA 39
	BE-41	Install water Efficient Fixtures and Equipment in Municipal Facilities	PA 40
	BE-46	Upgrade to Energy-Efficient Streetlights	Complete
	BE-47	Provide City Employee Staff Training on Climate Issues.	Fully Underway
	MW-13	Promote Waste Reduction through Enhanced Producer Responsibility	PA 42
	MW-15	Encourage Local Reuse and Repair	PA 43
	CE-8	Promote Climate-Related Educational Opportunities	PA 11
	CE-11	Facilitate Community Input on Climate Issues	PA 46
	CE-17	Provide Additional Information on Energy and Climate Issues Including Energy and GHG Reduction Progress through Existing City Channels	PA 9 (merged with CE-1 and CE-15)
	AD-6	Participate in Development of a Regional Climate Adaptation Strategy	PA 51
	AD-7	Develop a Resilience-Based Climate Adaptation Plan	PA 52
	AD-8	Include Measures to Reduce the Urban Heat Island Effect in Planning Documents	PA 15
	AD-9	Promote the Development of Oakland's Urban Forest	PA 53
	AD-10	Promote Water Conservation and Efficiency	PA 54
	AD-11	Promote Measures to Reduce the Impact of Floods	PA 55
	AD-12	Encourage Recycled Water Delivery and Use	PA 56
	AD-14	Provide Staff Training on Climate Impacts and Adaptation	PA 16

Oakland's Greenhouse Gas Emissions

GHG Emissions Baseline and Inventory Frequency

In 2009, City Council adopted Resolution No. 82129 C.M.S., establishing GHG reduction targets for Oakland, and establishing 2005 as the baseline year for comparisons. While many cities across California and around the world inventory their GHG emissions and monitor progress towards a reduction goal, the baseline year for comparison varies widely. Most American cities have established a baseline year between 1990 and 2005. This is important to consider when comparing GHG reductions among cities.

The GHG Emissions Inventory approach has evolved since the City's first inventory, created in 2009 and evaluating the baseline year 2005 emissions. The City has completed inventories for the years 2005, 2010, and 2013, and intends to create inventories for each odd numbered year going forward. The inventory of 2015 emissions is expected to be completed in 2017. It is important to note that it typically takes 12-18 months for sufficient information to become available to complete an inventory, hence the two-year delay from the time period evaluated and the year in which an inventory is conducted.

Approach to Calculating Oakland's Greenhouse Gas Emissions

The traditional method for calculating emissions associated with a City is to aggregate all emissions associated with activities within the boundaries of the City, usually referred to as an in-boundary or core emissions analysis. This approach is defined in protocols established by ICLEI – Local Governments for Sustainability, and serves to ensure that cities create inventories that can be compared to one another. Its strengths include a well understood and developed methodology for how to conduct the analysis, tools that can accurately measure emissions, and reporting standards to ensure that information is shared both nationally and internationally.

By contrast, leading edge cities are beginning to conduct emissions inventories using a consumption model, referred to as Consumption-Based Emissions Inventories (CBEIs) or lifecycle emissions analysis. This approach seeks to quantify the total emissions associated with the Oakland residents and businesses, regardless of where the emissions occur. A convenient way to understand the difference between these approaches is to consider a person driving 10 miles in Oakland. A core inventory would include only the emissions associated with the use of gasoline for 10 miles. A consumption inventory would also include the emissions associated with the extraction, refinement, and transport of that gasoline to Oakland, as well as a percentage of the emissions associated with the manufacture of the vehicle. The benefit of a consumption inventory is that it more accurately characterizes the emissions for which Oakland is responsible, and offers a more information on which to base policy decisions to reduce the carbon footprint of the community. On average, consumption based inventories document 2.5 to 3.0 times the emissions of a core inventory.

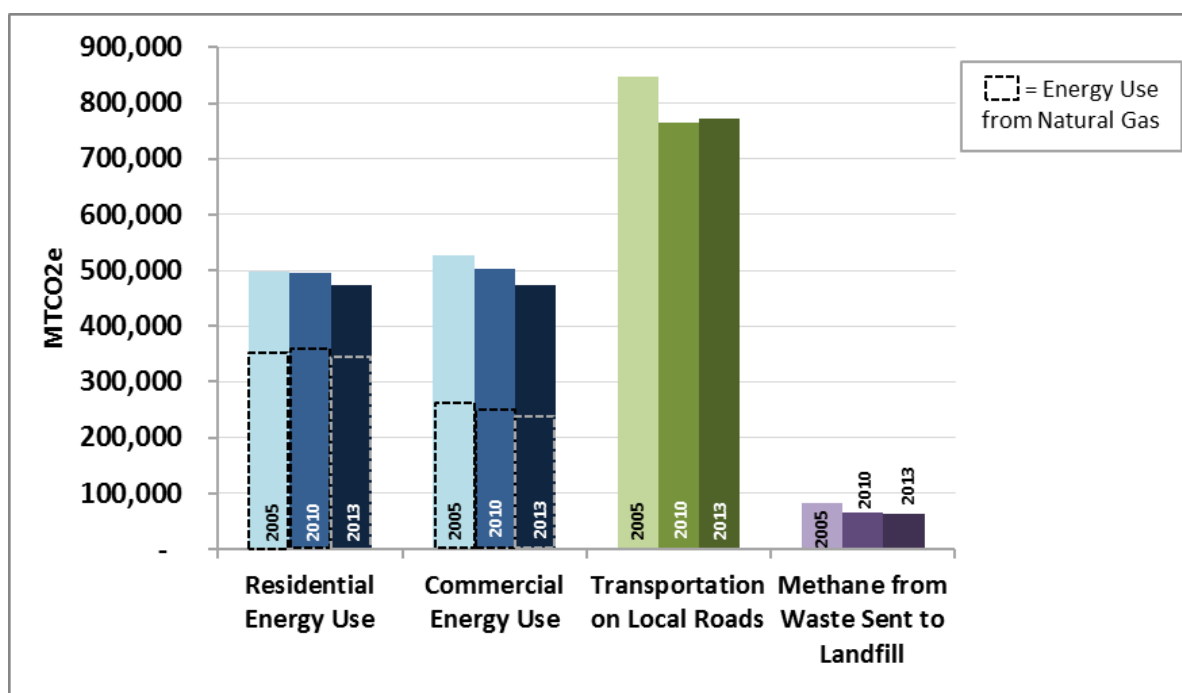
The City produces both a core and consumption based emissions inventory for each of its reporting years. In doing so, the City seeks to provide the most comprehensive and accurate information to City Council for consideration in determining which policies to pursue to reduce overall greenhouse gas emissions, and to best inform both government and community decisions that impact carbon emissions.

Oakland's GHG Emissions: 2005 - 2013

City Action Focus Areas

To date, the City has focused its GHG reduction actions on emission sources that the City has a relatively high degree of influence over and the ability to measure over time. These sources (transportation on local roads; electricity and natural gas consumption in residential, commercial and industrial buildings; and landfilled solid waste) are the primary focus of the ECAP. These sources are grouped into categories for the ease of tracking and reporting. The ECAP is designed to identify energy and GHG reduction actions that enable Oakland to achieve its GHG reduction targets for these sources. Emissions associated with natural gas are highlighted within the energy section to illustrate their significance in these categories. Figure 1 provides a summary of 2005 GHG emissions associated with these categories, and the corresponding changes in these sectors in 2010 and 2013. Additional detail on these sources is provided in Tables 2 – 5 below.

Figure 1. Oakland's GHG Emissions from Focus Area Sources from 2005-2013

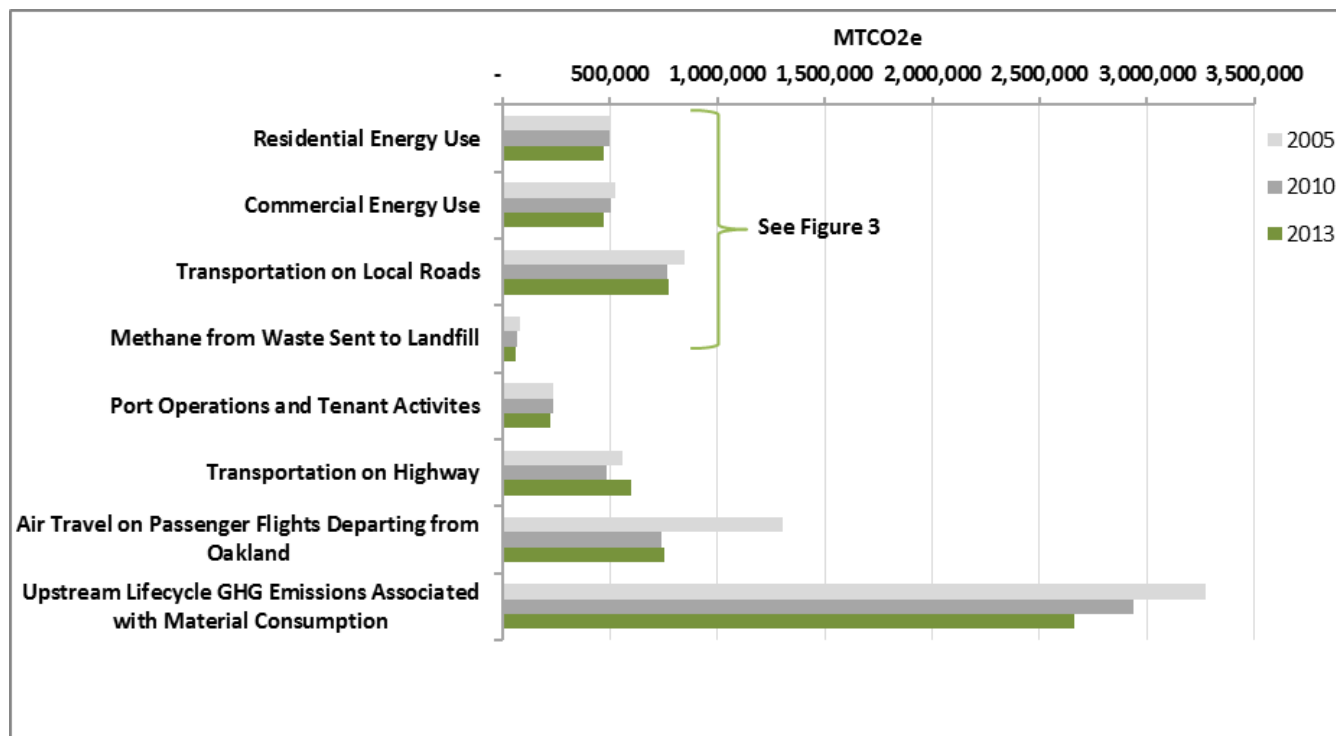


Recognizing All Relevant GHG Emission Sources

Beyond the ECAP focus areas, there are a number of significant GHG emission sources that, while City influence might be relatively limited, can be reduced through local and regional community action (e.g., passenger air travel associated with the Oakland International Airport, pass-through travel on local highways, lifecycle impacts of material consumption choices of residents and businesses).

This more comprehensive set of GHG emission sources associated with Oakland is identified in Tables 3 – 6 and summarized in Figure 2. Estimates of GHG emissions associated with each source are included where possible. The ECAP includes actions aimed at reducing GHG emissions outside of the City's primary focus areas identified above. Figure 2 shows the same core areas of emissions as Figure 1, but adds areas in which the City has less regulatory influence on emissions, including Port of Oakland operations, transportation on State and Federal highways, and lifecycle emissions of goods and services consumed in Oakland. The City will continue to report on all of these GHG emission sources, to the extent feasible, in future progress reports and updates to the ECAP.

Figure 2. GHG Emissions Associated with Oakland from Select Quantified Sources



Information provided in Tables 3a and 3b is intended to summarize all relevant sources to the extent possible, and to enable the City and other interested community stakeholders to report on and consider GHG emissions associated with Oakland in a variety of manners. For example, local organizations may wish to help educate community members about the importance of reducing lifecycle GHG emissions by changing material consumption choices.

The Emissions Inventory delves deeper into these categories, providing additional details to help inform the reader of the sources of each of the emissions. Table 3a shows the core emissions in Oakland from 2005 – 2013 broken down into greater detail. As described earlier, these core emissions reflect only those GHGs produced within Oakland’s municipal boundaries. Table 3b, by contrast, shows the consumption emissions for the same categories. To understand the scope of each of these categories, the following descriptions are offered:

- **Buildings and Energy Use**

Residential Electricity: Electricity supplied by the grid, via Pacific Gas & Electric Company, for single and multifamily homes in Oakland.

Residential Natural Gas: Natural Gas supplied by Pacific Gas & Electric Company for on-site combustion in single and multifamily homes in Oakland.

Commercial Electricity: Electricity supplied by the grid, via Pacific Gas & Electric Company, for commercial buildings in Oakland. This is inclusive of retail, office, hospital, and other specialty commercial uses.

Commercial Natural Gas: Natural Gas supplied by Pacific Gas & Electric Company for on-site combustion in commercial buildings in Oakland. This is inclusive of retail, office, hospital, and other specialty commercial uses.

Water and Wastewater: Emissions associated with the operation of water and wastewater treatment and conveyance facilities in Oakland.

- **Transportation and Mobile Sources**

Airport: The departing passenger and freight flights attributed to Oaklanders.

Public Transit: Emissions from fuel use from BART, AC Transit, Union Pacific Rail, and Amtrak.

State Highway Gasoline: Emissions from gasoline used for vehicle traffic on State highways.

State Highway Diesel: Emissions from diesel used for vehicle traffic on State highways.

On-Road Gasoline: Emissions from gasoline used for vehicle traffic on local roads.

On-Road Diesel: Emissions from diesel used for vehicle traffic on local roads.

Port of Oakland: Emissions from the sea port as reported by the Port. This does not include airplanes or maritime vessels, but rather land operations of buildings, vehicles, and other equipment operating at the Port.

- **Materials Use & Waste**

Solid Waste: Landfill methane emissions for core and lifecycle emissions from materials to landfill, recycling, and compost in consumption

Upstream of Goods & Food: Emissions from the consumption of non-disposed goods found through economic indicators in the Cool Climate Calculator. No emissions are shown in this category in the core inventory (Table 3a) as all emissions occur beyond the boundaries of Oakland, but do appear in the consumption inventory (Table 3b).

Construction Upstream Emissions: Pre-disposal emissions from the manufacturing and transportation of building materials used to construct buildings in Oakland. No emissions are shown in this category in the core inventory as all emissions occur beyond the boundaries of Oakland, but do appear in the consumption inventory (Table 3b).

- **Local Government Emissions**

Municipal Buildings and Facilities: All buildings owned and operated by the City.

Streetlight and Traffic Controllers: All streetlights and traffic controllers, including traffic lights, pedestrian signals, and associated lighting.

Municipal Vehicle Fleet: All vehicles owned and operated by the City, including its light duty fleet, maintenance vehicles, street sweepers, and specialty vehicles.

Municipal Waste Generation: All discarded materials from City facilities, including recycling, compost, and solid waste.

Table 3a. Oakland GHG Emissions by Source – Core Emissions

	CORE				
	2005 (MTCO ₂ e)	2010 (MTCO ₂ e)	2013 (MTCO ₂ e)	% Change Since Baseline	MT Change Since Baseline
Community Emissions					
Buildings & Energy Use	1,034,747	1,010,526	957,951	-7%	(76,796)
Residential Electricity	149,696	143,079	136,588	-9%	(13,108)
Residential Natural Gas	347,019	352,942	336,395	-3%	(10,624)
Commercial Electricity	258,614	248,991	231,431	-11%	(27,183)
Commercial Natural Gas	268,058	254,291	242,165	-10%	(25,893)
Water and Wastewater	11,360	11,223	11,372	0%	12
Transportation & Mobile Sources	1,832,674	1,609,328	1,712,508	-7%	(120,166)
Airport	146,618	76,781	78,270	-47%	(68,348)
Public Transit	45,126	43,391	41,261	-9%	(3,865)
State Highway Gasoline	538,168	468,930	574,370	7%	36,202
State Highway Diesel	21,122	19,436	24,196	15%	3,074
On-Road Gasoline	598,518	562,175	556,044	-7%	(42,474)
On-Road Diesel	248,122	203,615	215,348	-13%	(32,774)
Port of Oakland	235,000	235,000	223,020	-5%	(11,980)
Materials Use & Waste	82,977	65,898	63,205	-24%	(19,772)
Solid Waste	82,977	65,898	63,205	-24%	(19,772)
Upstream of Goods & Food	--	--	--	--	--
Construction Upstream Emissions	--	--	--	--	--
Total Community	2,950,398	2,685,752	2,733,664	-7%	(216,734)
Local Government Emissions					
Municipal Buildings & Facilities	21,998	23,324	22,386	2%	388
Streetlight & Traffic Controllers	5,927	5,912	5,127	-13%	(800)
Municipal Vehicle Fleet	10,169	6,184	4,669	-54%	(5,500)
Municipal Waste Generation	4,243	1,753	2,305	-46%	(1,938)
Total Local Government	42,337	37,173	34,486	-19%	(7,851)
Total Community and Local Government	2,992,735	2,722,925	2,768,150	-8%	(224,585)

Table 3b. Oakland GHG Emissions by Source – Consumption Emissions

	CONSUMPTION				
	2005 (MTCO2e)	2010 (MTCO2e)	2013 (MTCO2e)	% Change Since Baseline	MT Change Since Baseline
Community Emissions					
Buildings & Energy Use	1,341,782	1,454,119	1,395,010	4%	53,227
Residential Electricity	211,070	254,712	249,915	18%	38,844
Residential Natural Gas	425,707	432,973	412,674	-3%	(13,033)
Commercial Electricity	364,803	443,258	423,972	16%	59,169
Commercial Natural Gas	328,841	311,953	297,077	-10%	(31,764)
Water and Wastewater	11,360	11,223	11,372	0%	12
Transportation & Mobile Sources	3,707,148	2,815,383	2,940,762	-21%	(766,387)
Airport	1,671,027	972,592	967,450	-42%	(703,577)
Public Transit	45,126	43,391	41,261	-9%	(3,865)
State Highway Gasoline	679,219	590,440	723,156	6%	43,937
State Highway Diesel	25,211	23,189	28,865	14%	3,654
On-Road Gasoline	755,392	707,847	700,094	-7%	(55,298)
On-Road Diesel	296,174	242,924	256,916	-13%	(39,258)
Port of Oakland	235,000	235,000	223,020	-5%	(11,980)
Materials Use & Waste	3,815,248	3,543,252	3,252,819	-15%	(562,429)
Solid Waste	1,408,762	1,303,664	1,245,812	-12%	(162,950)
Upstream of Goods & Food	2,241,486	2,193,788	1,947,907	-13%	(293,579)
Construction Upstream Emissions	165,000	45,800	59,100	-64%	(105,900)
Total Community	8,864,178	7,812,754	7,588,590	-14%	(1,275,588)
Local Government Emissions					
Municipal Buildings & Facilities	28,005	27,231	26,904	-4%	(1,101)
Streetlight & Traffic Controllers	5,927	5,912	5,127	-13%	(800)
Municipal Vehicle Fleet	10,319	7,493	5,626	-45%	(4,693)
Municipal Waste Generation	4,243	1,753	2,305	-46%	(1,938)
Total Local Government	48,494	42,389	39,962	-18%	(8,532)
Total Community and Local Government	8,912,672	7,855,143	7,628,552	-14%	(1,284,121)

Table 4. Oakland GHG Emissions Data Sources

Activity	Core Sources	Upstream Sources
Buildings and Energy Use		
Residential Energy	Pacific Gas & Electric	ICLEI, Pacific Gas & Electric
Commercial Energy	Pacific Gas & Electric	ICLEI, Pacific Gas & Electric
Industrial Energy	Unable to Include - CPUC 15/15 Rule*	Unable to Include - CPUC 15/15 Rule*
Water and Wastewater	East Bay Municipal Utility District	---
Transportation and Mobile Sources		
State Highway Gasoline	Highway Performance Monitoring system, Air Resources Board EMFAC Database	REET - Argonne National Laboratory
State Highway Diesel	Highway Performance Monitoring system, Air Resources Board EMFAC Database, Onthemap Census	REET - Argonne National Laboratory
On-Road Gasoline	Metropolitan Transportation Commission	REET - Argonne National Laboratory
On-Road Diesel	Metropolitan Transportation Commission	REET - Argonne National Laboratory
Airport & Sea Port	Oakland Airport Monthly Reports, Port of Oakland GHG Inventory	REET - Argonne National Laboratory <i>Sea Port: Unable to include</i>
Public Transit	Union Pacific Railroad GHG Inventory, National Transit Database, Bay Area Rapid Transit, Alameda-Contra Costa Transit, Water Emergency Transportation Authority, Amtrak, Onthemap Census	---
Materials Use & Waste		
Solid Waste	CalRecycle, StopWaste, Alameda County Waste Characterization	EPA WARM Model
Upstream Goods & Services	---	Cool Climate Calculator, UC Berkeley
Construction Upstream	---	Census Building Permit Data, EIO-LCA

* The 15/15 Rule states that an aggregation sample must have more than 15 customers and no single customers data may comprise more than 15% of the total aggregated data in order for the data to be released. Oakland's industrial energy load is believed to have one customer that accounts for more than 15% of the total energy load.

Oakland's GHG Reduction Target

Overview of Oakland's GHG Reduction Target

In July 2009, the Oakland City Council approved a preliminary planning GHG emissions reduction target for the year 2020 at 36% below 2005 levels, on a path toward reducing GHG emissions by more than 80% below 2005 levels by 2050.

This planning target was developed based on publications of the Intergovernmental Panel on Climate Change (IPCC), widely recognized as the world's leading body of climate scientists. According to a 2009 IPCC report^{xvii}, achieving this level of GHG reductions throughout the industrial world will help to achieve a level of climate stabilization that would avoid the worst future climate impact scenarios.^{xviii} Subsequent reports from the IPCC have continued to validate this goal as appropriate for local and national level targets.

Oakland has an opportunity to demonstrate leadership by striving to achieve this level of GHG emissions reductions, reinforcing the City's commitment to local climate action.

Identifying an Oakland Preliminary Planning Target for GHG Reduction

A clear scientific near-consensus has emerged regarding the dangers of escalating concentrations of greenhouse gases in the Earth's atmosphere and the significant role that anthropogenic (human caused) sources of GHG emissions are playing in increasing those concentrations. Tremendous collective action will be necessary in the near term on a global scale to reduce GHG emissions to levels that avoid the worst impacts.

Projected local impacts of climate change include rising Bay and delta waters, decreased potable water supply, increased fire danger, added stress on infrastructure, pricing and quality of life burdens, ecological degradation, and others. The Bay Conservation and Development Commission (BCDC) has conducted Oakland-specific analysis of anticipated impacts to ocean levels resulting from climate change, and has predicted that sea levels may rise up to 55 inches by the end of this century.^{xix} Preliminary analysis shows that low-elevation portions of Oakland, including the airport, Coliseum area, and portions of West Oakland, could be vulnerable to more frequent flooding from moderate levels of sea rise, and regular inundation from a 55-inch rise in sea levels.^{xx}

Scientific Perspective on Needed GHG Reduction Goals

Significant reductions in global anthropogenic GHG emissions are projected to be necessary to reverse present trends and restore a stabilized atmospheric GHG concentration level similar to that of recent history. According to climate scientist James Hansen, "If humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted, paleoclimate evidence and ongoing climate change suggest that CO₂ will need to be reduced from its current 385 ppm to at most 350 ppm, but likely less than that."^{xxi} Since that statement, the level of CO₂ in the atmosphere has continued to rise, and has reached 406 PPM as of 2017. Achieving an atmospheric GHG concentration of 350 ppm CO₂ would roughly correlate to a concentration of approximately 450 ppm in total CO₂-equivalent (CO₂e) terms, a metric often used to express the total equivalent warming potential of CO₂ and other relatively minor but also significant greenhouse gases in the atmosphere.^{xxii}

According to the Intergovernmental Panel on Climate Change (IPCC), a body of the world's most authoritative climate scientists, achieving even an atmospheric GHG concentration of 450 ppm CO₂e will yield some negative climate impacts, including some deglaciation, species extinction, and changes in frequency and severity of flooding, droughts, fires and other impacts. However, this target is frequently framed in the literature near the best-case scenario end of the future range of projections, requiring highly aggressive GHG reductions.^{xxiii}

The IPCC's Fourth Assessment Report (FAR) suggests that industrialized countries would need to reduce GHG emissions to levels 25-40% below 1990 levels by 2020 and 80-95% below 1990 levels by 2050 to achieve a stabilized atmospheric GHG concentration of 450 ppm CO₂-equivalent (CO₂e).

Applying Current Global Climate Science in the Context of Oakland

Data for Oakland's 1990 GHG emissions are not available, but a 2005 GHG inventory was developed for Oakland to serve as the baseline comparison point for future GHG reduction assessments. Using Oakland's 2005 GHG emissions inventory as a baseline allows progress to be measured and demonstrated in an accurate and comprehensive manner. In addition to the 2005 baseline inventory, the City has completed GHG emissions inventories for the years 2010 and 2013. The City expects to be able to complete GHG inventories in all odd-numbered years to track progress towards the City's goal.

Based on information provided by the California Air Resources Board, achieving a statewide GHG reduction of 25% below 1990 levels would correlate to a statewide reduction target of approximately 36% below 2005 GHG levels. Achieving statewide reductions of 80% below 1990 levels would be roughly equivalent to an 83% reduction relative to 2005 levels.

Faced with a lack of data for 1990, staff assumes GHG emissions growth that has occurred in Oakland is similar to the State average during the time period from 1990 to 2005. For Oakland to meet the IPCC-suggested GHG reduction targets for industrialized countries, Oakland's GHG emissions would need to be reduced by at least 36% below 2005 levels by 2020, and 83% below 2005 levels by 2050. Oakland City Council adopted these targets in 2009.

State Perspective on Role of Local Governments in Reducing GHG Emissions

Below is an excerpt from the California Air Resources Board (CARB) adopted Climate Change Scoping Plan describing CARB's perspective on the role of local governments in reducing GHG emissions in California.^{xxiv}

The Role of Local Government: Essential Partners

Local governments are essential partners in achieving California's goals to reduce greenhouse gas emissions. They have broad influence and, in some cases, exclusive authority over activities that contribute to significant direct and indirect greenhouse gas emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations. Many of the proposed measures to reduce greenhouse gas emissions rely on local government actions.

Over 120 California cities have already signed on to the U.S. Conference of Mayors Climate Protection Agreement. In addition, over 30 California cities and counties have committed to developing and implementing Climate Action Plans. Many local governments and related organizations have already begun educating Californians on the benefits of energy efficiency measures, public transportation, solar homes, and recycling. These communities have not only demonstrated courageous leadership in taking initiative to reduce greenhouse gas emissions, they are also reaping important co-benefits, including local economic benefits, more sustainable communities, and improved quality of life.

Land use planning and urban growth decisions are also areas where successful implementation of the Scoping Plan relies on local government. Local governments have primary authority to plan, zone, approve, and permit how and where land is developed to accommodate population growth and the changing needs of their jurisdictions. Decisions on how land is used will have large impacts on the greenhouse gas emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas sectors.

To provide local governments guidance on how to inventory and report greenhouse gas emissions from government buildings, facilities, vehicles, wastewater and potable water treatment facilities, landfill and composting facilities, and other government operations, ARB recently adopted the Local Government Operations Protocol. ARB encourages local governments to use this protocol to track their progress in

achieving reductions from municipal operations. ARB is also developing an additional protocol for community emissions. This protocol will go beyond just municipal operations and include emissions from the community as a whole, including residential and commercial activity. These local protocols will play a key role in ensuring that strategies that are developed and implemented at the local level, like urban forestry and greening projects, water and energy efficiency projects, and others, can be appropriately quantified and credited toward California's efforts to reduce greenhouse gas emissions.

In addition to tracking emissions using these protocols, ARB encourages local governments to adopt a reduction goal for municipal operations emissions and move toward establishing similar goals for community emissions that parallel the State commitment to reduce greenhouse gas emissions by approximately 15 percent from current levels by 2020. To consolidate climate action resources and aid local governments in their emission reduction efforts, the ARB is developing various tools and guidance for use by local governments, including the next generation of best practices, case studies, a calculator to help calculate local greenhouse gas emissions, and other decision support tools.

The recent passage of SB 375 (Steinberg, Chapter 728, Statutes of 2008) creates a process whereby local governments and other stakeholders work together within their region to achieve reduction of greenhouse gas emissions through integrated development patterns, improved transportation planning, and other transportation measures and policies. The implementation of regional transportation-related greenhouse gas emissions targets and SB 375 are discussed in more detail in Section C.

Considering GHG Reduction Targets in the Context of Recent State Policy Action

Climate policies adopted at the State level in California (e.g., AB 32, SB 375) aim to reduce statewide GHG emissions to 1990 levels by 2020.^{xxv} This correlates to a reduction of approximately 15% below current levels by 2020. Executive Order S-3-05 issued by Governor Schwarzenegger calls for statewide GHG reductions of 80% below 1990 levels by 2050.^{xxvi}

As documented in the Climate Change Scoping Plan adopted by the California Air Resources Board (CARB) in December 2008, scheduled for update in 2017, a variety of State-driven strategies are being developed and implemented to help achieve these statewide goals. Additional and complementary local actions will be needed to help reach these goals and make additional progress. Table 5 summarizes these State-driven strategies outlined in the CARB Scoping Plan.

Table 5. Recommended Greenhouse Gas Reduction Measures from CARB Climate Change Scoping Plan^{xxvii}

Recommended Reduction Measures
California Light-Duty Vehicle Greenhouse Gas Standards <ul style="list-style-type: none"> • Implement Pavley standards • Develop Pavley II light-duty vehicle standards
Energy Efficiency <ul style="list-style-type: none"> • Building/appliance efficiency, new programs, etc. • Increase CHP generation by 30,000 GWh • Solar Water Heating (AB 1470 goal)
Renewables Portfolio Standard (33% by 2020)
Low Carbon Fuel Standard
Regional Transportation-Related GHG Targets
Vehicle Efficiency Measures
Goods Movement <ul style="list-style-type: none"> • Ship Electrification at Ports • System-Wide Efficiency Improvements
Million Solar Roofs
Medium/Heavy Duty Vehicles <ul style="list-style-type: none"> • Heavy-Duty Vehicle Greenhouse Gas Emission Reduction (Aerodynamic Efficiency) • Medium- and Heavy-Duty Vehicle Hybridization
High Speed Rail
Industrial Measures (for sources covered under cap-and-trade program) <ul style="list-style-type: none"> • Refinery Measures • Energy Efficiency & Co-Benefits Audits
Additional Reductions Necessary to Achieve the Cap
High Global Warming Potential Gas Measures
Sustainable Forests
Industrial Measures (for sources not covered under cap and trade program) <ul style="list-style-type: none"> • Oil and Gas Extraction and Transmission
Recycling and Waste (landfill methane capture)
Other Recommended Measures
State Government Operations
Local Government Operations
Green Buildings
Recycling and Waste (other measures)
Water Sector Measures
Methane Capture at Large Dairies

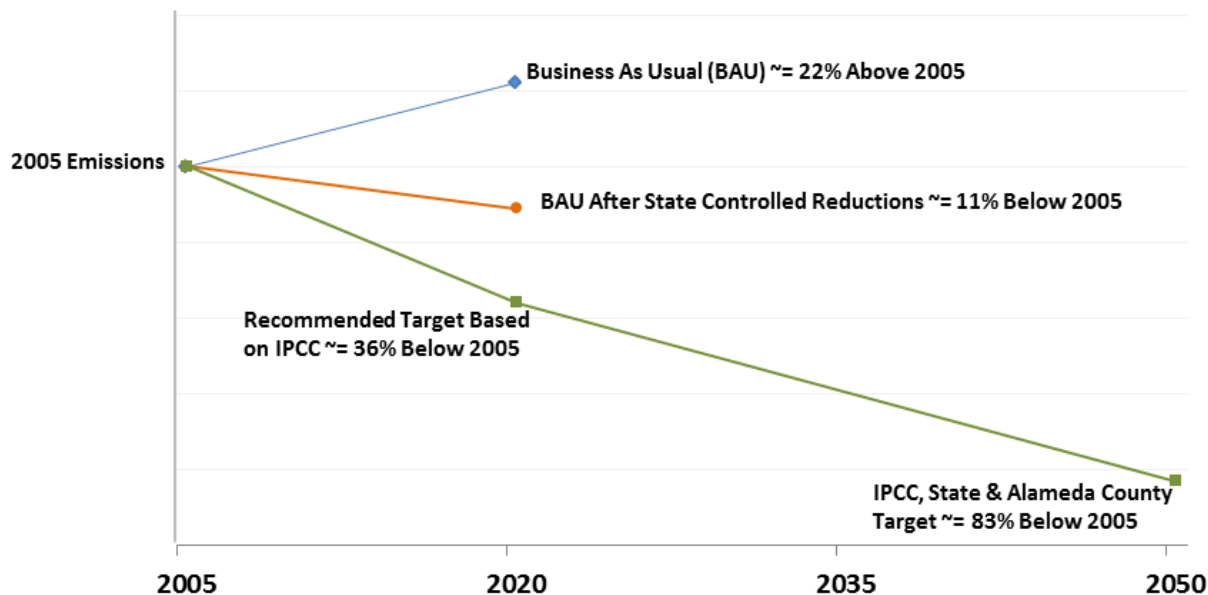
While some of these strategies may not affect Oakland significantly, most will have some impact in Oakland and should be considered when developing local GHG reduction targets and plans for meeting those targets.

Some of these State-driven strategies will affect future GHG emissions in Oakland irrespective of additional local action. For example, strategies such as requiring the sale of low carbon fuels and more fuel efficient vehicles on a statewide basis may create GHG reductions in Oakland without relying on local government implementation. Projections of future GHG emissions in Oakland are based on the assumed implementation of these State-driven strategies.

Other State-driven strategies identify goals for creating GHG reductions that can be translated to Oakland, but which will only be met if supported by new local action. For example, achieving statewide and regional goals related to reducing the number of vehicle miles traveled on local roads will require planning, policy and programmatic action at the local government level. To avoid any double-counting of GHG reductions, achievement of these goals is not assumed in business-as-usual projections of future GHG emissions in Oakland, as potential actions under consideration in the development of the ECAP will be needed to achieve these goals.

For the purpose of quantifying GHG reductions associated with a preliminary planning target, Oakland’s business-as-usual 2020 GHG projections have been adjusted based on these factors. These projections are also based on projected increases in population and economic activity provided by the Association of Bay Area Governments and vehicle miles traveled provided by the California Energy Commission.

Figure 3. Oakland GHG Emissions and Targets



Under business-as-usual conditions without implementation of the strategies outlined in the CARB Climate Change Scoping Plan, GHG emissions in Oakland were projected to increase by approximately 22% above 2005 levels by 2020. Assuming implementation of State-driven strategies as described above, Oakland’s GHG emissions in 2020 are projected to be approximately 11% below 2005 levels in the absence of additional local action.

Review of GHG Reduction Targets Established by Other Jurisdictions

Other jurisdictions within and outside of California have adopted a wide range of community-scale GHG reduction targets. These targets reference a variety of baseline years and target years, influenced by the date at which each target was adopted, local data availability, and other factors. These variables make direct comparison of adopted GHG reduction targets difficult. Table 6 below shows a summary of selected GHG reduction targets adopted by other institutions.

Table 6. Example GHG Reduction Targets Established by Other Jurisdictions

Jurisdiction	Community-Scale GHG Reduction Target
State	
California Assembly Bill 32	1990 levels by 2020 ^{xxviii}
Executive Order S-3-05	80% below 1990 levels by 2050 ^{xxix}
California Air Resources Board	Encourages local governments to adopt GHG reduction targets of 15% below current levels by 2020 ^{xxx}
California Cities	
Berkeley	80% below 2000 levels by 2050, on a path to reduce GHG emissions by ~25% from 2005 levels by 2020
Chula Vista	20% below 1990 levels by 2010
Hayward	12% below 2005 levels by 2020, 83% below 2005 level by 2050
Los Angeles	35% below 1990 levels by 2030
Palo Alto	5% below 2005 levels by 2012 and 15% below 2005 levels by 2020
San Diego	15% below 1990 levels by 2010
Bay-Area Counties	
Alameda County	80% below ~2007 levels by 2050
Marin County	15% below 2000 levels by 2020
San Francisco	20% below 1990 levels by 2012
Sonoma County & Cities	25% below 1990 levels by 2015 (all nine cities in Sonoma County have adopted targets at least as aggressive)
National, International	
Denmark	21% below 1990 levels by 2012
European Union	20% below 1990 levels by 2020
Germany	21% below 1990 levels by 2012
Luxembourg	28% below 1990 levels by 2010
Sweden	25% below 1990 levels by 2020
United Kingdom	20% below 1990 levels by 2010
Kyoto Protocol (and U.S. Mayors' Climate Protection Agreement)	7% below 1990 levels by 2012

Applying Oakland's GHG Reduction Target

Identification of Sub-Targets

There are many ways to report and evaluate community-scale GHG emissions data. In the absence of a standard protocol for community-scale GHG emissions accounting and reporting, it is currently up to each community to identify its preferred method.

It is recommended that each community apply its GHG reduction target to each category of GHG emission sources separately (e.g., transportation on local roads, building energy use). This method will help to avoid potential problems associated with double-counting of GHG reductions by multiple communities and increase the likelihood that collective action is producing the expected results.

Staff recommends that Oakland's target of reducing GHG emissions by 36% from 2005 levels by 2020 be separately applied to each GHG emission source category. GHG emissions reduction progress will be reported with respect to each emissions source category and sub-category (as illustrated in Tables 3a and 3b) as data and resources allow. Progress will be analyzed on both an absolute basis and per capita basis to enable future reflection on GHG reduction process, irrespective of population migration patterns.

Consideration of Regional Context

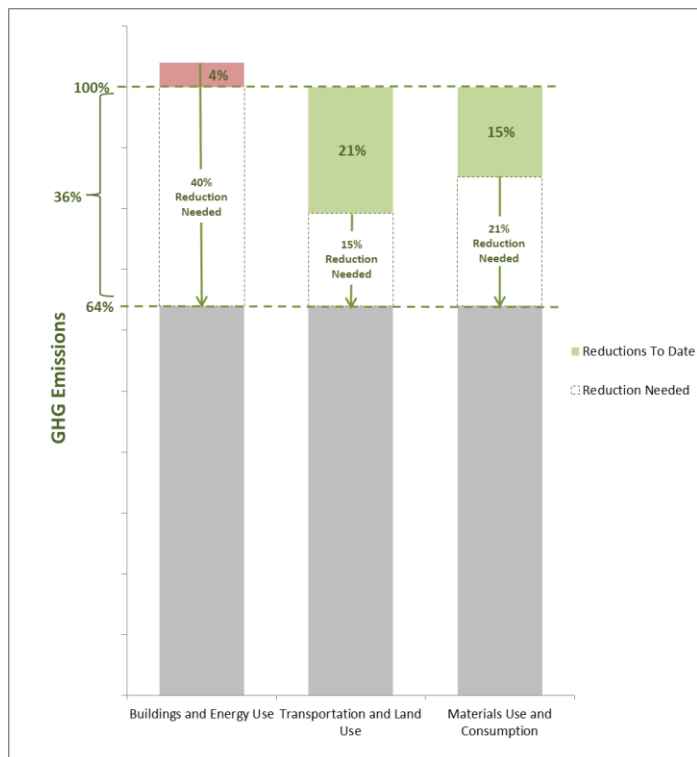
As regional and statewide action on climate protection grows, Oakland may be asked to adjust future growth plans to accommodate more or less residential, commercial, or industrial development than is currently planned. In some cases, increasing development in Oakland near comparatively transit-rich infrastructure may help the region to achieve bigger overall success toward energy and climate goals. Future updates to the ECAP will require reflection on regional plans and consideration of refinements to Oakland's targets, planned actions and reporting metrics to ensure that Oakland is able to meet its own goals, contribute effectively to regional GHG reduction progress and track its contribution toward mitigating this global problem.

Considering Actions Reducing GHG Emissions Outside of Oakland

Some policies and actions that could be undertaken by the Oakland City government might result in significant GHG reductions in other geographic communities, or in the future, in ways that are difficult to represent in a traditional inventory of Oakland citywide GHG emissions. These types of actions are reflected in the consumption-based inventory approach, and are an evolving area of focus for cities in targeting GHG reductions. For example:

- Fostering population movement to dense, transit-served urban centers like Oakland may lead to big overall statewide reductions in vehicle miles traveled and associated GHG emissions (while possibly increasing vehicle use and GHG emissions within Oakland).

Figure 4. Applying the 36% GHG Reduction Goal in Each Emissions Source Category



- Fostering decreased consumption of material resources can help to conserve fossil fuel energy used for production and transportation of goods outside of Oakland.
- Fostering decreased generation of waste sent to landfill may lead to reductions in landfill methane in another geographic location where Oakland's waste is sent.

In many cases these 'lifecycle' benefits occur elsewhere in time and/or space and can be difficult to quantify accurately. In situations where the GHG reduction benefits from these kinds of actions can be estimated at a sufficient level of accuracy, they will be reported as part of the story of Oakland's progress in fostering GHG emissions reductions, specifically in the consumption inventories. As of yet, no specific goals or targets have been established for consumption or lifecycle emissions, so comparisons of these inventories are for perspective only.

Revisiting Climate Targets and Plans

It is reasonable to assume that climate science will continue to evolve in the coming years and revisions to the target and actions recommended in this report may be appropriate. The ECAP outlines a process by which the City will periodically revisit GHG reduction targets to consider ongoing scientific, policy and technological developments, as well as progress toward the goal. A 2016-2017 Update to the ECAP was conducted consistent with this direction.

Achieving Oakland's 36% GHG Reduction Target

Oakland's Citywide Target: 36% Reduction in All GHG Emission Source Areas

Achieving Oakland's 36% GHG reduction target across all sources of GHG emissions will require significant action in many areas by all members of the Oakland community. In some areas (e.g., local land use planning, building codes), the City has significant opportunities to influence GHG emission sources and foster GHG reductions. In others areas (e.g., air travel and material consumption choices by residents), achieving Oakland's GHG reduction target will rely most heavily on the choices of individuals and additional leadership from local and regional partners. The City calls upon the greater Oakland community to embrace a 36% GHG reduction target for each GHG emission source area, and to take personal action toward that target wherever feasible.

Glossary

ABAG: Association of Bay Area Governments

AC Transit: The bus system for the East Bay

BAAQMD: Bay Area Air Quality Management District

BART: Bay Area Rapid Transit

BCDC: San Francisco Bay Conservation and Development Commission

BIG: Build It Green, an Oakland-based non-profit that provides green building assistance

BRT: Bus Rapid Transit

C&D: Construction and demolition debris

CCA: Community Choice Aggregation, a term used to describe an arrangement that enables a local government to supply electricity to customers within its borders and involves the local government in the purchase and sale of the energy commodity

CEC: California Energy Commission

CECO: Commercial Energy Conservation Ordinance

CH₄: Methane, a powerful greenhouse gas

CO₂e: Carbon dioxide equivalent units, converting all emissions to equivalent carbon dioxide units allows for the consideration of different greenhouse gases on comparable terms

CPUC: California Public Utilities Commission

CYES: California Youth Energy Services, a program that employs local youth to promote energy awareness

EPP: Environmentally Preferable Purchasing, a City policy designed to require purchase of products and services that minimize environmental and health impacts, toxics, pollution, and hazards to worker and community safety

GHG: Greenhouse Gas, the term used for gases that trap heat in the atmosphere. The principal greenhouse gases that enter the atmosphere as a result of human activity are carbon dioxide, methane, and nitrous oxide

GPR: GreenPoint Rated, a green building standard used in California for new residential projects

ICLEI: ICLEI – Local Governments for Sustainability, an international membership association of local governments focused on addressing the climate challenge

kW: A kilowatt, equal to 1,000 watts

kWh: A kilowatt hour (1,000 watts), the work performed by one kilowatt of electric power in one hour

Kyoto Protocol: The United Nations Treaty that targets the reduction of greenhouse gas emissions

LBNL: Lawrence Berkeley National Laboratory

LED: Light emitting diode

LEED: Leadership in Energy and Environmental Design, a commonly used green building standard

MTC: Metropolitan Transportation Commission

Net Zero Energy Buildings: A building that achieves maximum energy efficiency so that any remaining energy needs can be met through onsite renewable energy systems, such as solar water and space heating, solar electricity, or wind energy

OUSD: Oakland Unified School District

Peak Oil: A term used to describe the transition from many decades in which the available supply of oil grew each year to a period in which the rate of oil production enters its terminal decline

PG&E: Pacific Gas & Electric

PV: Photovoltaics, a solar power technology that converts sunlight into electricity

RECO: Residential Energy Conservation Ordinance

RPP: Residential Permit Parking

Solar thermal: A technology that captures solar energy for heat

SR2S: Safe Routes to School program

StopWaste.Org: The Alameda County Waste Management Authority and the Alameda County Source Reduction and Recycling Board serving as one agency

TALC: Transportation and Land Use Coalition, a local organization that advocates for alternative forms of transportation

Therm: 100,000 British Thermal Units (BTUs), equivalent to approximately 100 standard cubic feet of natural gas

Title 24 Energy Code: California's energy efficiency standards for residential and nonresidential buildings

VMT: Vehicle miles traveled

Zero Waste: The City's goal to eliminate waste sent to the landfill. All of the community's discarded material would be recycled or reused.

Endnotes

- ⁱ Adapted from a whitepaper titled “Products, Packaging and US Greenhouse Gas Emissions” written by Joshua Stolaroff and published by the Product Policy Institute in September 2009. For the purposes of this illustration, GHG emissions associated with Products & Packaging and the Provision of Food have been combined under the heading Material Consumption & Waste, and GHG emissions associated with Infrastructure (1% of total pie) have been combined under the heading Building HVAC & Lighting.
- ⁱⁱ Gupta, S., D. A. Tirpak, N. Burger, J. Gupta, N. Höhne, A. I. Boncheva, G. M. Kanoan, C. Kolstad, J. A. Kruger, A. Michaelowa, S. Murase, J. Pershing, T. Saijo, A. Sari, 2007: Policies, Instruments and Co-operative Arrangements. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- ⁱⁱⁱ A 36% reduction in GHG emissions from 2005 levels in Oakland is projected to be approximately equivalent to a 25% reduction from 1990 levels based on analysis by City of Oakland staff using California statewide 1990 and 2005 emissions as a proxy for Oakland.
- ^{iv} The White House. “President Obama signs an Executive Order Focused on Federal Leadership in Environmental, Energy, and Economic Performance” http://www.whitehouse.gov/the_press_office/President-Obama-signs-an-Executive-Order-Focused-on-Federal-Leadership-in-Environmental-Energy-and-Economic-Performance/
- ^v California Air Resources Board. <http://www.arb.ca.gov/cc/cc.htm>
- ^{vi} State of California Executive Department. Executive Order S-3-05. <http://www.dot.ca.gov/hq/energy/ExecOrderS-3-05.htm>
- ^{vii} California Air Resources Board. “Climate Change Proposed Scoping Plan.” Oct 2008. <http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm>
- ^{viii} Projected changes in population and VMT are drawn from reports by the Association of Bay Area Governments and vehicle miles traveled provided by the California Energy Commission.
- ^{ix} National Research Council (NRD), 2012. “Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future.
- ^x Cayan, Dan, with Mary Tyree, Mike Dettinger, Hugo Hidalgo, Tapash Das, Ed Maurer, Peter Bromirski, Nicholas Graham, and Reinhard Flick. “Climate Change Scenarios and Sea Level Rise Estimates for the California 2008 Climate Change Scenarios Assessment.” California Climate Change Center. Prepared for the California Energy Commission. Report CEC-500-2009-014-D. March 2009.
- ^{xi} National Oceanic and Atmospheric Administration. “Sea Level Rise and Coastal Flooding Impacts” <https://coast.noaa.gov/slr/>
- ^{xii} City of Oakland. “Bicycle Master Plan”. Page 113. December 2007.
- ^{xiii} City of Oakland. “Draft 2017 Pedestrian Master Plan.” Page 54. April 2017.
- ^{xiv} Matrix Consulting Group. “Performance Audit of the Public Works Agency.” April 29, 2009.
- ^{xv} Cayan, Dan, with Mary Tyree, Mike Dettinger, Hugo Hidalgo, Tapash Das, Ed Maurer, Peter Bromirski, Nicholas Graham, and Reinhard Flick. “Climate Change Scenarios and Sea Level Rise Estimates for the California 2008 Climate Change Scenarios Assessment.” California Climate Change Center. Prepared for the California Energy Commission. Report CEC-500-2009-014-D. March 2009.
- ^{xvi} Bay Conservation and Development Commission. “San Francisco Bay Scenarios for Sea Level Rise Index Map” http://www.bcdc.ca.gov/planning/climate_change/index_map.shtml

Appendix Endnotes

- ^{xvii} Gupta, S., D. A. Tirpak, N. Burger, J. Gupta, N. Höhne, A. I. Boncheva, G. M. Kanoan, C. Kolstad, J. A. Kruger, A. Michaelowa, S. Murase, J. Pershing, T. Saijo, A. Sari, 2007: Policies, Instruments and Co-operative Arrangements. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- ^{xviii} A 36% reduction in GHG emissions from 2005 levels in Oakland is projected to be approximately equivalent to a 25% reduction from 1990 levels based on analysis by City of Oakland staff using California statewide 1990 and 2005 emissions as a proxy for Oakland.
- ^{xix} California Climate Action Team. Draft Biennial Report. March 2009. <http://www.climatechange.ca.gov/publications/cat/>
- ^{xx} Bay Conservation and Development Commission. "San Francisco Bay Scenarios for Sea Level Rise Index Map" http://www.bcdc.ca.gov/planning/climate_change/index_map.shtml
- ^{xxi} Hansen, James and Makiko Sato, Pushker Kharecha, David Beerling, Robert Berner, Valerie Masson-Delmotte, Mark Pagani, Maureen Raymo, Dana L. Royer, James C. Zachos. "Target Atmospheric CO₂: Where Should Humanity Aim?" The Open Atmospheric Science Journal. Volume 2. ISSN: 1874-2823. pp.217-231
- ^{xxii} Fisher, B.S., N. Nakicenovic, K. Alfsen, J. Corfee Morlot, F. de la Chesnaye, J.C. Hourcade, K. Jiang, M. Kainuma, E. la Rovere, A. Matysek, A. Rana, K. Riahi, R.G. Richels, S. Rose, D.P. van Vuuren and R. Warren. 2007. Issues Related to Mitigation in the Long-Term Context. In Climate Change 2007: Mitigation - Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, S O. Davidson and B. Metz (eds.), Cambridge University Press, Cambridge. pp.229-230
- ^{xxiii} Gupta, S., D. A. Tirpak, N. Burger, J. Gupta, N. Höhne, A. I. Boncheva, G. M. Kanoan, C. Kolstad, J. A. Kruger, A. Michaelowa, S. Murase, J. Pershing, T. Saijo, A. Sari, 2007: Policies, Instruments and Co-operative Arrangements. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- ^{xxiv} California Air Resources Board. "Climate Change Proposed Scoping Plan." <http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm>
- ^{xxv} California Air Resources Board. <http://www.arb.ca.gov/cc/cc.htm>
- ^{xxvi} State of California Executive Department. Executive Order S-3-05. <http://www.dot.ca.gov/hq/energy/ExecOrderS-3-05.htm>
- ^{xxvii} California Air Resources Board. "Climate Change Proposed Scoping Plan." Oct 2008. <http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm>
- ^{xxviii} California Air Resources Board. <http://www.arb.ca.gov/cc/cc.htm>
- ^{xxix} State of California Executive Department. Executive Order S-3-05. <http://www.dot.ca.gov/hq/energy/ExecOrderS-3-05.htm>
- ^{xxx} California Air Resources Board. "Climate Change Proposed Scoping Plan." <http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm>



Photo: Greg Linhares, City of Oakland



Photo: Greg Linhares, City of Oakland



Photo: Greg Linhares, City of Oakland

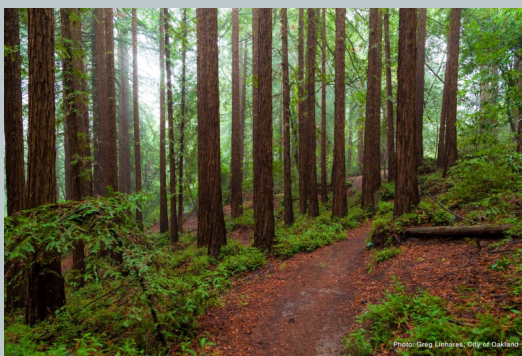


Photo: Greg Linhares, City of Oakland

City of **OAKLAND**

2015 Greenhouse Gas Emissions Inventory Report

March 2018

Table of Contents

Introduction	3
Oakland, California	3
Why We Report	3
Inventory Methodology.....	4
Core Emissions.....	5
Consumption Emissions	5
GHG Emissions Reporting.....	5
GHG Reduction Goals	6
Co-Benefits: Enhancing Equity through GHG Reduction.....	6
Core Emissions Summary.....	7
Consumption Emissions Summary.....	8
Per Capita Emissions Comparison to Other Cities	10
Emissions Relative to Economic Growth	10
Conclusions	11
Appendix A: GHG Emissions Data and Methodology	12
Appendix B: Materials Use and Waste	25
Appendix C: Local Government Emissions Data and Reductions	37

List of Figures

Figure 1: Oakland GHG Reduction Goals6

Figure 2: Core Emissions7

Figure 3: Core Emissions by Sector7

Figure 4: Consumption Emissions8

Figure 5: Consumption Emissions by Sector8

Figure 6: Core and Consumption Emissions by Category.....9

Figure 7: Core and Consumption Emissions Progress toward 2020 Goal9

Figure 8: Per Capita Emissions of Selected U.S. Cities 10

Figure 9: Emissions Reductions with Economic and Population Growth 10

Credit and Acknowledgments

This report was prepared by the Environmental Services Division of Oakland Public Works. The primary authors of the report are Daniel Hamilton, Sustainability Program Manager, Mukta Kelkar, Climate Corps Fellow, and Ben Linthicum, CivicSpark Fellow. For inquiries, please contact Mr. Hamilton at DHamilton2@oaklandnet.com

Organization Which Provided Data or Assistance:

- California Air Resources Board
- County of Alameda
- Alameda-Contra Costa Transit
- Amtrak
- Argonne National Laboratory
- Bay Area Rapid Transit
- CalRecycle
- Carnegie Mellon
- City of Oakland
- East Bay Municipal Utility District
- Federal Transit Administration
- ICLEI – Local Governments for Sustainability USA
- Metropolitan Transportation Commission
- Pacific Gas and Electric
- Port of Oakland
- Renewable & Appropriate Energy Laboratory, UC Berkeley
- StopWaste
- Union Pacific Railroad
- U.S. Department of Transportation
- U. S. Environmental Protection Agency
- Water Emergency Transportation Authority

Introduction

Oakland, California

Nationally recognized as one of America's greenest cities, Oakland aims its award-winning sustainability efforts toward building an ecologically sustainable, economically dynamic, and socially equitable future for the community. With 19 miles of shoreline, Oakland is vulnerable to volatile weather patterns, warming oceans, and changing tides; conditions making the city among the most threatened by impacts from climate change. The City's greenhouse gas (GHG) emissions reduction strategies, intended to address the ongoing impacts of a warming climate, are established in the Oakland Energy and Climate Action Plan (ECAP) that was adopted by Oakland City Council in 2012.

This GHG Emissions Inventory Report (Report) provides an update on the calculated emissions occurring in Oakland. It includes updates to the City's three previous GHG Emissions Inventories, covering the years 2005, 2010, 2013, and a new calculation of 2015 emissions. Additionally, this Report includes new GHG Emissions Inventories for each of the three subject years (2005, 2010, 2013, and 2015) to calculate consumption emissions. The differences between the standard core emissions and the new consumption emissions are described in the Report in detail.



Photo: Greg Linhares, City of Oakland

Why We Report

The City calculates and reports its greenhouse gas emissions because addressing the impacts of climate change is a core value of Oakland and its people. This Report provides an overview of Oakland's path to emissions reduction and helps guide policy to better protect and provide for our community. By making a targeted and coordinated approach to reducing emissions, we can work to protect residents, businesses, and properties throughout the region from increased impacts of climate change over time. The City has adopted strong emissions reduction goals of 36 percent fewer emissions by 2020 and 83 percent fewer emissions by 2050, relative to a 2005 baseline. The periodic calculation and reporting of

these emissions helps the City to understand whether it is on track to meet its goals, and helps the community understand how well Oakland is responding to this global challenge.

Because climate change disproportionately affects low income residents and people of color in Oakland, our City's sustainability efforts prioritize projects and programs that improve equity while also addressing climate change. Issues such as housing affordability, access to public transit, air quality and community health, and climate justice are all affected by the City's approach to meeting its GHG emissions goals. By prioritizing strategies to focus on these co-benefits of GHG reduction, the City ensures that its GHG reduction efforts are also part of our approach to meeting broader community needs.



Inventory Methodologies

There are two methods of analyzing GHG emissions across a community. The first method, called a core emissions approach, looks at direct emissions from a geographical perspective, for example, gasses that are emitted within city limits. Select indirect emissions may be included, such as the emissions from creation of electricity in a distant location for use within city limits. The core emissions approach is the standard used by cities in the United States, and this Report includes core emissions accordingly.

The second method, referred to as a consumption emissions approach, employs a lifecycle perspective that includes, for example, gasses that are emitted globally due to demand for goods and services generated within city limits. The consumption emissions approach provides a more thorough portrayal of the emissions for which the community is responsible, and holds the potential to inspire deeper emissions reductions. For these reasons, the City also conducts a consumption-based analysis.

Each approach offers a different lens through which to see what emissions Oakland is responsible for, and provides a method of determining which areas of focus are most appropriate in establishing policies to minimize these emissions. Since climate change is a global issue that requires solutions on a global scale, Oakland prioritizes the findings of the consumption emissions approach. As a city, Oakland seeks to have a global impact by affecting not only those emissions resulting from our local activities, but also to understand and address how activities within Oakland create emissions around the world.

Core Emissions

Core emissions are GHGs emitted within city limits, such as those that result from using natural gas in homes or driving gasoline-powered cars. Measurement of core emissions is the typical method used by cities to measure GHG emissions, making comparisons from city to city easy.

Consumption Emissions

Consumption emissions are GHGs emitted due to community demand, including those used in production, transportation, and eventual disposal of goods and services. Measurement of consumption emissions is a relatively new method, and will continue to evolve as better data become available and more local governments refine and improve the approach.

CORE VS. CONSUMPTION EMISSIONS

These are the two scales of GHG emissions that may be calculated in a city. For example, when driving a car:

Core emissions are the carbon dioxide (CO₂) and nitrogen oxide (NO_x) that are emitted from vehicles while driving within city limits.



Consumption emissions include the core tailpipe emissions described above, plus emissions from the extraction, refinement, and distribution of the fuel.



This Report provides a summary and details of core emissions in Oakland to maintain consistency with international protocols and comparability to similar cities. However, the bulk of the analysis is focused on presentation of consumption emissions. This approach offers the greatest potential to impact GHG emissions at a global scale, and to ensure that the City and the community have the best and most applicable information on the full impacts of decisions and behaviors.

GHG Emissions Reporting

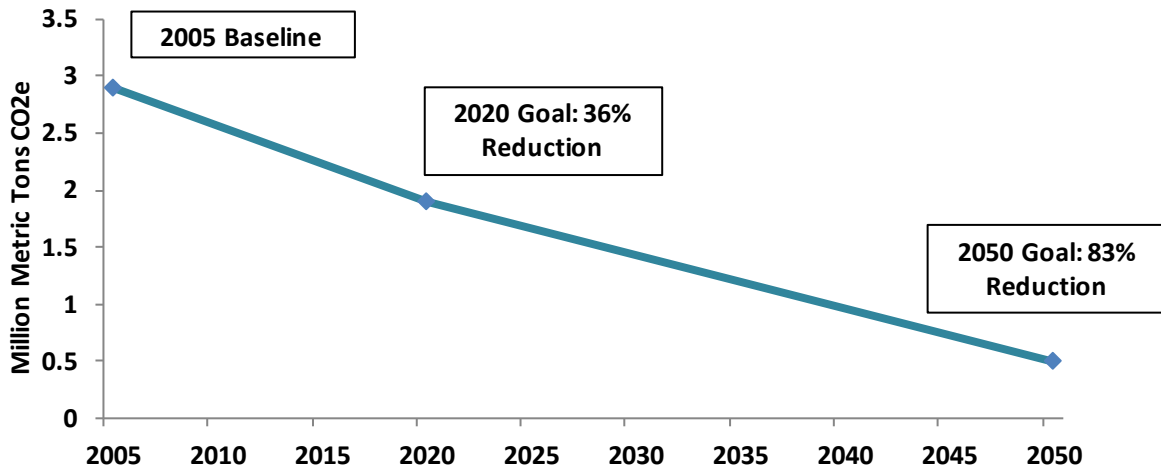
In recent years, local and regional governments across the world have been working to unify the approach to reducing GHG emissions. The City of Oakland has signed onto several of these efforts as part of its commitment, including the following:

- **Compact of Mayors** - Launched at the 2014 United Nations Climate Summit, the Compact of Mayors is the world's largest coalition of city leaders addressing climate change by pledging to reduce their greenhouse gas emissions, tracking their progress and preparing for the impacts of climate change. Beginning with the City's joining the Compact in 2015, this agreement requires the City of Oakland to inventory and report GHG emissions at least every three years, disclose climate vulnerabilities within two years, and disclose climate hazards within one year.
- **Under 2 Memorandum of Understanding (Under 2 MOU)** - This agreement was signed by Mayor Libby Schaaf in Paris at the U.N. Climate Change Conference of Parties, on December 6, 2015. Each signatory commits to limit emissions to 80 to 95 percent below 1990 levels, or below two metric tons per capita, by 2050, which is the level of emission reduction believed necessary to limit global warming to less than 2°C by the end of this century.
- **Mayor's National Climate Action Agenda** – This U.S.-based coalition of leading cities addressing climate change through policy and advocacy was started in 2015, and serves as a platform for furthering GHG reduction policies at the local and national levels.

GHG Reduction Goals

In 2009, the Oakland City Council adopted GHG reduction goals of 36 percent fewer emissions by 2020 and 83 percent fewer emissions by 2050. In pursuit of these goals, and in consistence with agreements, such as the Compact of Mayors and the Under 2 MOU, Oakland has committed to report on city-wide emissions every two years and strategize for meeting the 2020 and 2050 goals. **Figure 1** illustrates these goals in GHG emissions.

Figure 1: Oakland GHG Reduction Goals



Co-Benefits: Enhancing Equity through GHG Reduction

The City of Oakland strives to make a more livable and equitable city for all. In pursuing reductions of GHG emissions, the City has adopted a strategy of focusing on the emissions that not only contribute to climate change, but also create or exacerbate health, equity, and safety impacts for low income residents and communities of color. Examples of social benefits to be gained from GHG emissions reduction programs in Oakland include the following:

- Improved health outcomes, as indicated by measured rates of asthma and life expectancy, from air quality improvements in neighborhoods adjacent to freeways, industry, and the Port of Oakland
- Enhanced flood protection for low-lying neighborhoods resulting from lower runoff in the hill areas and reduced sea level rise
- Greater access to fresh and healthy foods to promote farmers markets, increase urban farming capacity, and better coordination among food providers
- Improved educational outcomes and experiences through collaboration with schools on water reduction, urban sustainability, and urban food growing efforts
- Lower utility bills and increased home comfort from energy efficiency retrofits of homes and apartments

In assessing new opportunities for programs and policies, the City actively considers these and other co-benefits to ensure that the approach to reducing emissions will also help address the health and equity of the community. While this Report is focused on GHG emissions rather than the co-benefits described above, additional discussion and details on social and climate justice considerations can be found in the Oakland ECAP.

Core Emissions Summary

Core emissions are GHGs emitted within city limits, such as those resulting from use natural gas in homes or gasoline in cars. This is the typical method cities use, making comparisons from city to city easy. In 2015, core emissions equaled 2,497,088 metric tons of carbon dioxide equivalent (MT CO2e). As shown in **Figure 2**, 56.6 percent of core emissions were generated in the transportation and land use sectors of the community, including both vehicle emissions and stationary emitters such as the wastewater treatment plant. 33.4 percent of emissions came from buildings and energy use, including electricity and natural gas use in homes, businesses, and other buildings. 2.6 percent came from material consumption and waste, specifically from emissions associated with breakdown of biological landfill contributions from Oakland homes and businesses. Finally, 6.1 percent came from the Port of Oakland and just 1.3 percent from City government activities.

Figure 2: Core Emissions

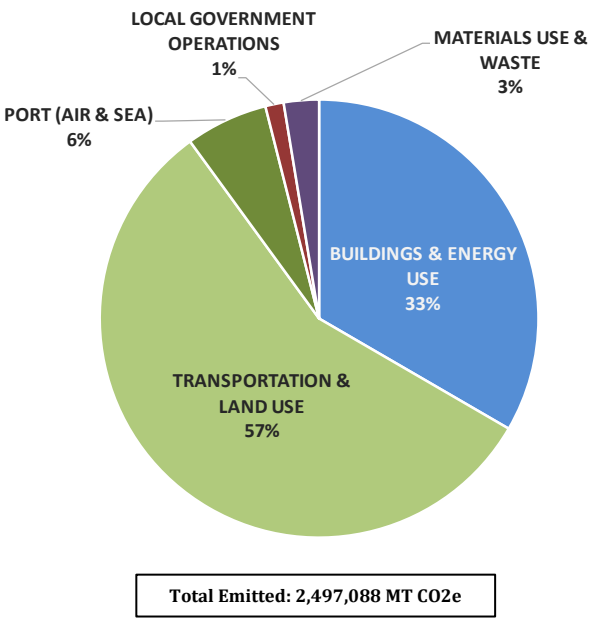
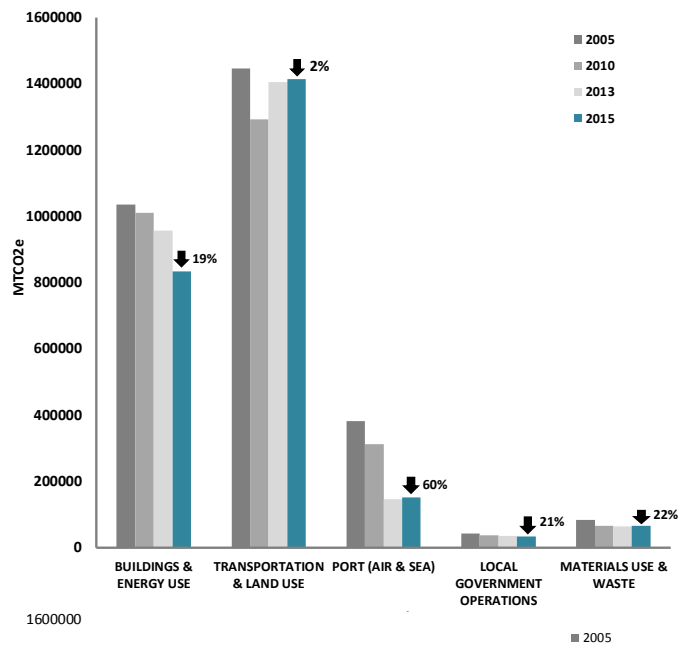


Figure 3: Core Emissions by Sector



Overall, core emissions are down in all activities compared to 2005. **Figure 3** provides details on the changes in core emissions since 2005, highlighting the areas in which emissions reductions have been achieved. It includes emissions associated with activities such as transportation, building energy and water use, solid waste, operating the sea and air ports, and operating the local government. The largest percentage reductions come from solid waste (22 percent reduction), maritime and airport operation (60 percent reduction), and local government operations (21 percent reduction). Overall, core emissions are 16.4% lower in 2015 than in 2005.

Consumption Emissions Summary

Consumption emissions are lifecycle GHGs emitted due to activities occurring within city limits, such as those required to produce, ship, and dispose of goods. In 2015, Oakland’s consumption emissions equaled 7,482,738 metric tons of carbon dioxide equivalent (MT CO₂e). This is more than double the core emissions shown on the previous page. As shown in **Figure 4**, 24 percent of these emissions were generated in the transportation and land use sectors of the community, compared to 56.6 percent in the core emissions analysis. 15.8 percent of emissions came from buildings and energy use, compared to 33.4 percent in the core analysis. Material consumption and waste emissions changed the most dramatically, increasing from 2.6 percent in the core analysis to 45 percent in the consumption analysis. This is due to the inclusion of emissions associated with manufacturing, processing, packaging, and shipping of products consumed by those living and working in Oakland.

Figure 4: Consumption Emissions

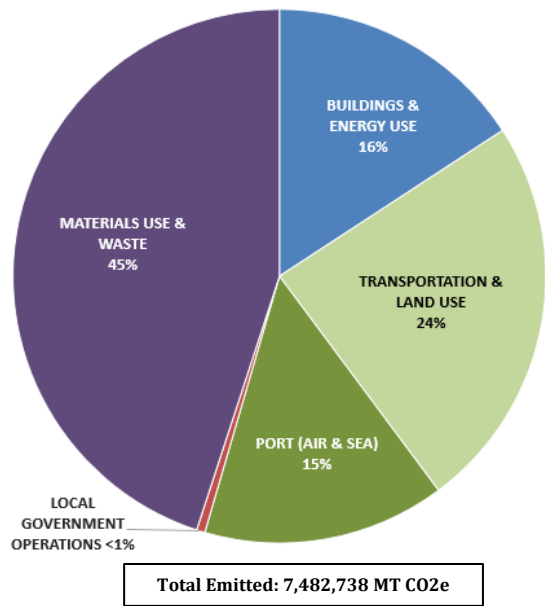
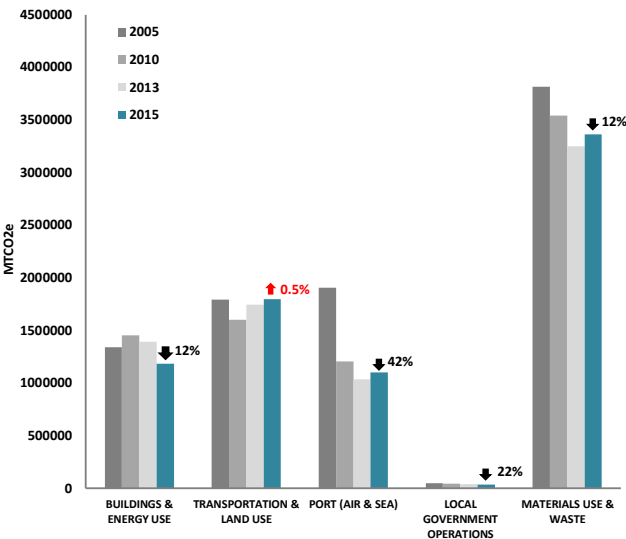


Figure 5: Consumption Emissions by Sector



The change in emissions associated with each sector is illustrated in **Figure 5**. This chart illustrates the changes in emissions associated with the same activities outlined in the core breakdown, but from a consumption perspective. Overall, consumption emissions are down in all activities except transportation and land use emissions, which are half a percent higher than in 2005. While population increases throughout the Bay area, there has been a corresponding increased number of vehicle miles traveled on Oakland’s roads. Population growth is a known driver of increased emissions. The largest percentage reductions come from material use and waste, sea and air port operation, and building and energy use.

Consumption emissions are higher than core emissions due to the addition of upstream emissions, which include all aspects of extracting raw materials, and manufacturing and shipping products to the community. In this analysis, the full impact of materials consumption and waste in Oakland’s emissions profile becomes apparent. It can be inferred from this the significant effect that a reduction in consumption, and particularly in the number of goods manufactured overseas and consumed in Oakland, would have on lowering GHG emissions.

As shown in **Figure 6**, there is significant difference in upstream emissions across these categories. Solid waste emissions, as described on the previous page, represent the largest difference between core and consumption emissions. However, differences are present in the port/airport, transportation/land use, and buildings/energy use categories as well. Local government operations do not have a significant difference between core and consumption emissions, and are approximately one percent of total emissions.

Both emissions summaries illustrate that the City has made substantial progress in reducing overall emissions, but additional progress is needed. **Figure 7** illustrates the progress made in meeting the emissions reduction goal from both the core and consumption approaches.

Figure 6: Core and Consumption Emissions by Category

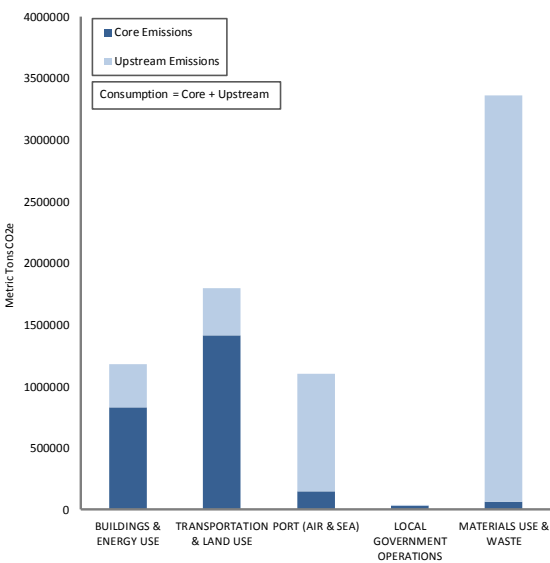
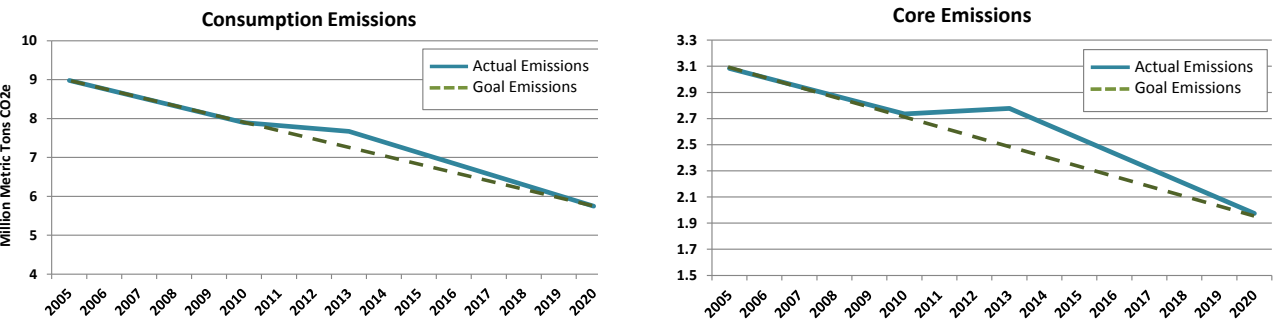


Figure 7: Core and Consumption Emissions Progress toward 2020 Goal

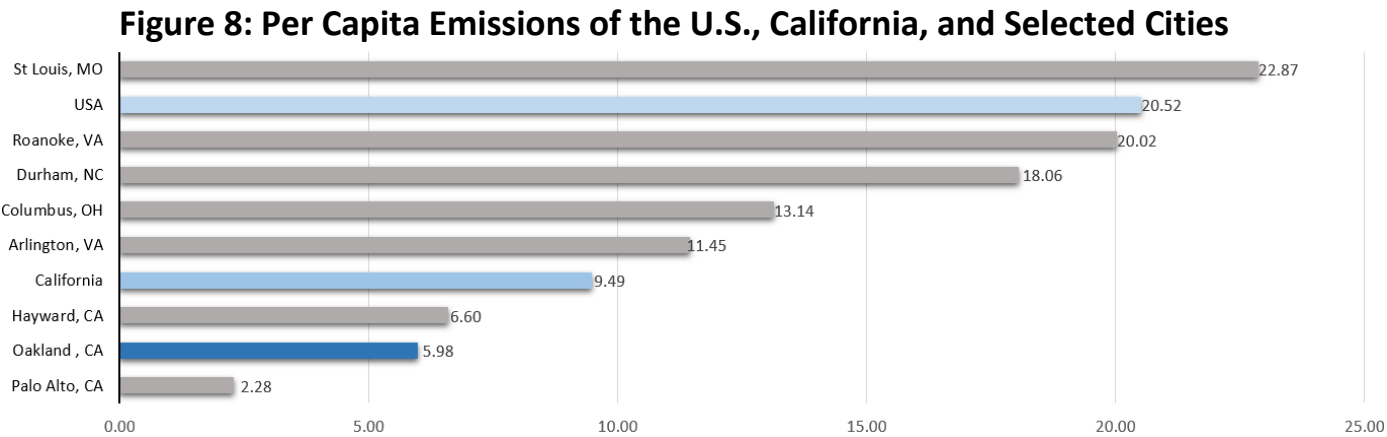


Core emissions are not on track to meet the 2020 goal, though they have been reduced more than sixteen percent since 2005. To meet this goal, Oakland must further reduce emissions by 585,000 MT

CO2e by 2020. Consumption emissions are also not on track to meet the 2020 goal, but have been reduced more than 16 percent since 2005, due largely to the City’s work in reducing waste-related emissions. To meet the 2020 goal from a consumption standpoint, Oakland must reduce emissions by 1,782,000 MT CO2e by 2020.

Per Capita Emissions Comparison to Other Cities

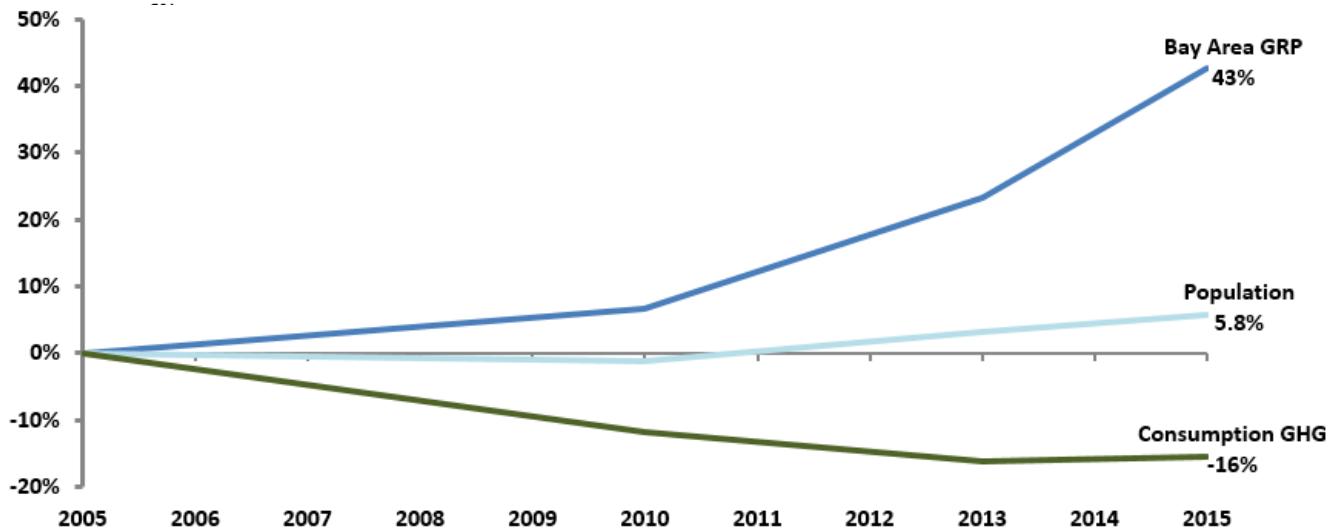
Another method of understanding GHG emissions is by comparison of per capita emissions, showing the rate of emissions per person in the community. This type of comparison allows cities of different sizes to compare emissions, while also ensuring that emissions are counted using a consistent methodology. As shown in **Figure 8**, 2015 per capita core emissions for the City of Oakland are very low by national standards, averaging 5.90MT CO2e, **46 percent lower than the California average and 71 percent lower than the national average.**



Emissions Relative to Economic Growth

The rate of emissions is also trending downward during a time of overall economic growth. Between the baseline year of 2005 and the inventory year of 2015, the population of the city grew by 5.8 percent. While no specific Oakland economic activity numbers are available, the Gross Regional Product, a composite figure representing overall economic activity in the Bay Area, also increased by 43 percent over the same time frame. This indicates that the community is finding ways to reduce its emissions even as more people live and work in Oakland. **Figure 9** illustrates the reduction in emissions relative to economic and population growth.

Figure 9: Emissions Reductions with Economic and Population Growth



Conclusions

Oakland has made substantial progress in reducing GHG emissions across the city. While much work remains to be done to meet the City's 2020 goal, the City has set in place a wide variety of programs, policies, and efforts that have proven successful in lowering its carbon footprint. In its ongoing implementation of the ECAP, the City will continue this progress and capitalize on the opportunities presented to lower emissions, while continuing to grow and prosper. The ability of City government to work with residents, businesses, coalitions, and community advocates will increase the likelihood that the City's ambitious goals are met.

Consistent with the Compact of Mayors and the Under 2 MOU, the City of Oakland is committed to reporting on its GHG emissions every two years, using protocols agreed to by the international community and consistent with the best practices in the industry. The City's ongoing focus on equity as a priority in targeting emissions reductions strategies will serve to further strengthen the community, while addressing its environmental priorities, and ensure that the resources invested in fighting climate change also help support climate justice.

With the progress identified in this GHG Emissions Inventory Report, the City of Oakland is well positioned to pursue its targets and continue to report its progress to the community in a timely manner.

Appendix A

GHG Emissions Data and Methodology

Table of Contents

Emissions Data and Methodology Overview	13
Reporting Protocol	13
Demographics of Oakland	14
Data Sources	15
Core Inventories.....	16
Consumption Inventories.....	20

List of Tables

Table 1: Demographics	14
Table 2: Sources by Activity	15
Table 3: 2005 Core Inventory – Community and Local Government	16
Table 4: 2010 Core Inventory – Community and Local Government	17
Table 5: 2013 Core Inventory – Community and Local Government	18
Table 6: 2015 Core Inventory – Community and Local Government	19
Table 7: 2005 Consumption Inventory – Community.....	20
Table 8: 2005 Consumption Inventory – Local Government Operations.....	21
Table 9: 2010 Consumption Inventory – Community.....	22
Table 10: 2010 Consumption Inventory – Local Government Operations.....	23
Table 11: 2013 Consumption Inventory – Community.....	24
Table 12: 2013 Consumption Inventory – Local Government Operations	25
Table 13: 2015 Consumption Inventory – Community	26
Table 14: 2015 Consumption Inventory – Local Government Operations	27

Emissions Data and Methodology Overview

The updates to the 2005, 2010, and 2013 GHG Emissions Inventories, and the newly created 2015 Inventory, were conducted following a review of similar inventories in U.S. cities, discussions and guidance from ICLEI Local Governments for Sustainability, and in coordination with a wide range of local and regional partners who maintain data necessary to complete a comprehensive analysis. This appendix sets forth the details regarding how each of the inventories were completed, the sources and details of the data used, and the demographic information used in completing the analysis.

Following the presentation of demographics and data sources used in the inventories, tables are provided showing the raw data, emissions in each of the major categories, and total carbon dioxide equivalent (CO₂e) emissions for each activity type. These files are summaries of a broader range of inputs associated with the emissions model used. For more information on the model files, please contact the Environmental Services Division of Oakland Public Works.

Reporting Protocol

The City of Oakland used ICLEI U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions Version 1.1 as the overarching inventory methodology. ICLEI's ClearPath tool was used for many calculations and as a database. When applicable, updates were made per instruction from sources used within ICLEI protocol. The City has committed to measuring progress on a regular basis through various programs including the Compact of Mayors, Under 2 MOU, and the Mayor's National Climate Action Agenda. Per these requirements, the Core Inventory was also analyzed using the Global Protocol for Community-Scale Emissions (GPC). Both versions have been published and shared through the Compact of Mayors and *Carbourn*.

Demographics of Oakland

Table 1: Demographics

	2000 Census		2010 Census		2013 ACS Estimates		2015 ACS Estimates		% Increase
	#	% of Total	#	% of Total	#	% of Total	#	% of Total	from 2005
Population									
Population	397,931		390,724		407,667		419,278		5%
Race & Ethnicity									
White Alone	124,829	31.4%	134,800	34.5%	160,621	39.4%	154,160	36.8%	23%
Black or African American Alone	141,538	35.6%	109,403	28.0%	110,070	27.0%	104,481	24.9%	-26%
American Indian or Alaska Native Alone	2,639	0.7%	3,126	0.8%	2,854	0.7%	3,540	0.8%	34%
Asian Alone	60,805	15.3%	65,642	16.8%	67,265	16.5%	64,168	15.3%	6%
Native Hawaiian and Other Pacific Islander Alone	1,995	0.5%	2,344	0.6%	2,446	0.6%	1,756	0.4%	-12%
Two or More Races	19,843	5.0%	21,881	5.6%	23,237	5.7%	25,914	6.2%	31%
Hispanic or Latino (of any race)	86,954	21.9%	99,244	25.4%	104,770	25.7%	114,054	27.2%	31%
Housing									
Housing Units	157,508		169,710		170,977		169,213		7%
Households	150,790		155,918				161,104		7%
Persons per Household	2.52		2.47		2.52		2.56		2%

Data Sources

Table 2: Sources by Activity

Activity	Core Sources	Upstream Sources
Buildings and Energy Use		
Residential Energy	Pacific Gas & Electric	ICLEI, Pacific Gas & Electric
Commercial Energy	Pacific Gas & Electric	ICLEI, Pacific Gas & Electric
Industrial Energy	Unable to Include - CPUC 15/15 Rule*	Unable to Include - CPUC 15/15 Rule*
Water and Wastewater	East Bay Municipal Utilitiy District	---
Transportation and Mobile Sources		
State Highway Gasoline	Highway Performance Monitoring system, Air Resources Board EMFAC Database	GREET - Argonne National Laboratory
State Highway Diesel	Highway Performance Monitoring system, Air Resources Board EMFAC Database, Onthemap Census	GREET - Argonne National Laboratory
On-Road Gasoline	Metropolitan Transportaion Commission	GREET - Argonne National Laboratory
On-Road Diesel	Metropolitan Transportaion Commission	GREET - Argonne National Laboratory
Airport & Sea Port	Oakland Airport Monthly Reports, Port of Oakland GHG Inventory	GREET - Argonne National Laboratory <i>Sea Port: Unable to include</i>
Public Transit	Union Pacific Railroad GHG Inventory, National Transit Database, Bay Area Rapid Transit, Alameda-Contra Costa Transit, Water Emergency Transportation Authority, Amtrak, Onthemap Census	---
Materials Use & Waste		
Solid Waste	CalRecycle, StopWaste, Alameda County Waste Characterization	EPA WARM Model
Upstream Goods & Services	---	Cool Climate Calculator, UC Berkeley
Construction Upstream	---	Census Building Permit Data, EIO-LCA

* The 15/15 Rule states that an aggregation sample must have more than 15 customers and no single customer's data may comprise more than 15% of the total aggregated data in order for the data to be released.

Core Inventories

Table 3: 2005 Core Inventory – Community and Local Government

2005 Core Emissions	"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oak
Buildings & Energy Use							1,034,747
Residential Energy							496,715
Grid Electricity	669,162,847	kWh	2,283,800	148,474	9.106	3.339	149,696
Natural Gas Consumption	65,260,095	Therm	6,526,000	346,009	32.630	0.653	347,019
Commercial Energy							526,672
Grid Electricity	1,156,040,831	kWh	3,945,500	256,502	15.731	5.768	258,614
Natural Gas Consumption	50,410,690	Therm	5,041,100	267,277	25.205	0.504	268,058
Water and Wastewater				5,102	37.821	0.314	11,360
Transportation & Mobile Sources							1,827,200
Airport	146,619,264	Gallons	1,858,338	146,427	1.189	0.542	146,618
Jet Fuel	135,758,578	Gallons	1,689,400	134,728	-	0.524	134,884
Passenger	135,758,578	Gallons	1,689,400	134,728	-	0.524	134,884
Aviation Fuel	10,860,686	Gallons	168,938	11,699	1.189	0.019	11,734
Passenger	10,860,686	Gallons	168,938	11,699	1.189	0.019	11,734
Public Transit							39,652
BART	289,071,795	kWh	226,916	14,752	0.095	0.332	14,873
AC Transit	1,691,534	gallons diesel	233,593	17,271	--	--	17,271
Union Pacific Rail	2,755	route miles in C	--	--	--	--	5,100
WETA Ferry	506,700	gallons	17,493	1,293	0.094	0.033	1,306
Amtrak	106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline							538,168
Gasoline Tailpipe Emissions:	1,341,112,334	VMT	7,609,500	534,492	20.066	10.652	538,168
Passenger Vehicles	97.1% 1,301,670,289	VMT	7,385,705	518,773	19.476	10.339	522,341
Light-Duty Truck	2.2% 28,889,375	VMT	163,919	11,514	0.432	0.229	11,593
Heavy-Duty Truck	0.02% 334,801	VMT	1,900	133	0.005	0.003	134
State Highway Diesel							21,122
Diesel Tailpipe Emissions:	30,878,866	VMT	285,495	21,108	0.036	0.045	21,122
Passenger Vehicles	23.6% 7,277,291	VMT	67,283	4,975	0.009	0.011	4,978
Light-Duty Truck	48.3% 14,924,218	VMT	137,984	10,202	0.018	0.022	10,209
Heavy-Duty Truck	8.3% 2,571,881	VMT	23,779	1,758	0.003	0.004	1,759
On-Road Gasoline							598,518
Gasoline Tailpipe Emissions:			8,463,100	594,446	21.995	11.821	598,518
On-Road Diesel							248,122
Diesel Tailpipe Emissions:			3,353,800	247,960	0.380	0.513	248,122
Port of Oakland				no data	no data	no data	235,000
Materials Use & Waste							82,977
Solid Waste	618,451	tons				3,258	82,977
Solid Waste from Franchise Haul	238,392	tons				1,762	45,571
Solid Waste from ADC	201,625	tons				497	12,414
Solid Waste from Self Haul	178,434	tons				1,000	24,992
TOTAL COMMUNITY							2,944,924
Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							21,998
Buildings and Facilities Electricity							14,635
Electric	65,458,807	kWh	223,409	14,524	0.891	0.327	14,635
Buildings and Facilities Natural Gas							7,363
Natural Gas	1,384,412	therms	138,441	7,340	0.692	0.014	7,363
Streetlight & Traffic Controllers							5,927
	26,507,507	kWh	90,469	5,882	0.361	0.132	5,927
Municipal Vehicle Fleet							10,577
Fleet: Diesel							2,628
Diesel	257,266	gallons	35,513	2,627	0.006	0.006	2,628
Fleet: Gasoline							7,519
Gasoline	852,674	gallons	106,542	7,487	0.181	0.103	7,519
Fleet: CNG							430
Compressed Natural Gas	62,117	gallons			0.476	0.033	430
Municipal Waste Generation							4,243
	10,411	tons					4,243
TOTAL LOCAL GOVERNMENT							42,745
TOTAL COMMUNITY AND LOCAL GOVERNMENT							2,987,669

Table 4: 2010 Core Inventory – Community and Local Government

2010 Core Emissions	"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to	
							Oak	
Buildings & Energy Use								1,010,526
Residential Energy								496,021
Grid Electricity	704,867,306	kWh	2,405,700	142,277	9.109	1.928		143,079
Natural Gas Consumption	66,373,978	Therm	6,637,400	351,915	33.187	0.664		352,942
Commercial Energy								503,282
Grid Electricity	1,226,636,428	kWh	4,186,500	247,595	15.852	3.355		248,991
Natural Gas Consumption	47,821,731	Therm	4,782,200	253,551	23.911	0.478		254,291
Water and Wastewater				5,034	37.373	0.310		11,223
Transportation & Mobile Sources								1,603,854
Airport	78,063,264	Gallons	971,419	76,682	0.529	0.286		76,781
Jet Fuel	72,027,503	Gallons	896,310	71,481	0.000	0.278		71,564
Passenger	72,027,503	Gallons	896,310	71,481	0.000	0.278		71,564
Aviation Fuel	6,035,761	Gallons	75,109	5,201	0.529	0.008		5,217
Passenger	6,035,761	Gallons	75,109	5,201	0.529	0.008		5,217
Public Transit								37,917
BART	267,635,305	kWh	210,089	12,425	0.795	0.168		12,495
AC Transit	1,804,039	gallons diesel	249,129	18,419	--	--		18,419
Union Pacific Rail	2,755	route miles in C	--	--	--	--		5,100
WETA Ferry	310,855	gallons	10,732	793	0.058	0.020		801
Amtrak	106,991	gallons diesel	14,775	1,092	0.086	0.028		1,103
State Highway Gasoline								468,930
Gasoline Tailpipe Emissions:	1,315,302,654	VMT	6,571,200	461,558	26.725	22.499		468,930
Passenger Vehicles	97.1% 1,276,619,669	VMT	6,377,941	447,984	25.939	21.837		455,139
Light-Duty Truck	2.2% 27,500,116	VMT	141,553	9,943	0.576	0.485		10,101
Heavy-Duty Truck	0.02% 6,865	VMT	1,640	115	0.007	0.006		117
State Highway Diesel								19,436
Diesel Tailpipe Emissions:	32,051,046	VMT	262,688	19,422	0.033	0.044		19,436
Passenger Vehicles	23.6% 7,553,542	VMT	61,908	4,577	0.008	0.010		4,581
Light-Duty Truck	48.3% 15,490,750	VMT	126,961	9,387	0.016	0.021		9,394
Heavy-Duty Truck	8.3% 2,669,511	VMT	21,879	1,618	0.003	0.004		1,619
On-Road Gasoline								562,175
Gasoline Tailpipe Emissions:			7,877,800	553,335	31.763	26.999		562,175
On-Road Diesel								203,615
Diesel Tailpipe Emissions:			2,752,200	203,480	0.310	0.427		203,615
Port of Oakland				no data	no data	no data		235,000
Materials Use & Waste								65,898
Solid Waste	555,970	tons				2,577		65,898
Solid Waste from Franchise Haul	184,786	tons				1,634		42,324
Solid Waste from ADC	264,995	tons				348		8,701
Solid Waste from Self Haul	106,189	tons				595		14,873
TOTAL COMMUNITY								2,680,278
Local Government Emissions			MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e	
Municipal Buildings & Facilities								23,324
Buildings and Facilities Electricity								14,030
Electric	69,133,236	kWh	235,950	13,954	0.893	0.189		14,030
Buildings and Facilities Natural Gas								9,294
Natural Gas	1,747,474	therms	174,747	9,265	0.874	0.017		9,294
Streetlight & Traffic Controllers								5,912
	29,132,671	kWh	99,429	5,880	0.376	0.080		5,912
Municipal Vehicle Fleet								6,643
Fleet: Diesel								2,383
Diesel	233,229	gallons	32,195	2,381	0.005	0.005		2,383
Fleet: Gasoline								3,776
Gasoline	426,173	gallons	53,250	3,742	0.126	0.116		3,776
Fleet: CNG								485
Compressed Natural Gas	70,000	gallons			0.537	0.038		485
Municipal Waste Generation								1,753
	7,439	tons						1,753
TOTAL LOCAL GOVERNMENT								37,632
TOTAL COMMUNITY AND LOCAL GOVERNMENT								2,717,911

Table 5: 2013 Core Inventory – Community and Local Government

2013 Core Emissions	"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oak
Buildings & Energy Use							956,096
Residential Energy							472,983
Grid Electricity	701,090,119	kWh	2,392,800	135,790	9.060	1.918	136,588
Natural Gas Consumption	63,262,073	Therm	6,326,200	335,416	31.631	0.633	336,395
Commercial Energy							473,596
Grid Electricity	1,187,906,499	kWh	4,054,300	230,079	15.351	3.249	231,431
Natural Gas Consumption	45,541,305	Therm	4,554,100	241,460	22.771	0.455	242,165
Water and Wastewater				5,084	31.782	0.313	9,517
Transportation & Mobile Sources							1,552,581
Airport	79,538,190	Gallons	989,773	78,170	0.513	0.292	78,270
Jet Fuel	73,688,026	Gallons	916,974	73,129	0.000	0.284	73,213
Passenger	73,688,026	Gallons	916,974	73,129	0.000	0.284	73,213
Aviation Fuel	5,850,164	Gallons	72,799	5,041	0.513	0.008	5,057
Passenger	5,850,164	Gallons	72,799	5,041	0.513	0.008	5,057
Public Transit							36,113
BART	279,617,965	kWh	200,409	13,291	0.759	0.161	13,358
AC Transit	1,525,069	gallons diesel	210,605	15,571	0.033	0.031	15,581
Union Pacific Rail	2,755	route miles in C	--	--	--	--	5,100
WETA Ferry	377,090	gallons	13,019	963	0.070	0.025	972
Amtrak	106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline							574,370
Gasoline Tailpipe Emissions:	1,642,134,179	VMT	8,046,200	565,168	33.383	28.078	574,370
Passenger Vehicles	97.1% 1,593,839,097	VMT	7,809,562	548,546	32.401	27.252	557,478
Light-Duty Truck	2.2% 35,373,793	VMT	173,326	12,174	0.719	0.605	12,373
Heavy-Duty Truck	0.02% 409,949	VMT	2,009	141	0.008	0.007	143
State Highway Diesel							24,196
Diesel Tailpipe Emissions:	42,238,621	VMT	327,017	24,178	0.043	0.057	24,196
Passenger Vehicles	23.6% 9,954,470	VMT	77,069	5,698	0.010	0.014	5,702
Light-Duty Truck	48.3% 20,414,557	VMT	158,052	11,686	0.021	0.028	11,694
Heavy-Duty Truck	8.3% 3,518,028	VMT	27,237	2,014	0.004	0.005	2,015
On-Road Gasoline	1,601,507,858	VMT					556,044
Gasoline Tailpipe Emissions:			7,789,400	547,130	32.030	27.226	556,044
On-Road Diesel	267,886,223	VMT					215,348
Diesel Tailpipe Emissions:			2,910,700	215,202	0.340	0.460	215,348
Port of Oakland				67,792	1.000	6.000	68,240
Materials Use & Waste							63,205
Solid Waste	568,713	tons				3,239	63,205
Solid Waste from Franchise Haul	185,690	tons				2,254	38,573
Solid Waste from ADC	271,074	tons				358	8,953
Solid Waste from Self Haul	111,949	tons				627	15,680
TOTAL COMMUNITY							2,571,882
Local Government Emissions			MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							22,386
Buildings and Facilities Electricity							13,373
Electric	68,660,589	kWh	234,336	13,298	0.887	0.188	13,373
Buildings and Facilities Natural Gas							9,013
Natural Gas	1,694,597	therms	169,459	8,985	0.847	0.017	9,013
Streetlight & Traffic Controllers							5,127
	26,321,865	kWh	89,836	5,098	0.340	0.072	5,127
Municipal Vehicle Fleet							5,194
Fleet: Diesel							1,295
Diesel	126,764	gallons	17,499	1,294	0.003	0.003	1,295
Fleet: Gasoline							3,328
Gasoline	374,700	gallons	46,819	3,290	0.141	0.130	3,328
Fleet: CNG							571
Compressed Natural Gas	80,000	gallons		525	0.980	0.069	571
Municipal Waste Generation							2,305
	5,655	tons			82.307		2,305
TOTAL LOCAL GOVERNMENT							35,011
TOTAL COMMUNITY AND LOCAL GOVERNMENT							2,606,893

Table 6: 2015 Core Inventory – Community and Local Government

2015 Core Emissions	"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oak
Buildings & Energy Use							833,582
Residential Energy							413,953
Grid Electricity	667,931,952	kWh	2,279,600	129,974	10.028	1.212	130,586
Natural Gas Consumption	53,289,645	Therm	5,329,000	282,542	26.645	0.533	283,367
Commercial Energy							410,285
Grid Electricity	1,163,270,504	kWh	3,970,200	226,362	17.465	2.111	227,428
Natural Gas Consumption	34,387,860	Therm	3,438,800	182,324	17.194	0.344	182,857
Water and Wastewater				5,365	31.204	0.330	9,344
Transportation & Mobile Sources							1,565,115
Airport	85,782,051	Gallons	1,054,090	83,241	0.551	0.311	83,348
Jet Fuel	79,409,988	Gallons	975,790	77,819	0.000	0.302	77,909
Passenger	79,409,988	Gallons	975,790	77,819	0.000	0.302	77,909
Aviation Fuel	6,372,063	Gallons	78,300	5,422	0.551	0.009	5,439
Passenger	6,372,063	Gallons	78,300	5,422	0.551	0.009	5,439
Public Transit							39,302
BART	273,220,484	kWh	223,798	12,760	0.985	0.119	12,820
AC Transit	1,564,357	gallons diesel	216,030	15,972	0.036	0.034	15,983
Union Pacific Rail	2,755	route miles in C.	--	--	--	--	8,157
WETA Ferry	481,101	gallons	16,609	1,228	0.089	0.031	1,240
Amtrak	106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline							574,259
Gasoline Tailpipe Emissions:	1,670,071,447	VMT	8,010,600	563,488	32.804	39.826	574,259
Passenger Vehicles	97.3% 1,624,979,518	VMT	7,794,314	548,274	31.918	38.751	558,754
Light-Duty Truck	1.9% 31,731,357	VMT	152,201	10,706	0.623	0.757	10,911
Heavy-Duty Truck	0.03% 501,021	VMT	2,403	169	0.010	0.012	172
State Highway Diesel							25,335
Diesel Tailpipe Emissions:	43,902,853	VMT	342,409	25,316	0.045	0.061	25,335
Passenger Vehicles	26.8% 11,765,965	VMT	91,766	6,785	0.012	0.016	6,790
Light-Duty Truck	47.8% 20,985,564	VMT	163,672	12,101	0.022	0.029	12,110
Heavy-Duty Truck	8.3% 3,656,641	VMT	28,519	2,109	0.004	0.005	2,110
On-Road Gasoline	1,627,422,538	VMT					555,741
Gasoline Tailpipe Emissions:			7,764,400	545,373	32.548	32.060	555,741
On-Road Diesel	270,905,409	VMT					218,890
Diesel Tailpipe Emissions:			2,958,600	218,741	0.350	0.470	218,890
Port of Oakland				67,792	1.000	6.000	68,240
Materials Use & Waste							64,727
Solid Waste	567,026	tons				2,258	64,727
Solid Waste from Franchise Haul	184,717	tons				1,514	37,302
Solid Waste from ADC	268,685	tons				345	8,953
Solid Waste from Self Haul	113,624	tons				399	15,680
Transportation from Solid Waste							2,792
TOTAL COMMUNITY							2,463,424
Local Government Emissions			MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							22,412
Buildings and Facilities Electricity							15,052
Electric	76,995,007	kWh	262,782	14,983	1.156	0.140	15,052
Buildings and Facilities Natural Gas							7,360
Natural Gas	1,694,597	therms	138,378	7,337	0.692	0.014	7,360
Streetlight & Traffic Controllers							3,721
	19,031,777	kWh	64,955	3,703	0.286	0.035	3,721
Municipal Vehicle Fleet							6,468
Fleet: Diesel							2,350
Diesel	230,000	gallons	31,749	2,348	0.005	0.005	2,350
Fleet: Gasoline							3,551
Gasoline	396,000	gallons	49,480	3,477	0.892	0.185	3,551
Fleet: CNG							568
Compressed Natural Gas	80,000	gallons		525	0.889	0.066	568
Municipal Waste Generation							1,063
	5,655	tons			37.975		1,063
TOTAL LOCAL GOVERNMENT							33,664
TOTAL COMMUNITY AND LOCAL GOVERNMENT							2,497,088

Consumption Inventories

Table 7: 2005 Consumption Inventory – Community

							MTCO2e attributed to	
2005 Consumption Emissions		"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	Oakland
Buildings & Energy Use								1,341,782
Residential Energy								636,778
Grid Electricity	669,162,847	kWh		2,283,800	148,474	9.106	3.339	149,696
Natural Gas Consumption	65,260,095	Therm		6,526,000	346,009	32.630	0.653	347,019
Upstream Electric Generation Emissions								48,783
Upstream Natural Gas Germeration Emissions								78,688
Transmission Losses	61,796,724	kWh		211,701	12,520	0.802	0.170	12,591
Commercial Energy								693,644
Grid Electricity	1,156,040,831	kWh		3,945,500	256,502	15.731	5.768	258,614
Natural Gas Consumption	50,410,690	Therm		5,041,100	267,277	25.205	0.504	268,058
Upstream Electric Generation Emissions								84,278
Upstream Natural Gas Generation Emissions								60,783
Transmission Losses	107,540,968	kWh		368,410	21,788	1.395	0.295	21,911
Water and Wastewater					5,102	37.821	0.314	11,360
Transportation & Mobile Sources								3,701,675
Airport								1,671,027
Jet Fuel	35,195,411	Gallons		1,689,400	134,728	0.000	0.524	1,667,117
Passenger	14,078,164	Gallons		16,291,000	1,299,200	0.000	5.050	1,300,700
Freight	3,519,541	Gallons		4,072,800	324,802	0.000	1.263	325,179
Total Jet Fuel Upstream	17,597,706	Gallons			29,514	0.442	262	41,238
Aviation Fuel	48,641	Gallons		56,287	3,898	0.397	0.006	3,910
Passenger	38,913	Gallons		45,030	3,118	0.317	0.005	3,128
Freight	9,728	Gallons		11,257	780	0.080	0.001	782
Public Transit								39,652
BART	289,071,795	kWh		226,916	14,752	0.095	0.332	14,873
AC Transit	1,691,534	gallons diesel		233,593	17,271	--	--	17,271
Union Pacific Rail	2,755	route miles in CA	--	--	--	--	--	5,100
WETA Ferry	506,700	gallons		17,493	1,293	0.094	0.033	1,306
Amtrak	106,991	gallons diesel		14,775	1,092	0.086	0.028	1,103
State Highway Gasoline								679,219
Gasoline Tailpipe Emissions:	1,341,112,334	VMT		7,609,500	534,492	20.066	10.652	538,168
Passenger Vehicles	97.1%	1,301,670,289	VMT	7,385,705	518,773	19.476	10.339	522,341
Light-Duty Truck	2.2%	28,889,375	VMT	163,919	11,514	0.432	0.229	11,593
Heavy-Duty Truck	0.02%	334,801	VMT	1,900	133	0.005	0.003	134
Gasoline Well to Pump Emissions:					127,640	2.050	1,145	141,051
Passenger Vehicles	97.1%				123,887	1.989	1,111	136,903
Light-Duty Truck	2.2%				2,750	0.044	25	3,038
Heavy-Duty Truck	0.02%				32	0.001	0.286	35
State Highway Diesel								25,211
Diesel Tailpipe Emissions:	30,878,866	VMT		285,495	21,108	0.036	0.045	21,122
Passenger Vehicles	23.6%	7,277,291	VMT	67,283	4,975	0.009	0.011	4,978
Light-Duty Truck	48.3%	14,924,218	VMT	137,984	10,202	0.018	0.022	10,209
Heavy-Duty Truck	8.3%	2,571,881	VMT	23,779	1,758	0.003	0.004	1,759
Diesel Well to Pump Emissions:					3,112	0.047	38.545	4,089
Passenger Vehicles	23.6%				733	0.011	9.084	964
Light-Duty Truck	48.3%				1,504	0.023	18.629	1,976
Heavy-Duty Truck	8.3%				259	0.004	3.210	341
On-Road Gasoline		1,496,269,740	VMT	8,463,100	722,086	24.045	1,157	755,392
Gasoline Tailpipe Emissions:				8,463,100	594,446	21.995	11.821	598,518
Gasoline Well to Pump Emissions (currently allocate 100% passenger cars)					127,640	2.050	1,145	156,874
On-Road Diesel		297,989,532	VMT	3,353,800	284,513	0.933	453	296,174
Diesel Tailpipe Emissions:				3,353,800	247,960	0.380	0.513	248,122
Diesel Well to Pump Emissions: (currently allocate 100% freight vehicles)					36,553	0.553	453	48,052
Port of Oakland					no data	no data	no data	235,000
Materials Use & Waste								3,815,248
Solid Waste								1,408,762
Landfill Methane	618,451	tons					3,258	82,977
Upstream from Franchise Hauled Waste	238,392	tons						650,421
Upstream from Self-Hauled Waste	142,747	tons						325,963
Upstream from Alternate Daily Cover	201,625	tons						284,274
Upstream Recycling	43,901	tons						56,374
Upstream Compost	39,495	tons						8,755
Upstream of Goods & Food								2,241,486
Goods	7.534	MTCO2e/Household						1,029,996
Food	8.039	MTCO2e/Household						1,211,490
Construction Upstream Emissions								165,000
Construction	252	New Buildings						165,000
TOTAL COMMUNITY								8,858,704
TOTAL COMMUNITY AND LOCAL GOVERNMENT								8,907,638

Table 8: 2005 Consumption Inventory – Local Government Operations

2005 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							28,005
Buildings and Facilities Electricity							18,973
Electric	65,458,807	kWh	223,409	14,524	0.891	0.327	14,635
Upstream Electric							4,338
Buildings and Facilities Natural Gas							9,032
Natural Gas	1,384,412	therms	138,441	7,340	0.692	0.014	7,363
Upstream Natural Gas							1,669
Streetlight & Traffic Controllers							5,927
	26,507,507	kWh	90,469	5,882	0.361	0.132	5,927
Municipal Vehicle Fleet							10,759
Fleet: Diesel							2,688
Diesel	257,266	gallons	35,513	2,627	0.006	0.006	2,628
Upstream Diesel				46	0.007	0.516	59
Fleet: Gasoline							7,634
Gasoline	852,674	gallons	106,542	7,487	0.181	0.103	7,519
Upstream Gasoline				84	0.002	1.428	115
Fleet: CNG							438
Compressed Natural Gas	62,117	gallons	7764.600	407.870	0.476	0.033	430
Upstream CNR				4.194	0.001	0.158	8
Municipal Waste Generation							4,243
	10,411	tons			151.53		
TOTAL LOCAL GOVERNMENT							48,934

Table 9: 2010 Consumption Inventory – Community

2010 Consumption Emissions							MTCO2e attributed to
"raw" data							Oakland
Buildings & Energy Use							1,454,119
Residential Energy							687,685
Grid Electricity	704,867,306	kWh	2,405,700	142,277	9.109	1.928	143,079
Natural Gas Consumption	66,373,978	Therm	6,637,400	351,915	33.187	0.664	352,942
Upstream Electric Generation Emissions							99,042
Upstream Natural Gas Generation Emissions							80,031
Transmission Losses	61,796,724	kWh	211,701	12,520	0.802	0.170	12,591
Commercial Energy							755,211
Grid Electricity	1,226,636,428	kWh	4,186,500	247,595	15.852	3.355	248,991
Natural Gas Consumption	47,821,731	Therm	4,782,200	253,551	23.911	0.478	254,291
Upstream Electric Generation Emissions							172,356
Upstream Natural Gas Generation Emissions							57,662
Transmission Losses	107,540,968	kWh	368,410	21,788	1.395	0.295	21,911
Water and Wastewater							11,223
Transportation & Mobile Sources							2,809,909
Airport							972,592
Jet Fuel	18,673,130	Gallons	10,804,100	876,991	0.168	139.9	886,167
Passenger	7,469,252	Gallons	8,643,300	689,303	-	2.379	690,102
Freight	1,867,313	Gallons	2,160,800	172,326	-	0.670	172,525
Total Jet Fuel Upstream	9,336,565	Gallons		15,362	0.168	136.8	23,540
Aviation Fuel	782,385	Gallons	905,364	62,696	6.374	0.100	62,885
Passenger	625,908	Gallons	724,291	50,157	5.099	0.080	50,308
Freight	156,477	Gallons	181,073	12,539	1.275	0.020	12,577
Public Transit							37,917
BART	267,635,305	kWh	210,089	12,425	0.795	0.168	12,495
AC Transit	1,804,039	gallons diesel	249,129	18,419	--	--	18,419
Union Pacific Rail	2,755	route miles in CA	--	--	--	--	5,100
WETA Ferry	310,855	gallons	10,732	793	0.058	0.020	801
Amtrak	106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline							590,440
Gasoline Tailpipe Emissions:	1,315,302,654	VMT	6,571,200	461,558	26.725	22.499	468,930
Passenger Vehicles	97.1%	1,276,619,669	VMT	6,377,941	447,984	25.939	455,139
Light-Duty Truck	2.2%	28,333,400	VMT	141,553	9,943	0.576	10,101
Heavy-Duty Truck	0.02%	328,358	VMT	1,640	115	0.007	117
Gasoline Well to Pump Emissions:				98,857	1.394	890	121,510
Passenger Vehicles	97.1%			95,950	1.353	863	117,936
Light-Duty Truck	2.2%			2,130	0.030	19.161	2,617
Heavy-Duty Truck	0.02%			25	0.000	0.222	30
State Highway Diesel							23,189
Diesel Tailpipe Emissions:	32,051,046	VMT	262,688	19,422	0.033	0.044	19,436
Passenger Vehicles	23.6%	7,553,542	VMT	61,908	4,577	0.008	4,581
Light-Duty Truck	48.3%	15,490,750	VMT	126,961	9,387	0.016	9,394
Heavy-Duty Truck	8.3%	2,669,511	VMT	21,879	1,618	0.003	1,619
Diesel Well to Pump Emissions:				2,853	0.036	35.492	3,753
Passenger Vehicles	23.6%			672	0.008	8.364	884
Light-Duty Truck	48.3%			1,379	0.017	17.154	1,814
Heavy-Duty Truck	8.3%			238	0.003	2.956	313
On-Road Gasoline							707,847
Gasoline Tailpipe Emissions:	1,588,160,052	VMT	7,877,800	671,849	33.435	1,093	707,847
Gasoline Well to Pump Emissions				553,335	31.763	26.999	562,175
(currently allocate 100% passenger cars)				118,514	1.672	1,066	145,672
On-Road Diesel							242,924
Diesel Tailpipe Emissions:	255,046,920	VMT	2,752,200	233,374	0.687	372	242,924
Diesel Well to Pump Emissions:				2,752,200	203,480	0.310	203,615
(currently allocate 100% freight vehicles)				29,894	0.377	372	39,309
Port of Oakland							235,000
Materials Use & Waste							3,543,252
Solid Waste							1,303,664
Landfill Methane	555,970	tons				2,577	65,898
Upstream from Franchise Hauled Waste	184,786	tons					493,829
Upstream from Self-Hauled Waste	84,951	tons					192,798
Upstream from Alternate Daily Cover	264,995	tons					482,846
Upstream Recycling	44,220	tons					56,783
Upstream Compost	48,757	tons					11,509
Upstream of Goods & Food							2,193,788
Goods	6.653	MTCO2e/Household					928,175
Food	8.229	MTCO2e/Household					1,265,613
Construction Upstream Emissions							45,800
Construction	156	New Buildings					45,800
TOTAL COMMUNITY							7,807,280
TOTAL COMMUNITY AND LOCAL GOVERNMENT							7,850,363

Table 10: 2010 Consumption Inventory – Local Government Operations

2010 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							27,231
Buildings and Facilities Electricity							15,830
Electric	69,133,236	kWh	235,950	13,954	0.893	0.189	14,030
Upstream Electric							1,800
Buildings and Facilities Natural Gas							11,401
Natural Gas	1,747,474	therms	174,747	9,265	0.874	0.017	9,294
Upstream Natural Gas							2,107
Streetlight & Traffic Controllers							5,912
	29,132,671	kWh	99,429	5,880	0.376	0.080	5,912
Municipal Vehicle Fleet							8,187
Fleet: Diesel							3,109
Diesel	233,229	gallons	32,195	2,381	0.005	0.005	2,383
Upstream Diesel				565	0.091	6.319	726
Fleet: Gasoline							4,594
Gasoline	426,173	gallons	53,250	3,742	0.126	0.116	3,776
Upstream Gasoline				601	0.012	10.161	818
Fleet: CNG							485
Compressed Natural Gas	70,000	gallons	8750.000	459.630	0.537	0.038	485
Upstream CNR							
Municipal Waste Generation							1,753
	7,439	tons			62.596		
TOTAL LOCAL GOVERNMENT							43,083

Table 11: 2013 Consumption Inventory – Community

2013 Consumption Emissions	"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oakland
Buildings & Energy Use							1,393,155
Residential Energy							662,589
Grid Electricity	701,090,119	kWh	2,392,800	135,790	9.060	1.918	136,588
Natural Gas Consumption	63,262,073	Therm	6,326,200	335,416	31.631	0.633	336,395
Upstream Electric Generation Emissions							99,292
Upstream Natural Gas Generation Emissions							76,279
Transmission Losses	61,465,572	kWh	210,566	13,964	0.797	0.169	14,035
Commercial Energy							721,049
Grid Electricity	1,187,906,499	kWh	4,054,300	230,079	15.351	3.249	231,431
Natural Gas Consumption	45,541,305	Therm	4,554,100	241,460	22.771	0.455	242,165
Upstream Electric Generation Emissions							168,761
Upstream Natural Gas Generation Emissions							54,912
Transmission Losses	104,145,460	kWh	356,777	23,661	1.351	0.286	23,780
Water and Wastewater				5,084	31.782	0.313	9,517
Transportation & Mobile Sources							2,780,834
Airport							967,450
Jet Fuel			11,053,200	897,145	0.172	143	906,499
Passenger	7,641,448	Gallons	8,842,600	705,194	-	2.741	706,011
Freight	1,910,362	Gallons	2,210,600	176,299	-	0.685	176,503
Total Jet Fuel Upstream	9,551,810	Gallons		15,652	0.172	139	23,985
Aviation Fuel			877,525	5,041	0.513	0.008	60,951
Passenger	606,662	Gallons	702,020	48,615	4.942	0.077	48,761
Freight	151,666	Gallons	175,505	12,154	1.236	0.019	12,190
Public Transit							36,113
BART	279,617,965	kWh	200,409	13,291	0.759	0.161	13,358
AC Transit	1,525,069	gallons diesel	210,605	15,571	0.033	0.031	15,581
Union Pacific Rail	2,755	route miles in CA	--	--	--	--	5,100
WETA Ferry	377,090	gallons	13,019	963	0.070	0.025	972
Amtrak	106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline							723,156
Gasoline Tailpipe Emissions:	1,642,134,179	VMT	8,046,200	565,168	33.383	28.078	574,370
Passenger Vehicles	97.1% 1,593,839,097	VMT	7,809,562	548,546	32.401	27.252	557,478
Light-Duty Truck	2.2% 35,373,793	VMT	173,326	12,174	0.719	0.605	12,373
Heavy-Duty Truck	0.02% 409,949	VMT	2,009	141	0.008	0.007	143
Gasoline Well to Pump Emissions:				121,047	1.707	1.089	148,786
Passenger Vehicles	97.1%			117,487	1.657	1.057	144,410
Light-Duty Truck	2.2%			2,608	0.037	23.462	3,205
Heavy-Duty Truck	0.02%			30	0.000	0.272	37
State Highway Diesel							28,865
Diesel Tailpipe Emissions:	42,238,621	VMT	327,017	24,178	0.043	0.057	24,196
Passenger Vehicles	23.6% 9,954,470	VMT	77,069	5,698	0.010	0.014	5,702
Light-Duty Truck	48.3% 20,414,557	VMT	158,052	11,686	0.021	0.028	11,694
Heavy-Duty Truck	8.3% 3,518,028	VMT	27,237	2,014	0.004	0.005	2,015
Diesel Well to Pump Emissions:				3,552	0.045	44.183	4,669
Passenger Vehicles	23.6%			837	0.011	10.413	1,100
Light-Duty Truck	48.3%			1,717	0.022	21.354	2,257
Heavy-Duty Truck	8.3%			296	0.004	3.680	389
On-Road Gasoline	1,601,507,858	VMT	7,789,400	664,314	34	1,082	700,094
Gasoline Tailpipe Emissions:			7,789,400	547,130	32.030	27.226	556,044
Gasoline Well to Pump Emissions				117,184	1.653	1,054	144,050
(currently allocate 100% passenger cars)							
On-Road Diesel	267,886,223	VMT	2,910,700	246,818	1	394	256,916
Diesel Tailpipe Emissions:			2,910,700	215,202	0.340	0.460	215,348
Diesel Well to Pump Emissions:				31,616	0.398	393	41,568
(currently allocate 100% freight vehicles)							
Port of Oakland				67,792	1	6	68,240
Materials Use & Waste							3,252,819
Solid Waste							1,245,812
Landfill Methane	568,713	tons				3,239	63,205
Upstream from Franchise Hauled Waste	169,190	tons					451,162
Upstream from Self-Hauled Waste	84,951	tons					203,125
Upstream from Alternate Daily Cover	264,995	tons					459,350
Upstream Recycling	44,800	tons					57,529
Upstream Compost	48,417	tons					11,441
Upstream of Goods & Food							1,947,907
Goods	5.916	MTCO2e/Household					830,713
Food	7.218	MTCO2e/Household					1,117,194
Construction Upstream Emissions							59,100
Construction	61	New Buildings					59,100
TOTAL COMMUNITY							7,426,808
TOTAL COMMUNITY AND LOCAL GOVERNMENT							7,467,640

Table 12: 2013 Consumption Emissions – Local Government Operations

2013 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							26,904
Buildings and Facilities Electricity							15,848
Electric	68,660,589	kWh	234,336	13,298	0.887	0.188	13,373
Upstream Electric							2,475
Buildings and Facilities Natural Gas							11,056
Natural Gas	1,694,597	therms	169,459	8,985	0.847	0.017	9,013
Upstream Natural Gas							2,043
Streetlight & Traffic Controllers							5,127
				5,098	0.340	0.072	5,127
Municipal Vehicle Fleet							6,497
Fleet: Diesel							1,690
Diesel	126,764	gallons	17,499	1,294	0.003	0.003	1,295
Upstream Diesel				307	0.049	3.434	395
Fleet: Gasoline							4,047
Gasoline	374,700	gallons	46,819	3,290	0.141	0.130	3,328
Upstream Gasoline				528	0.011	8.934	719
Fleet: CNG							760
Compressed Natural Gas	80,000	gallons	10000.000	525.290	0.980	0.069	571
Upstream CNR							
Municipal Waste Generation							2,305
	5,655	tons			82.307		2,305
TOTAL LOCAL GOVERNMENT							40,832

Table 13: 2015 Consumption Inventory – Community

2015 Consumption Emissions	"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oakland
Buildings & Energy Use							1,182,682
Residential Energy							566,809
Grid Electricity	667,931,952	kWh	2,279,600	129,974	10.028	1.212	130,586
Natural Gas Consumption	53,289,645	Therm	5,329,000	282,542	26.645	0.533	283,367
Upstream Electric Generation Emissions							77,109
Upstream Natural Gas Generation Emissions							64,255
Transmission Losses	58,558,548	kWh	200,608	11,438	0.882	0.107	11,492
Commercial Energy							606,530
Grid Electricity	1,163,270,504	kWh	3,970,200	226,362	17.465	2.111	227,428
Natural Gas Consumption	34,387,860	Therm	3,438,800	182,324	17.194	0.344	182,857
Upstream Electric Generation Emissions							134,767
Upstream Natural Gas Generation Emissions							41,464
Transmission Losses	101,985,587	kWh	349,378	19,920	1.537	0.186	20,014
Water and Wastewater				5,365	31.204	0.330	9,344
Transportation & Mobile Sources							2,934,934
Airport							1,032,373
Jet Fuel			11,911,500	960,525	0.190	172	965,984
Passenger	8,131,583	Gallons	9,529,200	759,954	-	2.954	760,834
Freight	2,032,896	Gallons	2,382,300	189,988	-	0.739	190,208
Total Jet Fuel Upstream	10,164,478	Gallons		10,583	0.190	169	14,942
Aviation Fuel			955,810	5,422	0.551	0.009	66,389
Passenger	652,499	Gallons	764,648	52,952	5.383	0.084	53,111
Freight	163,125	Gallons	191,162	13,238	1.346	0.021	13,278
Public Transit							39,302
BART	273,220,484	kWh	223,798	12,760	0.985	0.119	12,820
AC Transit	1,564,357	gallons diesel	216,030	15,972	0.036	0.034	15,983
Union Pacific Rail	2,755	route miles in CA	--	--	--	--	8,157
WETA Ferry	481,101	gallons	16,609	1,228	0.089	0.031	1,240
Amtrak	106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline							760,917
Gasoline Tailpipe Emissions:	1,670,071,447	VMT	8,010,600	563,488	39.826	32.804	574,259
Passenger Vehicles	97.1% 1,620,954,730	VMT	7,775,009	546,916	38.655	31.839	557,370
Light-Duty Truck	2.2% 35,975,600	VMT	172,559	12,138	0.858	0.707	12,370
Heavy-Duty Truck	0.02% 416,924	VMT	2,000	141	0.010	0.008	143
Gasoline Well to Pump Emissions:				140,618	22.630	1,572	186,658
Passenger Vehicles	97.1%			136,483	21.964	1,526	181,168
Light-Duty Truck	2.2%			3,029	0.487	33.867	4,021
Heavy-Duty Truck	0.02%			35	0.006	0.392	47
State Highway Diesel							30,854
Diesel Tailpipe Emissions:	43,902,853	VMT	342,409	25,316	0.045	0.061	25,335
Passenger Vehicles	23.6% 10,346,684	VMT	80,696	5,966	0.011	0.014	5,971
Light-Duty Truck	48.3% 21,218,906	VMT	165,491	12,236	0.022	0.029	12,245
Heavy-Duty Truck	8.3% 3,656,641	VMT	28,519	2,109	0.004	0.005	2,110
Diesel Well to Pump Emissions:				3,863	0.078	65.335	5,519
Passenger Vehicles	23.6%			910	0.018	15.398	1,301
Light-Duty Truck	48.3%			1,867	0.038	31.577	2,667
Heavy-Duty Truck	8.3%			322	0.007	5.442	460
On-Road Gasoline	1,627,422,538	VMT	7,764,400	681,669	54	1,556	736,661
Gasoline Tailpipe Emissions:			7,764,400	545,373	32.548	32.060	555,741
Gasoline Well to Pump Emissions				136,296	21.934	1,524	180,920
(currently allocate 100% passenger cars)							
On-Road Diesel	270,905,409	VMT	2,958,600	252,117	1	565	266,587
Diesel Tailpipe Emissions:			2,958,600	218,741	0.350	0.470	218,890
Diesel Well to Pump Emissions:				33,376	0.676	565	47,697
(currently allocate 100% freight vehicles)							
Port of Oakland				67,792	1	6	68,240
Materials Use & Waste							3,365,121
Solid Waste							1,171,141
Landfill Methane	567,026	tons				2,258	64,727
Upstream from Franchise Hauled Waste	180,428	tons					481,129
Upstream from Self-Hauled Waste	59,038	tons					133,900
Upstream from Alternate Daily Cover	249,277	tons					422,414
Upstream Recycling	50,000	tons					57,529
Upstream Compost	57,290	tons					11,441
Upstream of Goods & Food							2,069,981
Goods	6.048	MTCO2e/Household					883,927
Food	7.362	MTCO2e/Household					1,186,054
Construction Upstream Emissions							124,000
Construction	144	New Buildings					124,000
TOTAL COMMUNITY							7,482,738
TOTAL COMMUNITY AND LOCAL GOVERNMENT							7,520,929

Table 14: 2015 Consumption Emissions – Local Government Operations

2015 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							26,650
Buildings and Facilities Electricity							17,622
Electric	76,995,007	kWh	262,782	14,983	1.156	0.140	15,052
Upstream Electric							2,570
Buildings and Facilities Natural Gas							9,028
Natural Gas	1,383,777	therms	138,378	7,337	0.692	0.014	7,360
Upstream Natural Gas							1,669
Streetlight & Traffic Controllers							3,721
				3,703	0.286	0.035	3,721
Municipal Vehicle Fleet							6,757
Fleet: Diesel							1,690
Diesel	230,000	gallons	31,749	2,348	0.005	0.005	2,350
Upstream Diesel				557	6.231	0.090	716
Fleet: Gasoline							4,311
Gasoline	396,000	gallons	46,819	3,477	0.892	0.185	3,551
Upstream Gasoline				558	9.441	0.011	760
Fleet: CNG							757
Compressed Natural Gas	80,000	gallons	10000.000	525.290	0.889	0.066	568
Upstream CNR							
Municipal Waste Generation							1,063
	4,306	tons			37.975		1,063
TOTAL LOCAL GOVERNMENT							38,191

Appendix B

Materials Use and Waste Emissions

Table of Contents

Introduction	26
Emissions Data and Methodology Overview	26
Franchise-Hauled Waste	27
Self-Hauled Waste.....	28
Alternative Daily Cover	28
Upstream Emissions from Waste Disposal	29

List of Figures

Figure 1: Oakland Tonnage and Emissions from Franchise-Hauled Waste	27
Figure 2: Oakland Tonnage Breakdown from Franchise-Hauled Landfilled Waste.....	27
Figure 3: Oakland Tonnage Breakdown from ADC	28

List of Tables

Table 1: Oakland Tonnage from Self-Hauled Waste.....	28
Table 2: Oakland Tonnage from ADC.....	28
Table 3: Oakland Total Franchise-Hauled Landfill Tonnage and Upstream Emissions.....	29
Table 4: Oakland Total Recycling Tonnage and Emissions	30
Table 5: Oakland Total Compost Tonnage and Emissions	31
Table 6: WARM Upstream Emissions Factors.....	32
Table 7: Total Upstream Emissions Breakdown	33

Introduction

This Appendix presents additional detail on the GHG emissions associated with the solid waste sector of the City of Oakland, providing context for the extent, type, and impacts of these emissions. As noted in the Report, the consumption GHGs generated from material use and waste is the largest category of emissions in the city, accounting for 45 percent of total emissions. Oakland has a unique waste profile, as the majority of tonnage to landfill is from self-hauled or industrial waste used as Alternative Daily Cover (ADC). Much of this tonnage originates in Oakland-based businesses and entities with a regional or multi-state service area, including wastewater sludge from the East Bay Municipal Utility District and auto shred waste from Schnitzer Steel. This waste is not necessarily generated in Oakland, however it is delivered to landfill from an Oakland collection facility and is therefore included in the inventory.

Emissions Data and Methodology Overview

The 2015 GHG Emissions Inventory was developed using the protocols, recommendations, and guidance of ICLEI Local Governments for Sustainability. The City maintains extensive data regarding its waste management activities, which allows for a thorough analysis of emissions. As the City refined its approach to calculating emissions associated with the materials in the waste stream, a multitude of decisions were made regarding the classification of materials and the emissions profile of each material type. To understand these classifications and emissions assumptions, it is important to begin with the fundamental understanding of GHG emissions generated from solid waste disposal and processing.

The core emissions of waste are comprised of the biologic carbon, methane, and nitrous oxide emitted during the natural decay of biologic wastes in the landfill. By contrast, the consumption emissions include the core emissions described previously, as well as gasses produced during the extracting, harvesting, processing, and transporting of all materials that end up in the landfill or compost. These additional emissions are referred to as upstream emissions, since they occur before the products reach the consumer. Beyond the emissions involved in making the product and shipping it to consumers, the method of eventual disposal also affects the total consumption emissions generated; materials that are recycled have a reduced consumption emission. The extent of the emissions reductions from recycling and composting are documented in this appendix.

The calculations for upstream emissions were completed using the EPA Waste Reduction Model (WARM), which includes all aspects of pre-consumer and post-consumer emissions. Because the core emissions analysis and the WARM model both evaluate transportation and landfill emissions as part of their methodologies, the core emissions were subtracted out of the WARM emissions factor to limit its analysis to pre-consumer emissions. This correction ensures that the emissions are not double-counted.

Franchise-Hauled Waste

Waste disposed from Oakland is characterized by three types: franchise-hauling from residential, commercial, and City customers; self-hauling from private land uses such as construction sites, specialized operations, and City operations; and industrial waste put to use as Alternative Daily Cover (ADC). This section provides a detailed analysis of franchise-hauled waste, the largest component of the urban waste stream. **Figure 1** identifies the progress the City has made in reducing franchise-hauled waste as a part of the City's adopted Zero Waste Goal. Total landfill tonnage is down 29 percent from this source, resulting in an upstream emissions reduction of 34 percent from 2005 – 2015. In addition to landfill tonnage, metrics on recycling and compost were collected. Recycling tonnage has increased 14 percent since 2005, and Compost tonnage has increased 45 percent.

Figure 1: Oakland Tonnage and Emissions from Franchise-Hauled Waste

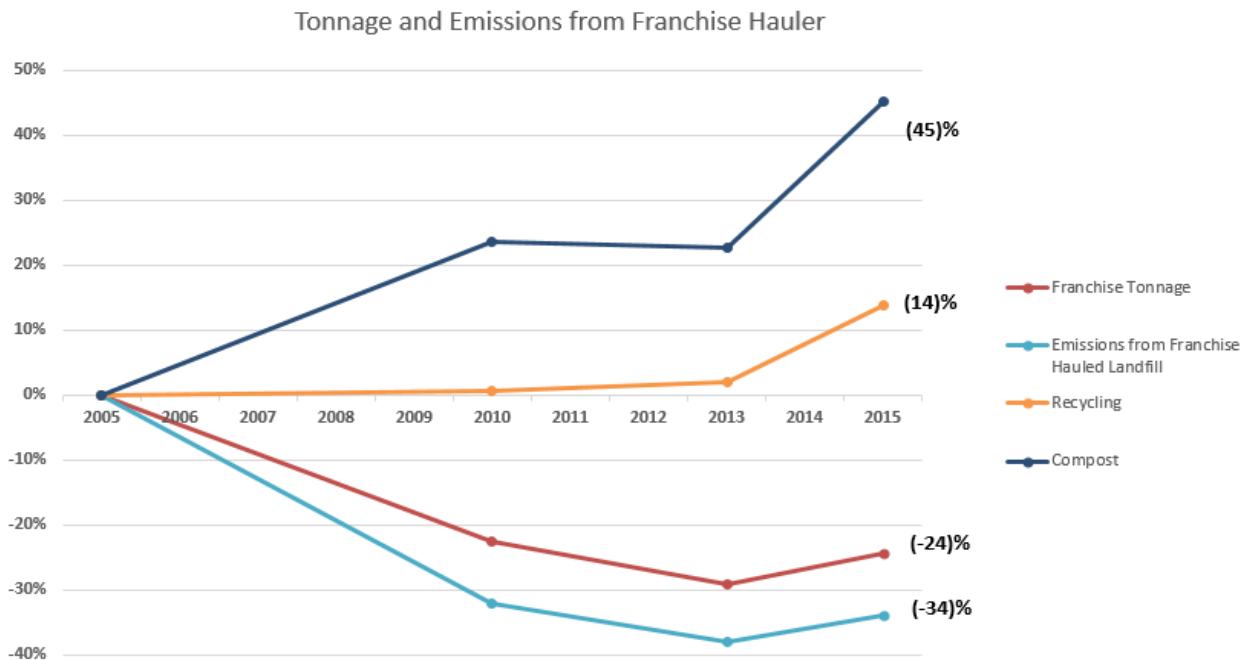
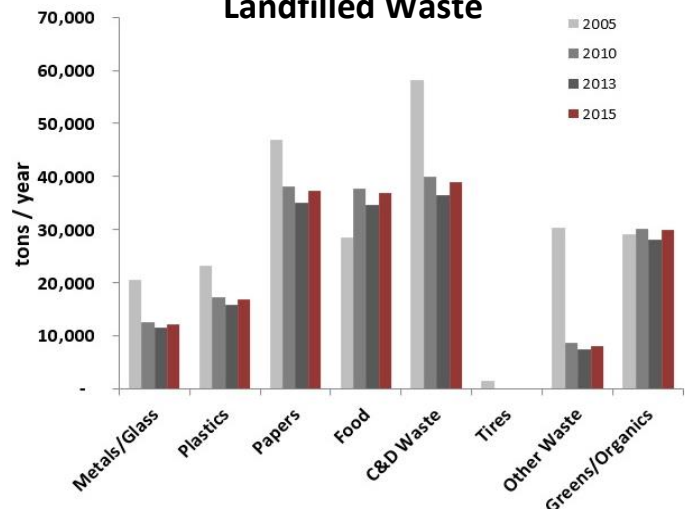


Figure 2: Oakland Tonnage Breakdown from Franchise-Hauled Landfilled Waste

Emissions from landfilled waste decreased at a higher rate than tonnage to landfill due to the composition of Oakland's waste. Paper products have a higher emissions factor because the sequestration of carbon in trees is lost when the trees are cut down to make these products. Sequestration is the ability of plants to hold carbon in solid form, keeping it out of the atmosphere and eliminating its effects on climate change. Construction and demolition (C&D) waste contains a high percentage of lumber, resulting in the same sequestration loss. In **Figure 2**, it can be seen that landfill contributions for categories like paper and C&D waste sharply decreased from 2005 - 2015.



Self-Hauled Waste

As described earlier in this Appendix, self-hauled waste typically is generated from properties on which private land uses such as construction and specialized operation occur. While the specific constituent content of self-hauled waste is unknown, it is characterized in this emissions analysis as primarily construction and demolition (C&D) waste. As shown in **Table 1**, self-hauled tonnage to landfill has decreased by 59 percent since 2005. The City has little influence over waste that is hauled directly to disposal facilities. However, the Alameda County Waste Management Authority has led emissions reductions in this sector through successful and targeted policies and programs. The City has passed a C&D Debris Waste Reduction and Recycling Ordinance to support these efforts.

Table 1: Oakland Tonnage from Self-Hauled Waste

Self-Hauled Waste		
Year	Tons	% Change from Baseline
2005	178434	
2010	106189	-40%
2013	111949	-37%
2015	73797	-59%

Alternative Daily Cover

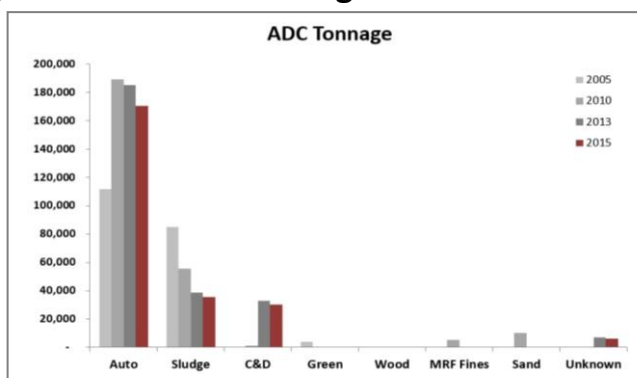
Alternative Daily Cover (ADC) is non-earthen material placed on the surface of the landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging. The landfill operators use specified waste from large industrial generators in Oakland as ADC, e.g., auto shredder waste from scrap metal recyclers and wastewater sludge from regional wastewater treatment facilities. However, to remain consistent with the methodology of the consumption inventory, all ADC is accounted for in the inventory. **Table 2** shows ADC has increased by 24 percent since 2005.

Table 2: Oakland Tonnage from ADC

Alternative Daily Cover		
Year	Tons	% Change from Baseline
2005	201625	
2010	264995	31%
2013	271074	34%
2015	249277	24%

Figure 3: Oakland Tonnage Breakdown from ADC

The composition of ADC changes year to year depending on industrial needs and economic factors. As shown in **Figure 3**, auto recycling shredder waste and construction and demolition waste have increased over the years, while sludge has decreased. Other categories of ADC are minimal in comparison and fluctuate year to year.



Upstream Emissions from Waste Disposal

The following tables detail the upstream emissions of items found in the landfill per EPA WARM emissions factors. Items in the landfill are categorized by the Alameda County Waste Characterization Study. Natural organic items such as leaves and grass do not have a correlating upstream emissions factor as no emissions went into the processing or transportation of these items. Emissions from these items are accounted for in the downstream, landfill methane sector. The emissions associated with paper, metal, concrete, and other items is based on national averages, and includes the full lifecycle emissions associated with the extraction, processing, refinement, and manufacturing of products from these materials. As upstream emissions from city-wide waste flow is an emerging methodology for cities and calculating downstream emissions is widely practiced, this inventory only includes upstream emissions in the following tables.

Table 3: Oakland Total Franchise-Hauled Landfill Tonnage and Upstream Emissions

Upstream Emissions and Tonnage from Franchise-Hauled Landfill Waste											
	Emissions from Franchise Haul (Landfill)						Tons by Franchise (Landfill)				
	2005	2010	2013	2015	MT Reduction	% Change	Emissions Factor	2005	2010	2013	2015
Aluminum Cans	3,266	1,291	1,182	1,261	(2,005)	-61%	4.9	805	265	242	259
Aluminum Ingot	-	-	-	-	-	-	-	-	-	-	-
Steel Cans	3,284	3,031	2,775	2,960	(324)	-10%	3.0	1,087	1,003	918	979
Copper Wire	-	-	-	-	-	-	-	-	-	-	-
Glass	2,346	2,592	2,373	2,531	185	8%	0.5	4,855	5,365	4,912	5,238
HDPE	2,108	903	827	882	(1,226)	-58%	1.4	1,475	632	578	617
PET	2,098	1,575	1,442	1,538	(560)	-27%	2.2	967	726	665	709
Corrugated Containers	36,798	19,846	18,171	19,378	(17,419)	-47%	4.4	8,298	4,476	4,098	4,370
Magazines / Third-class mail	17,675	54,657	50,044	53,368	35,692	202%	7.5	2,362	7,305	6,688	7,133
Newspaper	28,653	6,119	5,603	5,975	(22,678)	-79%	4.3	6,656	1,422	1,302	1,388
Office Paper	27,560	14,560	13,331	14,217	(13,344)	-48%	6.3	4,354	2,300	2,106	2,246
Phonebooks	1,543	-	-	-	-	-	5.7	269	-	-	-
Textbooks	4,620	-	-	-	-	-	7.4	622	-	-	-
Dimensional Lumber	33,450	14,782	13,535	14,434	(19,017)	-57%	1.9	17,471	7,721	7,069	7,539
Yard Trimmings	-	-	-	-	-	-	-	8,540	-	-	-
Grass	-	-	-	-	-	-	-	5,304	3,901	3,572	3,809
Leaves	-	-	-	-	-	-	-	5,304	3,901	3,572	3,809
Branches	-	-	-	-	-	-	-	2,360	4,238	3,881	4,138
Mixed Paper (general)	138,427	11,677	10,691	11,401	(127,025)	-92%	5.7	24,428	2,061	1,887	2,012
Mixed Paper (primarily residential)	-	115,061	105,350	112,347	112,347	-	5.6	-	20,620	18,880	20,134
Mixed Metals	50,836	21,611	19,787	21,101	(29,735)	-58%	3.7	13,837	5,882	5,386	5,743
Mixed Plastics	38,818	30,029	27,495	29,321	(9,497)	-24%	1.9	20,668	15,988	14,639	15,611
Food Waste	-	-	-	-	-	-	2.9	28,536	37,761	34,574	36,870
Mixed Organics	-	-	-	-	-	-	-	7,629	18,195	17,048	18,180
Mixed MSW	77,125	21,934	19,094	20,362	(56,763)	-74%	2.5	30,331	8,626	7,509	8,008
Carpet	28,816	11,414	10,450	11,144	(17,671)	-61%	3.8	7,603	3,012	2,757	2,941
Concrete	11,711	14,406	13,190	14,066	2,355	20%	1.0	11,711	14,406	13,190	14,066
Fly Ash	-	-	-	-	-	-	-	-	-	-	-
Tires	6,283	844	773	824	(5,459)	-87%	4.2	1,481	199	182	194
Asphalt Concrete	-	-	-	-	-	-	0.1	-	-	-	-
Asphalt Shingles	323	150	138	147	(176)	-55%	0.2	2,122	987	904	964
Drywall	991	622	570	607	(383)	-39%	0.2	5,802	3,644	3,336	3,558
Wood Flooring	51,236	38,492	35,243	37,584	(13,652)	-27%	3.8	13,513	10,152	9,295	9,912
Total	567,967	385,597	352,064	375,449	(186,355)	-34%		238,392	184,786	169,190	180,428

Table 4: Oakland Total Recycling Tonnage and Emissions

	Recycling Tonnage									
	2005	2010	2013	2015	% Change to '05	MTCO2e Change ("-" indicates credit)	2005 MTCO2e	2010 MTCO2e	2013 MTCO2e	2015 MTCO2e
Aluminum Cans	156	157	159	178	14%	(14)	(661)	(665)	(674)	(752)
Aluminum Ingot	24	24	25	27	14%	(4)	(173)	(174)	(176)	(197)
Steel Cans	443	446	452	505	14%	11	537	541	548	612
Glass	7,258	7,310	7,406	8,266	14%	30	1,475	1,485	1,505	1,679
HDPE	1,220	1,229	1,245	1,232	1%	14	670	675	684	677
PET	726	731	740	826	14%	15	754	759	769	859
Corrugated Containers	5,966	6,009	6,088	6,795	14%	160	7,823	7,880	7,984	8,910
Magazines / Third-class mail	-	-	-	-	-					
Newspaper	19,224	19,364	19,618	21,895	14%	612	29,889	30,106	30,501	34,041
Office Paper	-	-	-	-	-		-	-	-	-
Phonebooks	-	-	-	-	-		-	-	-	-
Textbooks	-	-	-	-	-		-	-	-	-
Dimensional Lumber	Compost									
Yard Trimmings	Compost									-
Grass	-	-	-	-	-		-	-	-	-
Leaves	-	-	-	-	-		-	-	-	-
Branches	-	-	-	-	-		-	-	-	-
Mixed Paper (general)	-	-	-	-	-		-	-	-	-
Mixed Paper (primarily residential)	Compost									
Mixed Paper (primarily from offices)	390	393	398	444	14%	29	1,401	1,411	1,430	1,596
Mixed Metals	4	4	4	5	14%	1	35	35	36	40
Mixed Plastics	5,028	5,065	5,131	5,727	14%	300	14,623	14,729	14,922	16,654
Food Waste	Compost									-
Mixed Organics	-	-	-	-	-		-	-	-	-
Mixed MSW	3,462	3,487	3,533	3,943	14%	180	8,803	8,867	8,984	10,026
Carpet	-	-	-	-						
Concrete	-	-	-	-						
Tires	-	-	-	-						
Asphalt Concrete	-	-	-	-						
Asphalt Shingles	-	-	-	-						
Drywall	-	-	-	-						
Wood Flooring	-	-	-	-						
Total	43,901	44,220	44,800	49,843	14%		56,374	56,783	57,529	64,119
	0%	1%	2%	14%			0%	1%	2%	14%

Table 5: Oakland Total Compost Tonnage and Emissions

	Compost Tonnage									
	2005	2010	2013	2015	% Change to '05	MTCO2e Change ("-" indicates credit)	2005 MTCO2e	2010 MTCO2e	2013 MTCO2e	2015 TCO2e
Aluminum Cans	-	-	-	-	-					
Aluminum Ingot	-	-	-	-	-					
Steel Cans	-	-	-	-	-					
Glass	-	-	-	-	-					
HDPE	-	-	-	-	-					
PET	-	-	-	-	-					
Corrugated Containers	-	-	-	-	-					
Magazines / Third-class mail	-	-	-	-	-					
Newspaper	-	-	-	-	-					
Office Paper	-	-	-	-	-					
Phonebooks	-	-	-	-	-					
Textbooks	-	-	-	-	-					
Dimensional Lumber	3,700	4,376	4,342	5,049	36%	2,678	7,342	8,684	8,616	10,020
Yard Trimmings	29,371	33,028	32,691	37,171	27%	-	-	-	-	-
Grass	-	-	-	-	-	-	-	-	-	-
Leaves	-	-	-	-	-	-	-	-	-	-
Branches	-	-	-	-	-	-	-	-	-	-
Mixed Paper (general)	-	-	-	-	-	-	-	-	-	-
Mixed Paper (primarily residential)	250	500	500	680	172%	2,430	1,413	2,825	2,825	3,842
Mixed Paper (primarily from offices)	-	-	-	-	-					
Mixed Metals	-	-	-	-	-					
Mixed Plastics	-	-	-	-	-					
Food Waste	6,175	10,853	10,884	14,390	133%	-	-	-	-	-
Mixed Organics	-	-	-	-	-					
Mixed MSW	-	-	-	-	-					
Carpet	-	-	-	-	-					
Concrete	-	-	-	-	-					
Tires	-	-	-	-	-					
Asphalt Concrete	-	-	-	-	-					
Asphalt Shingles	-	-	-	-	-					
Drywall	-	-	-	-	-					
Wood Flooring	-	-	-	-	-					
Total	39,495	48,757	48,417	57,290	45%		8,755	11,509	11,441	13,862
	0%	23%	23%	45%			0%	31%	31%	58%

Table 6: WARM Upstream Emissions Factors

	WARM Emissions Factors		
	Landfill	Recycling	Compost
Aluminum Cans	4.88	-9.11	
Aluminum Ingot		-7.19	
Steel Cans	3.02	-1.81	
Glass	0.48	-0.28	
HDPE	1.43	-0.88	
PET	2.17	-1.13	
Corrugated Containers	4.43	-3.12	
Magazines / Third-class mail	7.48		
Newspaper	4.30	-2.75	
Office Paper	6.33		
Phonebooks	5.74		
Textbooks	7.43		
Dimensional Lumber	1.91		1.98
Yard Trimmings	-		-
Grass	-		
Leaves	-		
Branches	-		
Mixed Paper (general)	5.67		
Mixed Paper (primarily residential)	5.58		5.65
Mixed Paper (primarily from offices)		-3.59	
Mixed Metals	3.67	-4.38	
Mixed Plastics	1.88	-1.03	
Food Waste	2.87		2.87
Mixed Organics	-		
Mixed MSW	2.54		
Carpet	3.79		
Concrete	1.00		
Tires	4.24		
Asphalt Concrete	0.08		
Asphalt Shingles	0.15		
Drywall	0.17		
Wood Flooring	3.79		

Table 7: Total Upstream Emissions Breakdown

	Total Upstream Emissions				
	2005 MTCO ₂ e	2010 MTCO ₂ e	2013 MTCO ₂ e	2015 MTCO ₂ e	2005 - 2015 MTCO ₂ e Reduction
Aluminum Cans	3,854	626	508	508	3,346
Aluminum Ingot	(173)	(174)	(176)	(197)	24
Steel Cans	4,312	3,572	3,323	3,571	741
Glass	11,085	8,242	14,261	12,632	(1,547)
HDPE	3,094	1,578	1,511	1,559	1,535
PET	3,166	2,334	2,211	2,396	770
Corrugated Containers	50,130	27,727	26,155	28,288	21,841
Magazines / Third-class mail	20,321	54,657	50,044	53,368	(33,046)
Newspaper	62,831	36,226	36,104	40,016	22,815
Office Paper	31,686	14,560	13,331	14,217	17,469
Phonebooks	1,774	-	-	-	1,774
Textbooks	5,312	-	-	-	5,312
Dimensional Lumber	86,889	48,218	57,273	50,054	36,835
Yard Trimmings	-	-	-	-	-
Grass	-	-	-	-	-
Leaves	-	-	-	-	-
Branches	-	-	-	-	-
Mixed Paper (general)	159,149	11,677	10,691	11,401	147,747
Mixed Paper (primarily residential)	1,413	117,886	108,175	116,189	(114,777)
Mixed Paper (primarily from offices)	1,401	1,411	1,430	1,596	(195)
Mixed Metals	79,507	34,312	71,815	65,526	13,981
Mixed Plastics	86,124	60,946	221,912	206,657	(120,533)
Food Waste	126,770	108,233	99,098	105,680	21,089
Mixed Organics	-	-	-	-	-
Mixed MSW	475,813	568,648	320,837	284,190	191,623
Carpet	33,129	11,414	10,450	11,144	21,985
Concrete	52,094	37,676	46,209	38,134	13,960
Tires	7,223	844	773	824	6,399
Asphalt Concrete	-	-	-	-	-
Asphalt Shingles	371	150	138	147	225
Drywall	1,139	622	570	607	532
Wood Flooring	58,906	38,492	35,243	37,584	21,322
Total	1,367,321	1,189,876	1,131,886	1,086,094	281,227
					-21%

Appendix C

City of Oakland Emissions Data and Reductions

Table of Contents

Introduction	38
Local Government Progress – Leading By Example	39
Local Government Inventories.....	40

List of Tables

Table 1: 2005 Oakland LGO Core Inventory40
Table 2: 2010 Oakland LGO Core Inventory40
Table 3: 2013 Oakland LGO Core Inventory41
Table 4: 2015 Oakland LGO Core Inventory41
Table 4: 2005 Oakland LGO Consumption Inventory42
Table 5: 2010 Oakland LGO Consumption Inventory42
Table 6: 2013 Oakland LGO Consumption Inventory43
Table 7: 2015 Oakland LGO Consumption Inventory43

Introduction

Reducing GHG emissions to meet the City's goal will require each sector of the community to take actions to lower their carbon footprint. The City strives to be a leader not only in meeting community goals, but in implementing reductions in its own operations. To ensure that the City is doing its part, a variety of programs have been undertaken to reduce waste, energy use, and other factors that impact GHG emissions. These programs span all aspects of operations, and seek to lower emissions to the greatest degree feasible. In doing so, the City seeks to identify programs, technologies, practices, and ideas that can work across the community. By first reducing its own emissions, the City can demonstrate that they too are working towards reaching the 2020 GHG reduction goals.

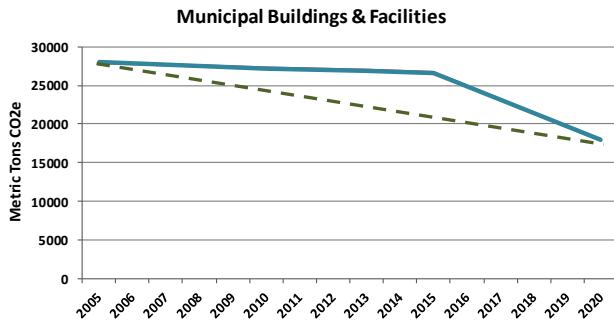


In addition to conducting an inventory of communitywide GHG emissions, the City assesses all emissions associated with the operation of City government. This approach ensures that the actions undertaken within the government sector are reviewed and their impacts evaluated. This Appendix sets forth the emissions associated with local government operations, including details on the programs and activities that have been employed to reduce emissions across departments and services.

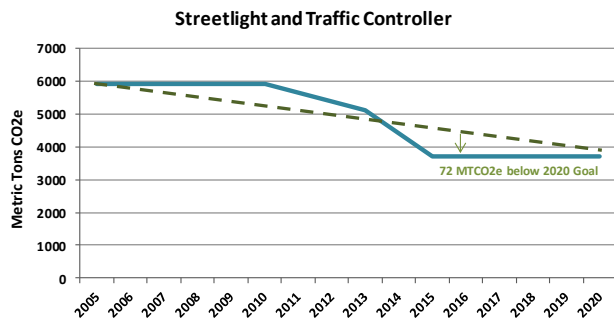


Local Government Progress – Leading By Example

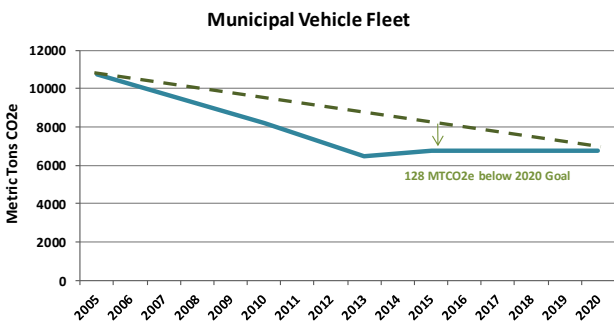
The local government operations inventory was created separately in an effort to better understand how government operations can reduce emissions on track with 2020 and 2050 goals. Within the local government, four main subsections were calculated: buildings and facilities, streetlights and traffic controls, vehicle fleet, and waste generation. The City of Oakland has made significant progress reducing emissions since 2005 due to the efforts of many key staff and programs, as described below.



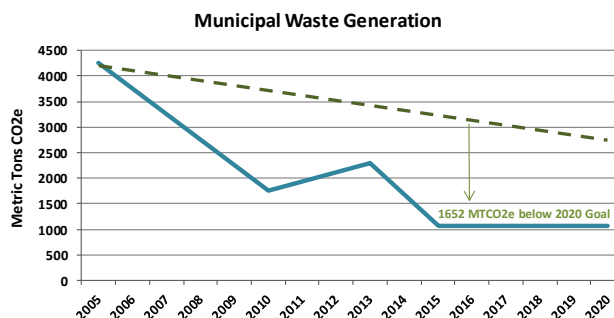
Oakland has reduced emissions in its municipal buildings by five percent since 2005. This is due to lighting and HVAC retrofits, engaging building managers and employees in conservation, and installing energy management systems. The City maintains 116 municipal buildings, and must reduce emissions by 8,700 MT CO₂e to meet the 2020 goal in this category.



Oakland has reduced emissions associated with streetlights by 37 percent through replacing lamps with LEDs. By 2015, more than 30,000 high pressure sodium (HPS) streetlights, representing more than 90 percent of City total, were converted to LED. The City has more than 35,000 streetlights, and has met its 2020 goal in this category with existing measures.



Oakland reduced emissions from the City fleet by 37 percent since 2005 by reducing the number of vehicles in use, and replacing gasoline-powered vehicles with natural gas and hybrid electric vehicles. The City maintains more than 1,800 vehicles in its fleet, and has exceeded its 2020 goal in this category with existing measures.



Oakland has reduced its emissions from waste at city buildings by 75 percent by increasing recycling, launching compost service in buildings, and increased employee awareness and attention on waste reduction. The City has exceeded its 2020 goal in this category with existing measures.

Local Government Inventories

The following series of tables provides the GHG emissions information for all components of local government operations at the City of Oakland. These tables include the inventory information for the years 2005, 2010, and 2013. Consistent with the methodology described in this report, the Core inventory refers to emissions generated within the City limits, while Consumption emissions also include emissions associated with the extraction, production, and transportation of products consumed in Oakland.

Table 1: 2005 Oakland LGO Core Inventory

Local Government Emissions	"raw data"	units	MMBtu	MTCO ₂	MTCH ₄	MTN ₂ O	MTCO ₂ e
Municipal Buildings & Facilities							21,998
Buildings and Facilities Electricity							14,635
Electric	65,458,807	kWh	223,409	14,524	0.891	0.327	14,635
Buildings and Facilities Natural Gas							7,363
Natural Gas	1,384,412	therms	138,441	7,340	0.692	0.014	7,363
Streetlight & Traffic Controllers							5,927
	26,507,507	kWh	90,469	5,882	0.361	0.132	5,927
Municipal Vehicle Fleet							10,577
Fleet: Diesel							2,628
Diesel	257,266	gallons	35,513	2,627	0.006	0.006	2,628
Fleet: Gasoline							7,519
Gasoline	852,674	gallons	106,542	7,487	0.181	0.103	7,519
Fleet: CNG							430
Compressed Natural Gas	62,117	gallons			0.476	0.033	430
Municipal Waste Generation							4,243
	10,411	tons					4,243
TOTAL LOCAL GOVERNMENT							42,745

Table 2: 2010 Oakland LGO Core Inventory

Local Government Emissions			MMBtu	MTCO ₂	MTCH ₄	MTN ₂ O	MTCO ₂ e
Municipal Buildings & Facilities							23,324
Buildings and Facilities Electricity							14,030
Electric	69,133,236	kWh	235,950	13,954	0.893	0.189	14,030
Buildings and Facilities Natural Gas							9,294
Natural Gas	1,747,474	therms	174,747	9,265	0.874	0.017	9,294
Streetlight & Traffic Controllers							5,912
	29,132,671	kWh	99,429	5,880	0.376	0.080	5,912
Municipal Vehicle Fleet							6,643
Fleet: Diesel							2,383
Diesel	233,229	gallons	32,195	2,381	0.005	0.005	2,383
Fleet: Gasoline							3,776
Gasoline	426,173	gallons	53,250	3,742	0.126	0.116	3,776
Fleet: CNG							485
Compressed Natural Gas	70,000	gallons			0.537	0.038	485
Municipal Waste Generation							1,753
	7,439	tons					1,753
TOTAL LOCAL GOVERNMENT							37,632

Table 3: 2013 Oakland LGO Core Inventory

Local Government Emissions		MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities						22,386
Buildings and Facilities Electricity						13,373
Electric	68,660,589 kWh	234,336	13,298	0.887	0.188	13,373
Buildings and Facilities Natural Gas						9,013
Natural Gas	1,694,597 therms	169,459	8,985	0.847	0.017	9,013
Streetlight & Traffic Controllers						5,127
	26,321,865 kWh	89,836	5,098	0.340	0.072	5,127
Municipal Vehicle Fleet						5,194
Fleet: Diesel						1,295
Diesel	126,764 gallons	17,499	1,294	0.003	0.003	1,295
Fleet: Gasoline						3,328
Gasoline	374,700 gallons	46,819	3,290	0.141	0.130	3,328
Fleet: CNG						571
Compressed Natural Gas	80,000 gallons		525	0.980	0.069	571
Municipal Waste Generation						2,305
	5,655 tons			82.307		2,305
TOTAL LOCAL GOVERNMENT						35,011

Table 4: 2015 Oakland LGO Core Inventory

Local Government Emissions		MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities						22,412
Buildings and Facilities Electricity						15,052
Electric	76,995,007 kWh	262,782	14,983	1.156	0.140	15,052
Buildings and Facilities Natural Gas						7,360
Natural Gas	1,694,597 therms	138,378	7,337	0.692	0.014	7,360
Streetlight & Traffic Controllers						3,721
	19,031,777 kWh	64,955	3,703	0.286	0.035	3,721
Municipal Vehicle Fleet						6,468
Fleet: Diesel						2,350
Diesel	230,000 gallons	31,749	2,348	0.005	0.005	2,350
Fleet: Gasoline						3,551
Gasoline	396,000 gallons	49,480	3,477	0.892	0.185	3,551
Fleet: CNG						568
Compressed Natural Gas	80,000 gallons		525	0.889	0.066	568
Municipal Waste Generation						1,063
	5,655 tons			37.975		1,063
TOTAL LOCAL GOVERNMENT						33,664

Table 5: 2005 Oakland LGO Consumption Inventory

2005 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							28,005
Buildings and Facilities Electricity							18,973
Electric	65,458,807	kWh	223,409	14,524	0.891	0.327	14,635
Upstream Electric							4,338
Buildings and Facilities Natural Gas							9,032
Natural Gas	1,384,412	therms	138,441	7,340	0.692	0.014	7,363
Upstream Natural Gas							1,669
Streetlight & Traffic Controllers							5,927
	26,507,507	kWh	90,469	5,882	0.361	0.132	5,927
Municipal Vehicle Fleet							10,759
Fleet: Diesel							2,688
Diesel	257,266	gallons	35,513	2,627	0.006	0.006	2,628
Upstream Diesel				46	0.007	0.516	59
Fleet: Gasoline							7,634
Gasoline	852,674	gallons	106,542	7,487	0.181	0.103	7,519
Upstream Gasoline				84	0.002	1.428	115
Fleet: CNG							438
Compressed Natural Gas	62,117	gallons	7764.600	407.870	0.476	0.033	430
Upstream CNR				4.194	0.001	0.158	8
Municipal Waste Generation							4,243
	10,411	tons			151.53		
TOTAL LOCAL GOVERNMENT							48,934

Table 5: 2010 Oakland LGO Consumption Inventory

2010 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							27,231
Buildings and Facilities Electricity							15,830
Electric	69,133,236	kWh	235,950	13,954	0.893	0.189	14,030
Upstream Electric							1,800
Buildings and Facilities Natural Gas							11,401
Natural Gas	1,747,474	therms	174,747	9,265	0.874	0.017	9,294
Upstream Natural Gas							2,107
Streetlight & Traffic Controllers							5,912
	29,132,671	kWh	99,429	5,880	0.376	0.080	5,912
Municipal Vehicle Fleet							8,187
Fleet: Diesel							3,109
Diesel	233,229	gallons	32,195	2,381	0.005	0.005	2,383
Upstream Diesel				565	0.091	6.319	726
Fleet: Gasoline							4,594
Gasoline	426,173	gallons	53,250	3,742	0.126	0.116	3,776
Upstream Gasoline				601	0.012	10.161	818
Fleet: CNG							485
Compressed Natural Gas	70,000	gallons	8750.000	459.630	0.537	0.038	485
Upstream CNR							
Municipal Waste Generation							1,753
	7,439	tons			62.596		
TOTAL LOCAL GOVERNMENT							43,083

Table 6: 2013 Oakland LGO Consumption Inventory

2013 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							26,904
Buildings and Facilities Electricity							15,848
Electric	68,660,589	kWh	234,336	13,298	0.887	0.188	13,373
Upstream Electric							2,475
Buildings and Facilities Natural Gas							11,056
Natural Gas	1,694,597	therms	169,459	8,985	0.847	0.017	9,013
Upstream Natural Gas							2,043
Streetlight & Traffic Controllers							5,127
				5,098	0.340	0.072	5,127
Municipal Vehicle Fleet							6,497
Fleet: Diesel							1,690
Diesel	126,764	gallons	17,499	1,294	0.003	0.003	1,295
Upstream Diesel				307	0.049	3.434	395
Fleet: Gasoline							4,047
Gasoline	374,700	gallons	46,819	3,290	0.141	0.130	3,328
Upstream Gasoline				528	0.011	8.934	719
Fleet: CNG							760
Compressed Natural Gas	80,000	gallons	10000.000	525.290	0.980	0.069	571
Upstream CNR							
Municipal Waste Generation							2,305
	5,655	tons			82.307		2,305
TOTAL LOCAL GOVERNMENT							40,832

Table 7: 2015 Oakland LGO Consumption Inventory

2015 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							26,650
Buildings and Facilities Electricity							17,622
Electric	76,995,007	kWh	262,782	14,983	1.156	0.140	15,052
Upstream Electric							2,570
Buildings and Facilities Natural Gas							9,028
Natural Gas	1,383,777	therms	138,378	7,337	0.692	0.014	7,360
Upstream Natural Gas							1,669
Streetlight & Traffic Controllers							3,721
				3,703	0.286	0.035	3,721
Municipal Vehicle Fleet							6,757
Fleet: Diesel							1,690
Diesel	230,000	gallons	31,749	2,348	0.005	0.005	2,350
Upstream Diesel				557	6.231	0.090	716
Fleet: Gasoline							4,311
Gasoline	396,000	gallons	46,819	3,477	0.892	0.185	3,551
Upstream Gasoline				558	9.441	0.011	760
Fleet: CNG							757
Compressed Natural Gas	80,000	gallons	10000.000	525.290	0.889	0.066	568
Upstream CNR							
Municipal Waste Generation							1,063
	4,306	tons			37.975		1,063
TOTAL LOCAL GOVERNMENT							38,191

City of Oakland Elected Officials

Mayor Libby Schaaf

Members of the City Council

Lynette Gibson McElhaney (District 3), Council President

Annie Cambell Washington (District 4), Vice Mayor

Rebecca Kaplan (At Large)

Dan Kalb (District 1) • Abel J. Guillen (District 2) • Noel Gallo (District 5)

Desley Brooks (District 6) • Larry Reid (District 7, President Pro Tem)

Barbara Parker, City Attorney • Brenda D. Roberts, City Auditor



This report was developed under the leadership of Oakland
Public Works—Environmental Services Division with
contributions from numerous City Staff and partners.

250 Frank Ogawa Plaza, Suite 5301
Oakland, CA 94612

www.sustainableoakland.com



CITY OF OAKLAND

Bloomberg Associates

Pathways to Deep GHG Reductions in Oakland: Final Report

March 2018



Acknowledgements

The Bloomberg Associates Sustainability Practice has worked with the City of Oakland to identify opportunities and measure the impact of deep greenhouse gas (GHG) reductions. A number of people have contributed their time and energy to this effort. Specific thanks to the following people for their contributions:

- **Oakland Public Works** – Becky Dowdakin, Daniel Hamilton, Shayna Hirshfield-Gold
- **OakDOT** – Ryan Russo, Michael Ford, Iris Starr
- **Bureau of Planning and Building** – Darin Raneletti
- **City Administrator's Office** – Christine Daniel, Alex Orologas
- **Oakland Climate Fellows** – Mukta Kelkar, Ben Linthicum, Allison Hooks, Yoni Carnice
- **AECOM** – Claire Bonham-Carter, Amruta Sudhalkar

About Bloomberg Associates

Bloomberg Associates is an international consulting service founded by Michael R. Bloomberg as a philanthropic venture. Its mission is to help city governments improve the quality of life of their citizens.

Directed by a team of globally recognized experts and industry leaders, the consultancy works to improve urban environments by collaborating with cities to develop best practices, build consensus and foster key relationships. Through its guidance and mentorship, Bloomberg Associates delivers actionable insights and plans across multiple disciplines.



Introduction.....1

Progress to Date.....8

Pathways to 80 by 50 Reduction.....12

Policy Considerations.....27

Conclusion.....44

Appendices

A. Buildings Technical Materials.....48

B. Transportation Technical Materials.....86

C. Stakeholder Engagement.....116

A sepia-toned photograph of a city skyline reflected in water. The skyline features several tall buildings, including a prominent curved skyscraper on the right. A blimp is visible in the sky on the left. The word "Introduction" is overlaid in the center in a white, bold, sans-serif font with a slight drop shadow.

Introduction



Oakland is a recognized climate leader, but must accelerate action to achieve its GHG reduction goals

Oakland is a recognized leader in taking action to reduce its greenhouse gas (GHG) emissions and preparing the city for climate change.

The City Council **approved the City's first Energy and Climate Action Plan (ECAP) in 2011**, which set **goals to reduce GHG emissions 36% below 2005 levels by 2020 and 83% by 2050**. The City is a signatory to the Global Covenant of Mayors for Climate and Energy and the U.S. Climate Alliance to meet the commitments of the Paris Climate Accord.

Despite this leadership on the national and global stage, the **City is not on track to achieve its climate goals**. Bloomberg Associates was engaged by the City to identify the actions that Oakland needs to take to meet its targets.

To complete this analysis, **Bloomberg Associates utilized the CURB climate action planning tool**. The final results of the analysis are presented in this report.





Oakland is the first U.S. city to use CURB to conduct in-depth GHG analysis

BA

CURB was 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**

Oakland is the first city in North America to use the tool in-depth as a key input into its climate planning and will share its experience as a pilot with other cities.

CURB measures the GHG impacts of more than 1,000 actions across six sectors:



Private Building Energy*



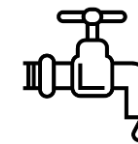
Municipal Buildings & Public Lighting



Electricity Generation



Solid Waste



Waste & Wastewater



Transportation*

*Given that 86% of Oakland's GHG emissions are generated by private buildings and transportation, analysis focused on these sectors in CURB.



The analysis utilized CURB to support data-driven climate action planning in Oakland

BA

Bloomberg Associates and the City of Oakland, with technical support from CURB's development team, piloted a unique six-part methodology to utilize CURB to support data-driven climate action planning.

1 Gathered Baseline Data

Identified data from the best available sources to estimate where Oakland's building, transportation, and energy systems are today and to forecast population and economic trends.

2 Engaged Local and National Experts

Interviewed more than 30 local and national experts and hosted a series of sector-specific workshops with more than 50 Bay Area experts to refine the baseline data and collaboratively estimate the city's projected trajectory and actions needed to achieve GHG reduction goals.

3 Outlined Key Assumptions

The analysis assumes Oakland reaches 100% carbon-free energy by 2030. A carbon-free energy grid is the backbone of future deep GHG reductions and is critical to Oakland achieving an 83% reduction by 2050. The analysis also rests upon core (in-boundary) assumptions for buildings and transportation that are detailed in the next section of the report.

Oakland tracks both core (in-boundary) and consumption-based emissions, however this analysis is limited to core GHG emissions due to the parameters of the CURB tool.

4 Developed GHG Reduction Scenarios

Developed two scenarios for the CURB tool:

- **Projected Trajectory:** Assumes technological advances and market adoption/penetration, stated State and Federal policies, existing City policies and funded programs, and limited City actions responding to market trends
- **Deep Decarbonization:** the actions needed to achieve an 83% reduction in GHG emissions by 2050

5 Analyzed Gaps Between Scenarios

Compared GHG emissions reductions from the Projected Trajectory to the reductions achieved in Deep Decarbonization to identify the key gaps between what the city is projected to achieve and what it needs to achieve to meet its GHG reduction goals. This part of the analysis identified the key gaps where City action is required.

6 Identified Policy Areas and Case Studies

Based upon the gap analysis and the modeled GHG reduction impacts, the analysis identified priority policy areas where City action is needed. These policy areas should help shape the ECAP update.

The report also includes case studies from other cities around the world that could serve as models for Oakland in the targeted areas it needs to take action to achieve deep GHG reductions.



The analysis was limited by several important factors

Data Availability

- There are no comprehensive, detailed databases on the conditions or types of systems in Oakland's building stock or vehicles, nor is there detailed mode share information for the city. As a result, the analysis utilizes proxy data or educated assumptions based on research and expert interviews.

Underlying Assumptions

- Analysis that models more than 30 years into the future is an inherently projective exercise that involves a series of key underlying assumptions. While transparently documented in this report, the analysis relies upon assumptions on technology development, market changes and the impacts of State-level policies. It does not incorporate any assumptions regarding behavioral changes that could change consumption patterns (e.g., increasing plug loads for electronics). These are largely outside the City's control, yet for the purposes of this analysis, shape the determination of where City action is needed.

Core Versus Consumption Emissions

- Oakland is a leading city in measuring consumption-based emissions in addition to core (in-boundary) emissions. Reducing consumption-based emissions over the long term is critical to reducing the impacts of climate change; however, it often falls outside the scope of traditional city-level powers and responsibilities. Due to the setup of CURB, this analysis was limited to core (in-boundary) emissions.

Constraints of the CURB Tool

- The structure for transportation actions in CURB includes grouping many individual potential actions within broader categories (e.g., passenger mode shift). The outputs of the tool, therefore, do not allow for granular analysis in the impact of any one individual action to shift modes. This particularly limited the assessment of the economic costs of transportation actions to shift modes and electrify vehicles.

Climate Change

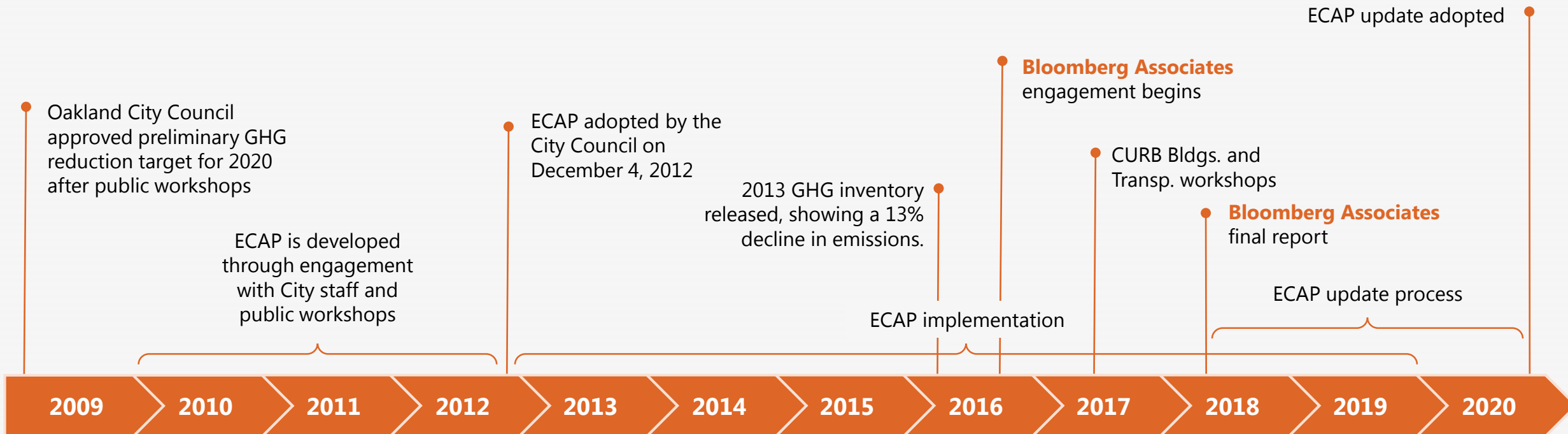
- This analysis does not account for the impacts that climate change may have on energy consumption patterns. While a warming climate is likely to shift heating and cooling loads in Oakland, this analysis does not attempt to forecast the extent or pace of such changes.



CURB's outputs can help inform Oakland's policies and investments, including the update of its Energy and Climate Action Plan (ECAP)

Oakland's ECAP **outlines and prioritizes the actions the City will take to reduce energy consumption and GHG emissions in Oakland.** ECAP **establishes GHG reduction targets and actions**, as well as frameworks for coordinating implementation and reporting on progress.

Oakland will **begin updating its ECAP in 2018, for adoption in 2020.** Bloomberg Associates' analysis is intended to serve as a **decision support tool for the updated plan**, identifying the critical actions needed to put Oakland on a pathway to meet its long-term GHG reduction goals and facilitating communication with key stakeholders.





Taking action to reduce GHG emissions provides many benefits to Oakland residents

Buildings Co-Benefits



Transportation Co-Benefits



Social Equity

- Energy costs have a disproportionate impact on lower income residents
- Energy efficiency measures lower energy bills, saving money for households and businesses

- Improving public transit service and pedestrian and bicycle infrastructure is likely to benefit those without access to a private vehicle

Local Economy

- Reduction in building energy use reduces costs
- When a business or household lowers their energy costs, the savings can be spent elsewhere in the local economy, resulting in additional jobs

- Reducing transportation costs through alternative modes of transportation (e.g., walking, biking, and mass transit) can provide savings over private car usage
- These savings can be spent elsewhere in the local economy, resulting in additional jobs

Energy Independence

- Reducing the use of imported fossil fuels lowers the community's vulnerability to energy price and supply shocks

- Reducing fossil fuel usage lowers the community's vulnerability to energy price and supply shocks

Deferred Infrastructure

- Reducing energy consumption can help defer the need for new sources of energy generation

- Reduced vehicle use will result in less wear and tear on roads, decreasing frequency of repairs

Public Health

- Reducing fossil fuel use in buildings and energy generation reduces the emission of air pollutants, improving air quality and lowering risks of asthma, respiratory disorders, heart attacks and cancer

- Transit-oriented urban design reduces the number of vehicles on the road, reducing congestion and improving regional air quality
- Active forms of transportation (e.g., walking and biking) reduce obesity and other health risks and improve public health

A sepia-toned photograph of a city skyline reflected in water. The skyline features several tall buildings, including a prominent curved skyscraper on the right. A blimp is visible in the sky on the left. The text "Progress to Date" is overlaid in the center.

Progress to Date

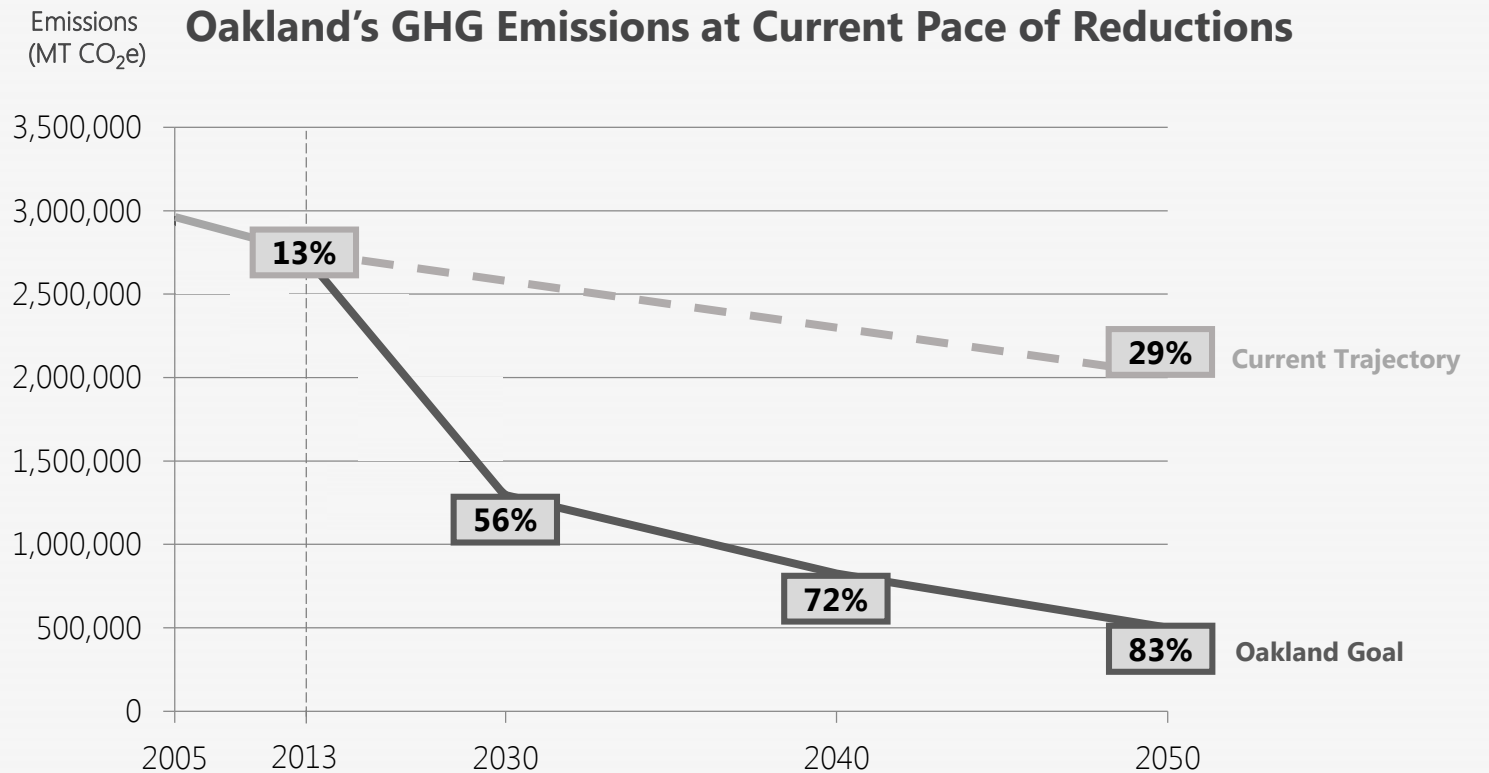


At its current pace, Oakland will not meet its 2050 GHG reduction goal

In 2009, **Oakland adopted an ambitious greenhouse gas (GHG) goal** to reduce its core emissions 83% by 2050 from a 2005 baseline.

In 2013, Oakland's GHG emissions decreased 13% from its 2005 baseline. **If Oakland continues on its Current Trajectory, it will only achieve a 29% decrease in emissions by 2050**, accounting for population and economic growth – far short of its adopted target.

Oakland needs to accelerate action if it hopes to achieve its near- or long-term GHG goals. This report seeks to identify which actions the city needs to take.



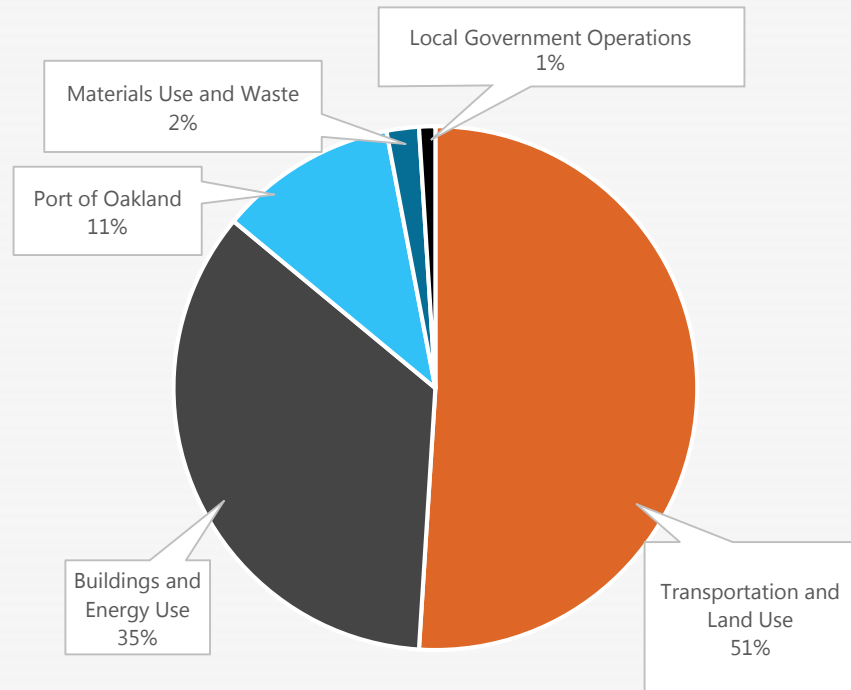


Oakland's most significant GHG reductions have come from the Port and Buildings

BA

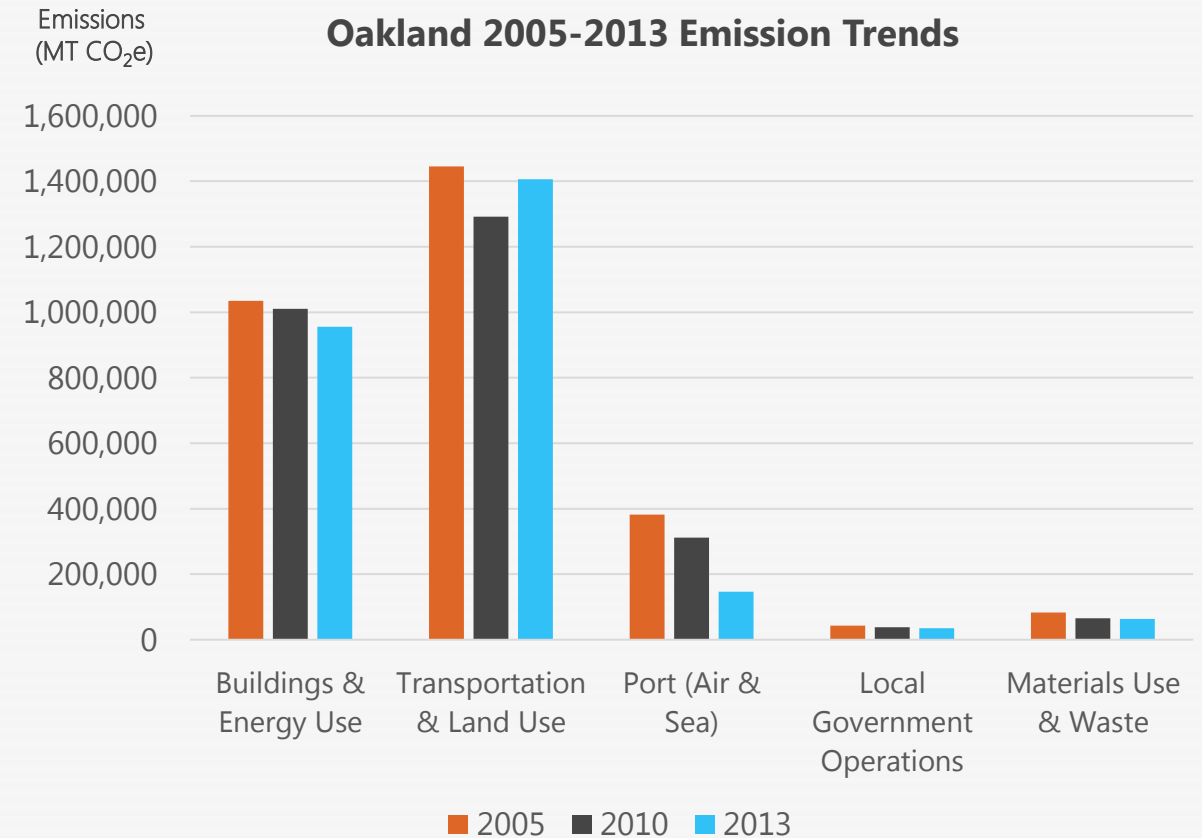
In 2013, Oakland's largest sources of emissions were **Transportation and Land Use** (51%) and **Buildings and Energy Use** (35%). All other sources were responsible for only 14% of emissions.

Oakland 2013 Core Emissions



Oakland has made progress in reducing GHG emissions across the city. Overall, **core emissions were 13% lower in 2013 than in 2005**.

Oakland 2005-2013 Emission Trends



Note: While GHG data is available for 2015 in Oakland, the CURB tool and the analysis in this report is based on 2013 baseline data

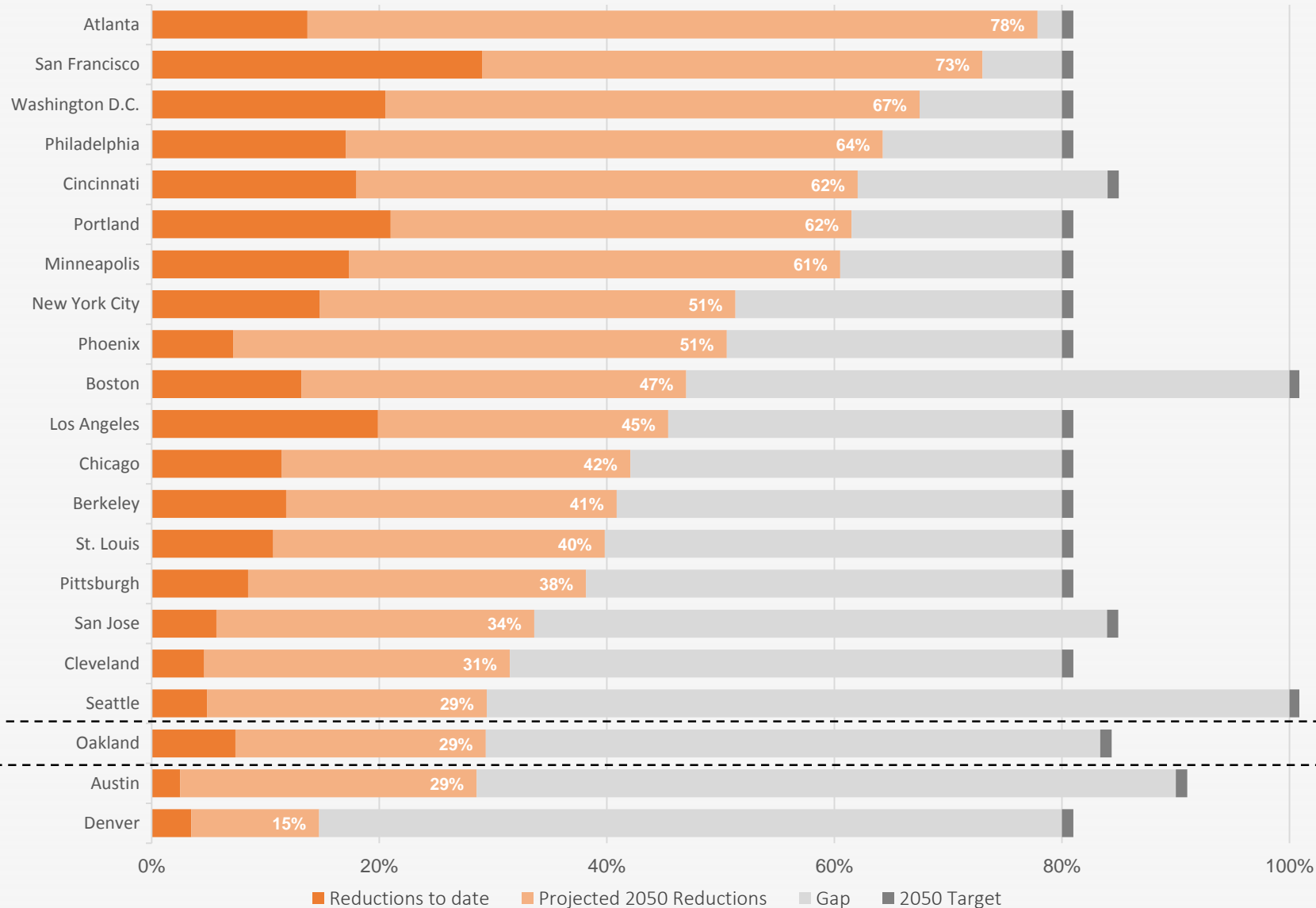
Source: Oakland 2013 GHG Inventory



Oakland is not alone; many U.S. cities are not on track to meet their climate goals and need to accelerate action

BA

Progress of U.S. cities with 80x50 GHG Goal



- U.S. cities that have set aggressive GHG reduction goals have shown demonstrable progress in reducing emissions in recent years; however, **no large U.S. city is currently on track to meet its 2050 GHG reduction goals**
- While Oakland's projected emission reductions are behind some of the leading large cities in the U.S., the city is well ahead of most cities that have not set GHG reduction goals
- Oakland's per-capita emissions are among the lowest in the nation, making further emission reductions more challenging compared with other cities that start with higher per-capita emissions

A sepia-toned photograph of a city skyline reflected in water. The skyline includes several tall buildings, some with curved facades, and a blimp flying in the sky. The text "Pathways to 80 by 50 Reduction" is overlaid in the center.

Pathways to 80 by 50 Reduction



CURB enables users to understand how changes to distinct building systems and a city's transportation sector impacts GHG emissions

To understand what the City needs to do to put it on a pathway to meet its GHG targets, Bloomberg Associates developed and modeled two GHG scenarios.

The first forecasts the GHG impacts of expected changes to the city's buildings and transportation systems if the City takes minimal additional action (its "**Projected Trajectory**") in 2030 and 2050. The second models the scale of change needed to achieve Oakland's long-term GHG goal ("**Deep Decarbonization**") in 2030 and 2050. Within these scenarios, the analysis focused on 60 distinct actions.



Buildings

CURB categorizes buildings in two ways...

- **Type:** Existing or New
- **Use:** Residential or Commercial

... and includes actions across **seven building systems:**

- Lighting
- Appliances
- Space Heating
- Cooling
- Water Heating
- Water Fixtures
- Building Envelope



Transportation

CURB organizes transportation into **four sets of potential actions** across **11 modes of transportation:**

- Transit Oriented Development
- Passenger Mode Shift
- Vehicle Electrification
- Fuel Efficiency

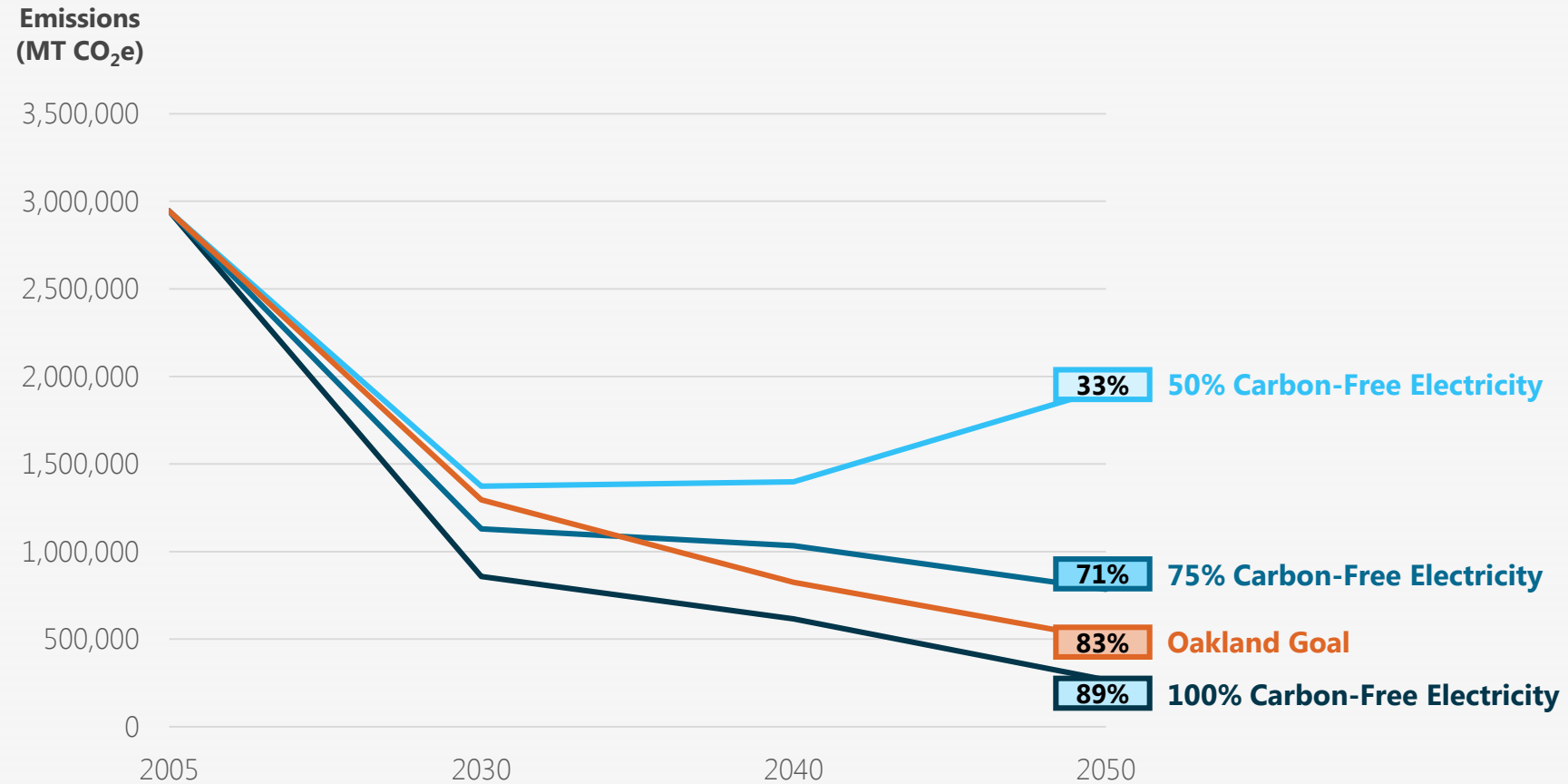


Both scenarios were modeled assuming an electric grid powered by 100% carbon-free energy, which is critical to meet Oakland's goal

BA

Emissions Reductions from Deep Decarbonization Scenario

- **Oakland can meet its near-term targets** under the Deep Decarbonization scenario **if at least 50% of its electricity is carbon-free**
- **Meeting its 2050 goal without a 100% carbon-free grid would require significantly more City action** than the current Deep Decarbonization scenario **and is likely not possible**



This analysis relied on variety of sources to develop the key assumptions for the Projected Trajectory and Deep Decarbonization scenarios

Document Review

Bloomberg Associates reviewed key documents, reports, white papers, and articles to better understand the current conditions of Oakland's building and transportation sectors and opportunities to reduce the GHG emissions.



Buildings documents

Transportation documents

Expert Interviews

Bloomberg Associates interviewed 30 local and national experts to build out the Projected Trajectory and Deep Decarbonization scenarios.

Workshops

Bloomberg Associates convened more than 30 experts at three in-person workshops to develop estimates for all CURB inputs for buildings and transportation.



12+ buildings experts met on July 27 in Oakland City Hall.



20+ transportation experts met on September 14 in Oakland City Hall.



Key assumptions for the Projected Trajectory and Deep Decarbonization scenarios

BA

Key overarching CURB assumption

- **Oakland's electricity grid will be served by 100% carbon-free energy by 2030.**

Key building-related assumptions

- **California's energy efficiency laws will continue to drive significant improvements in building efficiency**, particularly for new buildings. These mandates should lead to near-zero net energy for all new construction by 2020 for residential buildings and 2030 for commercial properties.
- Oakland's current renovation program is reaching 1-2% of multi family properties per year. At best that program will upgrade 66% of multi-family properties in Oakland by 2050.

Key transportation-related assumptions

- **California incentives will increase adoption rate of zero/low emission vehicles for private autos and light-duty trucks** over historical trends. New sales of electric/low emissions vehicles will increase from current 5% of total sales to 40% by 2030 and 90% by 2050.
- **Fuel efficiency improvements will continue to be driven by CAFE standards set by the State and Federal Government.**
- 2030 projections do not account for autonomous vehicles due to uncertainty over near-term technological and regulatory hurdles; by 2050 AVs will be a normalized part of the transportation system.

More detailed assumptions can be found in Appendix A and B 'Technical Materials'.



Developing the Projected Trajectory and Deep Decarbonization scenarios

Bloomberg Associates worked with more than 60 experts to estimate the current condition of building and transportation systems (e.g., efficiency and fuel sources of heating systems, mode share split, and fuel sources and efficiency of vehicles), their projected conditions in 2030 and 2050 without significant City action, and the conditions they need to be in 2030 and 2050 to enable the City to meet its GHG targets. This resulted in more than 950 data points modeled by CURB.

Projected Trajectory

Bloomberg Associates estimated the Projected Trajectory of Oakland's emissions, assuming:

- **Projected technological advances & market adoption/penetration** (e.g., market adoption of electric heat pumps)
- **Stated State & Federal policies** (e.g., California Title 24 Building Code updates)
- **Existing City policies and funded programs** (e.g., Community Choice Energy program; NOT unfunded building retrofit plan)
- **Limited City actions responding to market trends** (e.g., revised building codes to legalize new technologies; NOT future programs incentivizing adoption of new building technology)

	CURB Tool Options		Today	2030	2050		
New Residential				Projected Trajectory	Projected Trajectory		
	Mid-Range Efficiency			25%	25%		
	High-						
Existing Residential			CURB Tool Options		Today	2030 Projected Trajectory	2050 Projected Trajectory
	Mid-			Private Autos and Trucks	69.1%	55.1%	48.0%
	High-			Motorcycle	1.6%	1.6%	1.6%
New Commercial	Mid-			Taxi/TNC 1or2 pass.	1.6%	10.0%	5.0%
	High-			TNC Pooled Ride	Not avail.	2.0%	5.0%
			Shared Minibus	Not avail.	3.0%	10.0%	
Existing Commercial			Standard Bus/BRT	11.9%	10.0%	8.0%	
	Mid-			BART	6.5%	7.0%	8.0%
	High-			Amtrak	1%	1.0%	2.0%
		Mode Share	Transportation Mode	Ferryboat	0.1%	0.3%	0.4%
				Biking	3.3%	5.0%	6.0%
				Walking	4.9%	5.0%	6.0%

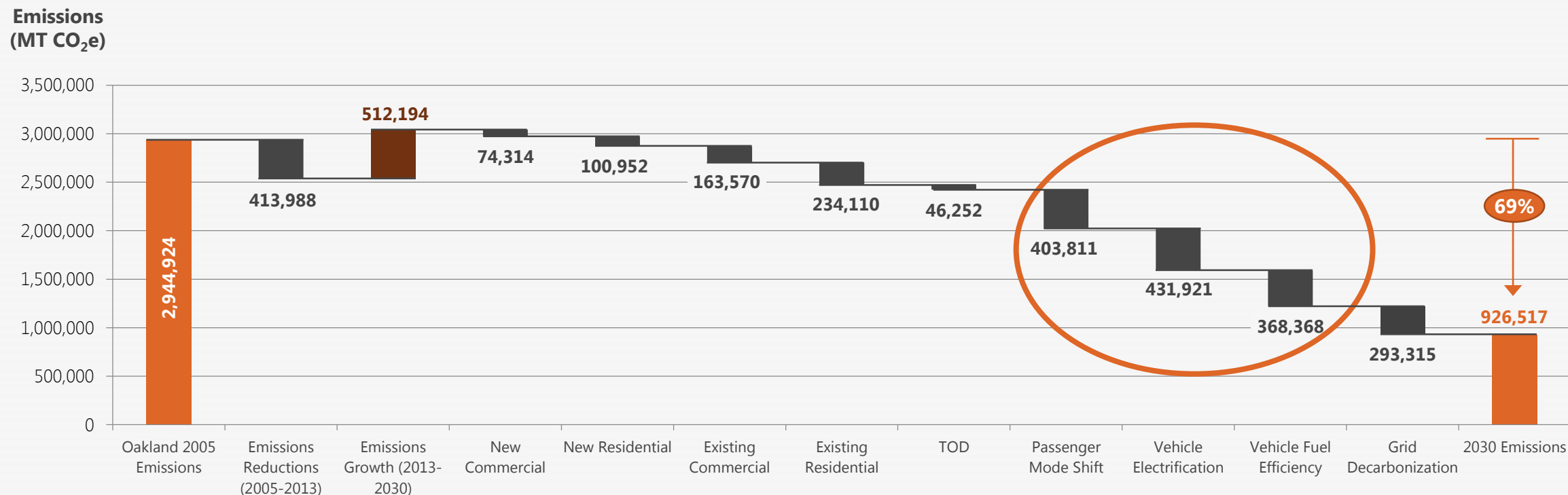
Deep Decarbonization

The Deep Decarbonization scenario models Oakland's GHG emissions based on the changes necessary to achieve the City's 2050 GHG reduction goal.

	CURB Tool Options		Today	2030	2050		
New Residential				Deep Decarbonize	Deep Decarbonize		
	Mid-Range Efficiency			0%	0%		
	High						
Existing Residential							
	Mid						
	High						
New Commercial							
	Mid						
	High						
Existing Commercial							
	Mid						
	High						
Mode Share		Transportation Mode	CURB Tool Options		Today	2030 Deep Decarbonization	2050 Deep Decarbonization
			Private Autos and Trucks		69.1%	40.0%	20.0%
			Motorcycle		1.6%	1.6%	1.6%
			Taxi/TNC 1or2 pass.		1.6%	3.0%	3.0%
			TNC Pooled Ride		Not avail.	5.0%	5.0%
			Shared Minibus		Not avail.	9.0%	10.0%
			Standard Bus/BRT		11.9%	15.0%	19.9%
			BART		6.5%	8.0%	14.0%
			Amtrak		1%	3.0%	3.0%
			Ferryboat		0.1%	0.4%	1.0%
			Biking		3.3%	7.5%	10.0%
			Walking		4.9%	7.5%	12.5%

Transportation offers the largest opportunities for GHG reductions in the 2030 Deep Decarbonization scenario, but Oakland must make progress in all areas

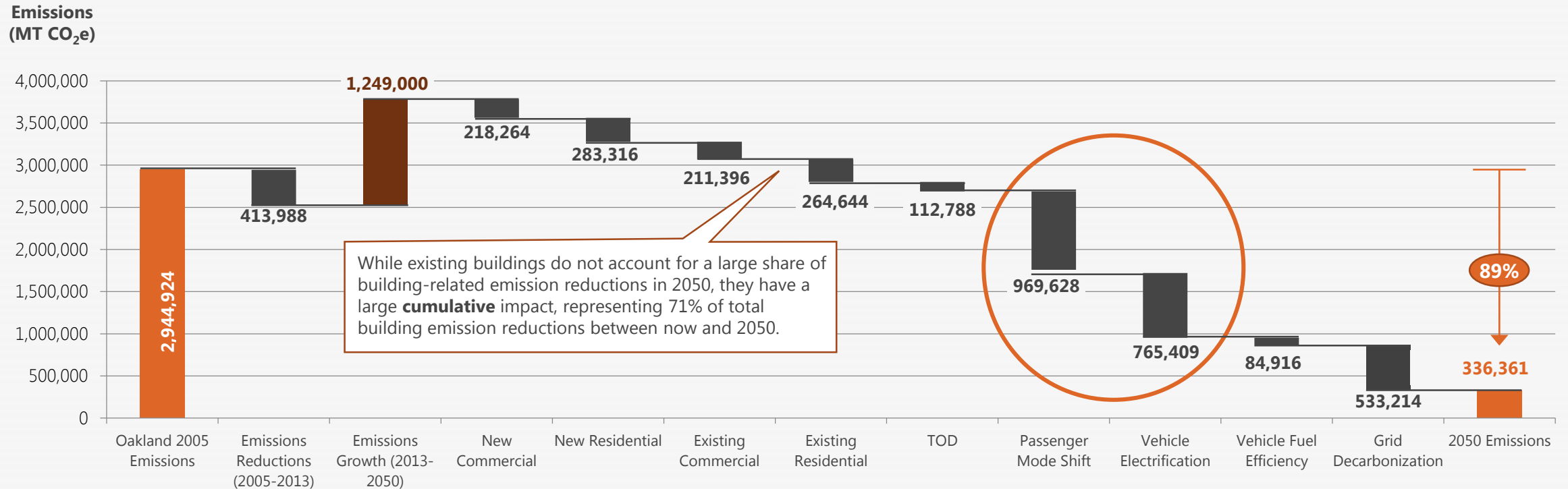
2030 Emissions Reductions in Deep Decarbonization Scenario





Shifting to less carbon intensive modes of transport and electrifying vehicles offer the largest GHG reductions in the 2050 Deep Decarbonization scenario

2050 Emissions Reductions in Deep Decarbonization Scenario



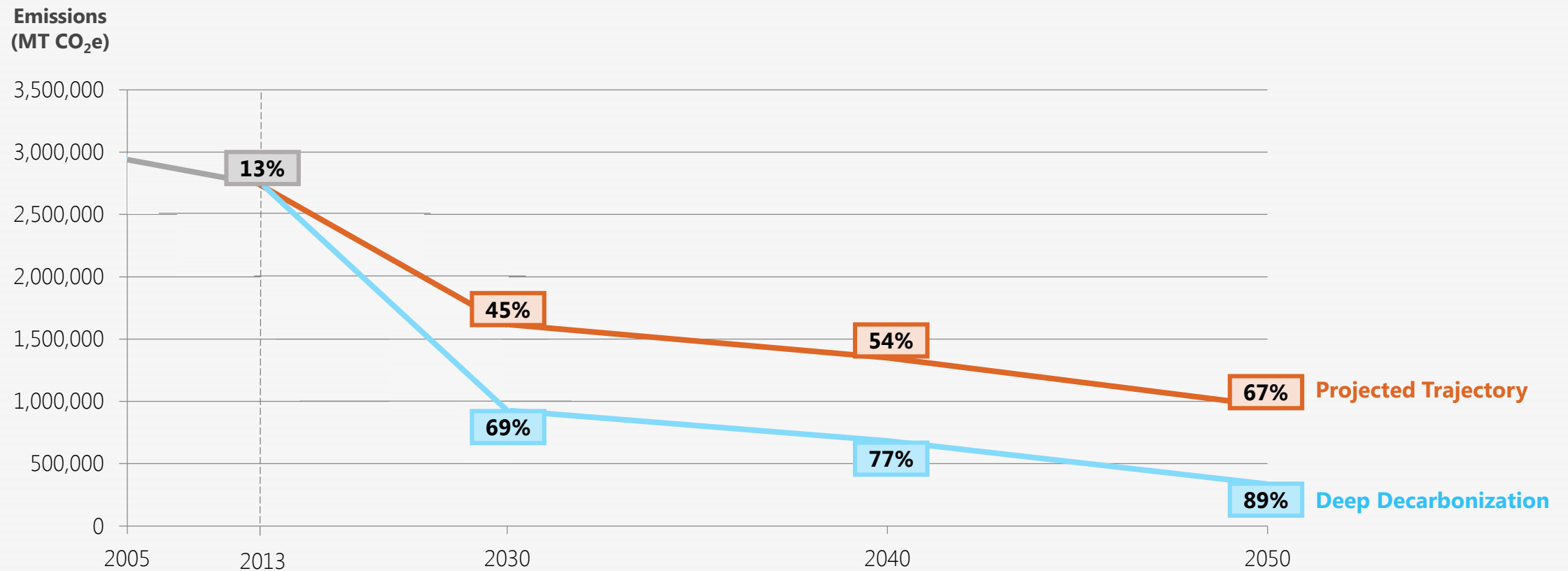


Comparing the two scenarios identifies the changes needed in Oakland's buildings and transportation systems

BA

Achieving the necessary level of GHG emission reductions will require City action.

Oakland's GHG Emissions Under CURB Scenarios





As an example, comparing adoption rates of window types highlights where gaps exist between the scenarios

BA

City action is needed to increase adoption rates of low-energy windows in Oakland's existing building stock.

Windows example

	CURB Options	Today	2030			2050		
			PT	DD	Delta	PT	DD	Delta
New Residential	Single Paned		0%	0%	0%	0%	0%	0%
	Double-Glazed		0%	0%	0%	0%	0%	0%
	Double G Low-E		98%	98%	0%	95%	95%	0%
	Triple-Glazed		2%	2%	0%	5%	5%	0%
Existing Residential	Single Paned	86%	46%	30%	-16%	12%	0%	-12%
	Double-Glazed	14%	40%	0%	-40%	40%	0%	-40%
	Low-E	-	10%	70%	60%	43%	95%	52%
	Triple-Glazed		4%	0%	-4%	5%	5%	0%
New Commercial	Single Paned		5%	0%	-5%	3%	0%	-3%
	Double-Glazed		0%	0%	0%	0%	0%	0%
	Double G Low-E		95%	100%	5%	97%	100%	3%
	Triple-Glazed		0%	0%	0%	0%	0%	0%
Existing Commercial	Single Paned	84%	64%	34%	-30%	28%	0%	-28%
	Double-Glazed	16%	27%	0%	-27%	34%	0%	-34%
	Low-E		9%	66%	57%	38%	100%	62%
	Triple-Glazed		0%	0%	0%	0%	0%	0%

More detailed assumptions can be found in Appendix A and B 'Technical Materials'.



Short-term City actions in buildings should focus on space heating and building envelope



There are many differences in the near-term improvements expected to occur in building systems under the Projected Trajectory and what is needed in the Deep Decarbonization scenario. This is particularly pronounced and important from a GHG perspective for Space Heating and Building Envelopes, which represent almost one-third of Oakland's overall GHG reduction potential.

Gap Assessment between 2030 Projected Trajectory and Deep Decarbonization Scenarios

		New Buildings		Existing Buildings	
System	Overall GHG ↓ Potential	Residential	Commercial	Residential	Commercial
Lighting	2%	Low	Low	Low	Medium
Appliances	1%	Medium	Medium	High	High
Space Heating	18%	High	Medium	High	Medium
Water Heating and Fixtures	3%	High	High	High	High
Cooling	1%	High	Low	Medium	High
Building Envelope	12%	Low	Low	High	High

Legend

Low	= Minimal City action required to achieve goals
Medium	= Moderate City action required to achieve goals
High	= Significant City action required to achieve goals
Priority City action area	



In the long-term, Oakland must eliminate fossil fuel use in all buildings



In the long-term, the biggest gap between the scenarios exists in eliminating fossil fuels for Space Heating and improving Building Envelopes in existing buildings.

Gap Assessment between 2050 Projected Trajectory and Deep Decarbonization Scenarios

		New Buildings		Existing Buildings	
System	Overall GHG ↓ Potential	Residential	Commercial	Residential	Commercial
Lighting	2%				
Appliances	1%				
Space Heating	18%				
Water Heating and Fixtures	3%				
Cooling	1%				
Building Envelope	12%				

Legend

Low	= Minimal City action required to achieve goals
Medium	= Moderate City action required to achieve goals
High	= Significant City action required to achieve goals
	= Priority City action area



Short-term City actions needed to reduce private vehicle trips



Short-term differences exist in the share of Private Autos and Trucks, and to a lesser extent Bus/BRT, as well as the rate of vehicle electrification for Private Autos and low-capacity taxis.

Mode Type	Today	2030			
	Mode Share	Mode Share		Vehicle Electrification	Fuel Efficiency
		Projected Trajectory	Deep Decarbonization		
Overall GHG Reduction Potential		39.8%		50.6%	n/a
Private Autos and Trucks	69.1%	55.1%	40%		
Motorcycle	1.6%	1.6%	1.6%		
Taxi or 1-2 Passenger TNC	1.6%	10%	3%		
TNC Pooled Ride	N/A	2%	5%		
Shared Minibus	N/A	3%	9%		
Bus/BRT	11.9%	10%	15%		
BART	6.5%	7%	8%		
Amtrak	1%	1%	3%		
Ferryboat	0.1%	0.3%	0.4%		
Biking	3.3%	5%	7.5%		
Walking	4.9%	5%	7.5%		

	2030
Overall GHG ↓ Potential	5.6%
New TOD Households	

Legend

Low	= Minimal City action required to achieve goals
Medium	= Moderate City action required to achieve goals
High	= Significant City action required to achieve goals
	= Priority City action area



Long-term City action needed to electrify key vehicle types and shift to low-carbon travel modes



In the long-term, significant gaps will continue to exist in the mode share and electrification of private vehicles. Gaps also exist in the share of passengers taking mass transit and walking.

Mode Type	Today	2050			
		Mode Share		Vehicle Electrification	Fuel Efficiency
		Projected Trajectory	Deep Decarbonization		
Overall GHG Reduction Potential		39.8%		50.6%	n/a
Private Autos and Trucks	69.1%	48%	20%		
Motorcycle	1.6%	1.6%	1.6%		
Taxi or 1-2 Passenger TNC	1.6%	5%	3%		
TNC Pooled Ride	N/A	5%	5%		
Shared Minibus	N/A	10%	10%		
Bus/BRT	11.9%	8%	19.9%		
BART	6.5%	8%	14%		
Amtrak	1%	2%	3%		
Ferryboat	0.1%	0.4%	1%		
Biking	3.3%	6%	10%		
Walking	4.9%	6%	12.5%		

	2030
Overall GHG ↓ Potential	5.6%
New TOD Households	

Legend

Low	= Minimal City action required to achieve goals
Medium	= Moderate City action required to achieve goals
High	= Significant City action required to achieve goals
Priority	= Priority City action area



The CURB analysis shows that a few changes are key to reducing Oakland's GHG emissions

BA

While cities must take an “all of the above” approach to climate action to achieve deep reductions, the analysis shows that not **all actions are equal**. Given the projected changes that will occur to Oakland's building and transportation systems as new technologies are adopted and State and Federal regulations take effect, **there are a few changes that have an outsized impact on the city's GHG emissions**.

1

Shift to 100% carbon-free energy

2

Eliminate fossil fuels from building heating systems

3

Improve building insulation and windows

4

Significantly shift people away from private auto trips

5

Accelerate the electrification of vehicles

A sepia-toned photograph of a city skyline reflected in water. The skyline features several tall buildings, including a prominent curved skyscraper on the right. A blimp is visible in the sky on the left. The text "Policy Considerations" is overlaid in the center.

Policy Considerations



To achieve the changes identified in this analysis, Oakland should focus on a few key actions

BA

This analysis identifies the specific actions the City needs to take to change its building and transportation systems to go beyond the Projected Trajectory and achieve its GHG reduction goals.

Near-Term Actions (2018-2030)



- Update codes for new buildings to eliminate gas heating systems by 2030
- Accelerate the electrification of space heating systems and dramatically improve building envelopes in existing buildings



- Increase mass transit options and coverage
- Continue to build out pedestrian and bike infrastructure
- Accelerate the electrification of private vehicles and low capacity taxi/TNC vehicles

Long-Term Actions (2030-2050)

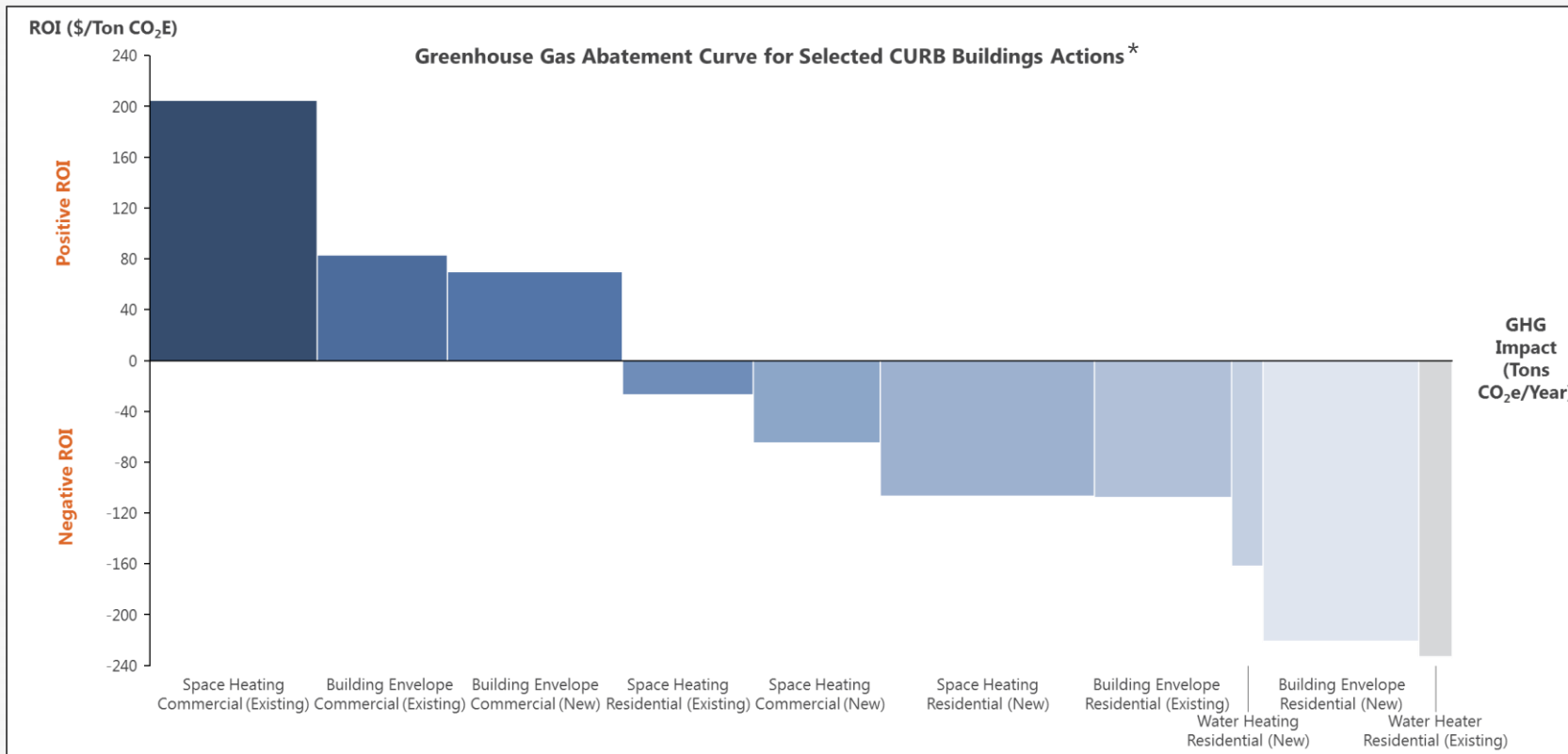
- Eliminate fossil fuel use in all buildings
- Continue to support large regional activities to expand transit options
- Prioritize low carbon modes of transportation in infrastructure investments
- Ensure the electrification of shared mobility vehicles



Many of the buildings actions needed to achieve Oakland’s goal have a positive ROI; others may require financial incentives or mandates for widespread adoption



Oakland’s GHG Abatement Curve outlines the cost effectiveness of each building action relative to its potential impact on GHG emissions; however it does not identify who pays that cost or receives that benefit.



*Collectively, all other buildings actions reduce GHG emissions by 32,000 tons of CO₂e per year (6% of total buildings-related reductions), at a weighted average ROI of \$-1,000.

Key Takeaways

- Commercial Buildings actions tend to produce a positive ROI; property owners should be able to take action without additional economic incentives from the City
- Oakland will need to place particular emphasis on the residential building stock – and may need to commit financial resources to incentivize residential retrofits
- Due to limitations of CURB, this analysis is not available for transportation actions



Successful cities use four key types of policies to achieve transformational change and reduce GHG emissions

1 Lead by Example

Small in overall GHG impact, but critical to provide highly-visible examples, demonstrate value and pilot new technologies.

2 Incentivize Action

Spur early action through incentives that catalyze other actors, create examples, and produce more reductions sooner (greater cumulative impact).

3 Require Results

Enact performance-based standards or targets that do not target specific actors or technologies, but focus on impacts.

4 Mandate Action

Takes full advantage of City policymaking, regulatory, and enforcement authorities. Principal burden of implementation is on private actors with City setting policy, enforcing actions, and potentially providing assistance.



The City of Oakland has several efforts planned or underway impacting GHG emissions from the buildings sector



Policy/Program	Status	Description	Impact
BayREN Single Family and Multifamily Renovation Programs	Operational since 2013	Since 2013, both the Single Family and Multifamily programs have provided technical assistance and rebates for energy efficiency retrofits across the 9 county Bay Area region. Region-wide the Single Family program has delivered 5,407 projects and the Multifamily program has delivered 21,306 retrofitted units as of September 2017.	Pilot resulted in energy retrofits of an estimated 1,400 homes in Oakland. Improved efficiency by 23% in single family, 15% in multifamily.
Green Building Ordinance for Private Development	Completed November 2010. Effective January 2011	Ordinance that requires high levels of energy performance in new construction for residential and commercial private development, as well as additions and alterations to existing buildings.	Lowered energy use in new construction by an estimated 10% from State code.
PACE Financing	First provider authorized in 2010; 4 additional providers approved in 2015. Ongoing in market	Offer property-based financing home improvements including but not limited to energy efficiency, water efficiency, solar energy improvements. While property owners enroll in the program voluntarily and this program is not directly administered by the City, the City of Oakland must approve companies to contract in Oakland.	545 PACE-financed retrofits were completed in FY 2016. Lifetime savings from these projects are 17,244 metric tons of CO2 and 45 GWh of electricity use avoided.
Downtown Commercial Retrofit Program	Completed	Enhanced incentives and technical assistance using ARRA funding to help downtown commercial property owners improve energy efficiency. Called the "Oakland Shines" campaign, it emphasized Class B buildings as part of its plan to reach 80% of downtown businesses.	Project generated 191 retrofits of commercial buildings, with 4.5 GWh of electricity use avoided and 67,470 therms of gas avoided.
Weatherization and Energy Retrofit Loan Program	Completed; looking to expand	Retrofit Program serves 20-40 properties per year, offers loans of \$6,500 to \$30,000 to owner occupied low to moderate income households. Loan funds can be used for variety of energy efficiency projects.	Reduced energy bills by an average of 30%.



The City of Oakland has several efforts planned or underway impacting GHG emissions from the transportation sector



City Policy/Program	Status	Description	Impact
OakDOT Strategic Plan	Released 2017	The Strategic Plan outlines the Departments of Transportation's goals and strategies for improving equity, sustainable infrastructure, mode share, safety, and government responsiveness.	The transportation policies, plans, and programs outlined in this table are all so recent that it is too early to assess their impacts. It is also difficult to assess local impacts without understanding the regional impacts, due to the geographic centrality of Oakland within the transportation flows of the broad Bay Area region. Over time, it will be important to measure the impact through changes to mode share and vehicle miles travelled.
Bicycle & Pedestrian Plans	Pedestrian Plan was accepted June 13th 2017; Bicycle Plan Update in progress (first plan passed in 2007)	The Pedestrian Plan outlines the Department of Transportation's goals to improve walkability and pedestrian safety, repair existing streets to encourage walking, and increase funding for pedestrian improvements. The Bicycle Plan details proposed new bike facilities in Oakland. 48 miles of new bike paths were constructed between 2007 and 2016.	
Complete Streets Policy	Adopted in April 2013	Plan to provide streets that are safe and convenient for all users. Actions include streetscape design, traffic signal upgrades, and bicycle and pedestrian facilities design.	
Expansion of Ford GoBike Bike Share System	System launched and in process of expansion.	Ford GoBike was established in 2016. By the end of 2017, the City of Oakland will have 70 parking stations and 850 bikes.	
Expansion of BRT corridors	Under construction beginning in 2017	Implementing BRT along International Boulevard, which carried 12% of AC Transit patrons in 2011 (more than any other corridor).	
Parking and Mobility Policies and Programs	Part of OakDOT Strategic Plan	Parking subsidies for downtown employees were discontinued in 2010. Special parking permits for designated car share organizations since 2015. Developing demand-based parking programs.	



Actions in other cities offer examples of what Oakland could do to reduce emissions from buildings



Not exhaustive

Lead by Example

- Require all new municipal buildings to meet net-zero energy standards (Vancouver)

Incentivize Leaders

- Launch GHG/energy reduction challenge programs for targeted building types (e.g., hotels, offices) (New York City, Chicago)
- Provide grants, loans, or rebates for retrofits in targeted building types (e.g. affordable housing) or systems (Toronto, Denver, Palo Alto)
- Exempt buildings from benchmarking or audit requirements for taking specified actions (Boston, New York City)

Require Results

- Enact performance-based energy codes that require set % of GHG reductions from individual buildings (New York City, proposed)
- Require targeted buildings to undergo retro-commissioning on a regular basis (New York City)
- Conduct periodic compliance studies of energy codes or use a 3rd party compliance review for code enforcement (Pittsburgh)
- Require point-of-sale energy audits (Austin)

Mandate Action

- Mandate that building systems be brought up to current code upon any updates to those systems (Berkeley, New York City)
- Require new or substantially retrofitted buildings to meet passive house standards (Brussels)
- Require public displays of energy performance (New York City)
- Require targeted buildings to perform annual benchmarking (27 U.S. cities)
- Require targeted buildings to perform regular audits (New York City)



Actions in other cities offer examples of what Oakland could do to reduce emissions from transportation



Not exhaustive

Lead by Example

- Install City-owned EV chargers (Raleigh, NC)
- Electrify public transit vehicles and City-owned vehicles (Los Angeles, New York City, Seattle)
- Support electric car share systems (Paris, Los Angeles)

Incentivize Leaders

- Streamline permitting for electric vehicle charging and service equipment (Chicago, Austin)
- Tax credits for alternative fuel charging (Washington D.C.)
- Engage private fleets to accelerate conversion to low-emission vehicles (Hamburg)
- Zero/low emission vehicle purchase subsidies (Seattle, Riverside)

Require Results

- Require transit expansion to serve dense areas outside of city center (Boston, Johannesburg)
- Preferred treatment for zero/low emission vehicles, including fast lanes, parking discounts, reduced congestion fee (San Jose, Sacramento, Milan)

Mandate Action

- Create low emission zones (London, + 220 other cities)
- Congestion pricing (Oslo, London, Stockholm)
- Vehicle bans in city centers (Oslo, Madrid – planned)

Several cities have enacted programs to accelerate change in the specific building and transportation systems targeted for Oakland

Bloomberg Associates produced case studies of eight programs implemented in other cities that are accelerating change in the buildings and transportation systems targeted for Oakland.

1 Lead by Example



Vancouver
Net Zero Standards for
Municipal Buildings



Seattle
Vehicle Electrification

2 Incentivize Action



Melbourne
Building Energy
Efficiency Incentives



Chicago
EV Purchase Subsidies

3 Require Results



Brussels
Passive House
Standards & Subsidies



Milan
Low Emission Zone and
Congestion Charge

4 Mandate Action



Austin
Point-of-Sale
Energy Audits



Nottingham
Workplace Parking Levy



Net Zero Standards for Municipal Buildings: Vancouver



Vancouver has required all new City-owned buildings, including housing, offices, and schools, to meet LEED Gold standards since 2004 and will eliminate GHG emissions from all new City-owned buildings starting in 2018.

Program Overview

In 2004, Vancouver passed the **Green Building Strategy** that mandated all new City-owned buildings be designed to LEED Gold standards.

In 2015, the **Renewable Energy Strategy for City-Owned Buildings** expanded Vancouver's ambitions, setting goals to:

- Build all new city-owned buildings will be built to zero emissions standards beginning in 2018
- Reduce GHG by 55% and achieve 70% renewable energy by 2025
- Reach 100% renewable energy and eliminate all GHG emissions across all municipal buildings by 2040

Results

- Municipal buildings have seen a **23% decrease in total annual green house gas emissions** between 2007 – 2016
- Demonstrating the value of city leadership: Vancouver has experienced a **20% decrease in annual GHG emissions for all new buildings** between 2007- 2016, despite less strict standards for non City-owned buildings
 - By 2013, Vancouver surpassed 220 LEED certified projects

Note: Currently, Vancouver's grid is more than 30% renewable, which can supply electricity demand in buildings. Further investments in renewable generation capacity will aim to supply transportation demand and can contribute to building's reduction in remaining fossil fuel use (primarily natural gas).



Policy Area	Standards for Municipal Buildings
Cost	\$100,000 for a new position at the Office of the Chief Building Official to enforce LEED Gold standards
Status	Enacted in 2004
Action Type	Lead by example



Energy Efficiency Incentives: Melbourne



Melbourne's 1200 Building Program incentivizes building upgrades for energy and water efficiency by providing information and access to creative financing options.

Program Overview

Launched in 2010, the 1200 Buildings Program targets certain ownership groups – 'institutional leaders' as well as underperforming buildings – offering these building owners information on and incentives for efficiency upgrades. The program provides:

- **Large-scale renewable electricity procurement** – participation in the program gives businesses the option to purchase renewable energy through the Melbourne Renewable Energy Project, a long-term purchasing contract held by the City of Melbourne that provides 100% renewable energy
- **Help accessing Environmental Upgrade Financing** – a system where building owners can enter an agreement with a private finance institution and the City of Melbourne's Sustainable Melbourne Fund (SMF), for a loan to finance building upgrades. The building owners are able to repay their loan through the SMF with added incentives such as longer lending periods, greater security and lower rates
- **Information on the building retrofitting and solar opportunities** – the organization helps businesses understand the costs, processes and other considerations of installing solar panels and other upgrades to a building

Results

- By 2013, the program helped fund **\$4.9 million in retrofits that estimate a savings of 5,350 tons of CO2e emissions a year**
- By 2015, the program had acquired **53 signatures from major commercial companies** including GPT Group, ING, Stockland and Asia Pacific Group, to enter the program
- Now 16 other cities across Australia have adopted programs for Environmental Upgrade Financing



Policy Area	Encourage building upgrades for energy and water efficiency
Cost	\$380,000 on consultants, staff and marketing and TBD from the Sustainable Melbourne Fund for financing
Status	Launched 2010
Action Type	Incentivize leaders



Passive House Standards and Subsidies for New Buildings: Brussels



Brussels requires all new buildings, including houses, offices, and schools, to meet rigorous energy-efficiency regulations – known as Passive House standards – for heating, cooling, and energy consumption.

Program Overview

Passive House energy legislation was passed in two parts:

- In 2007, Brussels passed **an ordinance to regulate the energy performance of buildings** and encourage the early adoption of Passive House standards. The performance requirements apply to energy consumption, heating and cooling, and building envelope; they vary for new buildings and retrofits
- In 2011, Brussels passed **the Passive House Law requiring all new buildings to comply with ultra-energy efficiency standards**, beginning in 2015

Critically, Brussels also **provided financial incentives for the creation of Passive House buildings.**

- From 2007 to 2014, the Exemplary Buildings (BatEx) program utilized funds from energy providers to award €45 million (~\$55 million) in subsidies.
- BatEx funded projects that strived to be zero-emission, prioritized the use of eco-friendly construction materials, were simple and feasible in technical and financial terms, and had reasonable payback timelines.

Results

The combination of stringent regulations and subsidies have resulted in:

- An initial 17% reduction in energy consumption (in comparison with buildings not covered) and a new reduction of 25% in energy consumption after the 2011 law
- 243 BatEx projects, representing 6.7 million square feet of new Passive House buildings
- 3,000 additional Passive House buildings constructed in Brussels (beyond BatEx projects)



Policy Area	Eliminate fossil fuel use in new buildings
Cost	BatEx distributed €45 million (~\$55 million) in subsidies to winning projects
Status	Passed 2011, in effect as of 2015
Action Type	Mandate action, incentivize leaders



Point of Sale Energy Audits: Austin



Austin's Energy Conservation Audit and Disclosure (ECAD) ordinance requires energy audits and disclosures for all homes and buildings within Austin City limits, served by Austin Energy, that meet certain age/size requirements. As part of a real estate transaction, ECAD's energy disclosures uncover energy improvement opportunities. Non-compliance with the ordinance can result in a misdemeanor and fines.

Program Overview

ECAD was approved by Austin City Council in November 2008 and took effect in June 2009. **It requires residential building owners to disclose a home energy audit, conducted by a certified ECAD Energy Professional, prior to sale.** An ECAD energy audit is required for:

- **Residential properties that are 10 years or older** and results must be disclosed to potential buyers
- **Multi-Family buildings that are 10 years or older** and results must be made available to all potential and current residents
- **Commercial buildings that are 10,000 sq. ft. or larger** and energy ratings must be reported to the City by June 1 of each year

ECAD auditors evaluate properties and make recommendations for improving the energy-efficiency of windows, attic insulation, air conditioning and heating systems, and the air duct system.

- Austin Energy provides a variety rebates, incentives, and loans for energy-efficiency upgrades.

Results

An estimated 98% of the 3,000 to 4,500 homes that are audited each year receive at least one energy efficiency recommendation:

- 68% need in-home weatherization
- 68% need HVAC air duct system renovation
- 58% need solar shading
- 79% need additional attic insulation

Although ECAD does not require energy improvements, Austin Energy provides a variety of energy efficiency upgrade incentives, which are estimated to save an annual:

- ~8 million kWh of energy (equivalent to powering 650 homes)
- ~5,000 tons of CO₂



Policy Area	Time of sale energy audit requirements
Costs	Each audit costs home or building owners an estimated \$100 - \$200 per unit
Status	Took effect June 2009
Action Type	Mandate action



Vehicle Electrification: Seattle



Drive Clean Seattle is designed to accelerate the city’s transition away from fossil fuels. By investing in publically accessible charging stations, it aims to reduce GHG emissions from the City’s fleet 50% by 2025 and cut oil used for transportation 50% by 2035.

Program Overview

Mayor Murray announced the Drive Clean Seattle resolution in 2016, which was passed by the City Council in late 2016. **The program invests in publicly accessible charging stations** to create a robust network of charging infrastructure. Seattle plans to **install 400 charging stations over the next 5-7 years.**

In addition to charging stations, the program includes plans to:

- **Electrify the City’s fleet** to reduce fleet’s GHG emissions by 50% by 2025. Will achieve this through a combination of cleaner fuels, more efficient vehicles, and significant investment in electric vehicles
- **Electrify existing transit options** by converting Seattle’s trolley bus, streetcar, and light rail systems to carbon-free electricity. Also supports the expansion of light rail throughout the region and partners with regional transit agencies to identify opportunities to continue to use carbon-free electricity as a transit fuel
- **Review City regulations, policies, and codes** to encourage electric vehicles and private sector investment in cleaner transportation choices

Drive Clean Seattle required a coordinated effort across multiple city departments, including the Office of Sustainability and Environment, the Department of Transportation, Seattle City Light (the City’s municipal electric utility), the Department of Construction and Inspections, and the Department of Finance and Administrative Services.

Results

As of May 2017, Seattle had:

- Installed 100 charging stations at 20 publicly locations
- Joined with Los Angeles, San Francisco, and Portland in sending to automakers a request for information — the first step in a formal bidding process —to buy or lease larger and heavy-duty electric vehicles for their fleets with plans to purchase about 850 over the next three years



Policy Area	Vehicle Electrification
Costs	Current budget includes ~\$1.7 million for 170 charging stations
	Total cost of charging stations ~\$5 million (\$10-\$15k per station)
Status	In-progress, launched in 2016
Action Type	Lead by example, incentivize leaders



EV Purchase Subsidies: Chicago



Drive Clean Chicago is a \$14 million incentive program operated by the Chicago Department of Transportation (CDOT) with funding from the Federal Congestion Mitigation Air Quality program. It provides vouchers and rebates to fleet owners, leased vehicle operators, manufacturers, vehicle technology vendors, and station developers to accelerate the adoption of alternative fuel vehicles and infrastructure.

Program Overview

Drive Clean Chicago began in 2016. Funds provide:

- **\$10 million in vouchers for all-electric and hybrid trucks and busses;** commercial truck owners or leasers can receive up to \$30k for the purchase of a new vehicle that operates 75% of the time in Chicago
- **\$1.275 million in vouchers for alternative fuel taxis;** taxi fleet owners can receive up to \$10k towards conversion or incremental cost of a new vehicle that operates 75% of the time in Chicago
- **\$1.425 million in rebates for CNG fueling and DC fast charging stations** located in Chicago; fleet owners/station owners can receive a 30% rebate on capital cost for station development

Results

As of July 2017, CDOT had awarded the full \$10 million for trucks and \$1.275 million for taxis, as well as \$600k for charging stations.

With these funds, Drive Clean Chicago has supported the deployment of more than 400 carbon-free vehicles for area fleets, which has resulted in the country's first privately-run 100% zero emission electric bus fleet for tenants at the Prudential Plaza-Aon building. It has also helped to purchase/build 220 alternative fuel stations. Drive Clean Chicago's successes have led to an estimated:

- Savings of 200,000 barrels of oil
- Reduction of 2,585 metric tons of GHG emissions



Policy Area	Vehicle Electrification
Costs	\$14 million
Status	Passed in 2016, applications accepted through 2018
Action Type	Incentivize leaders



Low Emission Zone and Congestion Charges: Milan



The City of Milan has implemented a Low Emission Zone and Congestion Charge that aim to reduce traffic congestion and improve air quality. Vehicles entering the zoned area in the city center are automatically charged a daily fee that funds sustainable mobility projects.

Program Overview

In 2008 Milan implemented a **pollution charge based upon vehicle pollution class**. Vehicles entering an 8.2 km² (4.5% of city) area in the center of the city are **charged €0-10 (~\$0-12), based upon the emission intensity of the vehicle**.

- The system is operated through 43 electronic gates using automatic number plate recognition technology that identifies the pollution class of the vehicle from vehicle registration data

After a **public referendum received 79% support in 2011, the scheme was expanded to include a congestion charge** beginning in 2012. Vehicles entering into the regulated area are charged €5 (~\$6) for daily access.

- Entrance tickets vary for residents, service vehicles, and parking garages and all types of public transit and low emission vehicles are exempt from the charge
- Beginning in 2017, diesel vehicles without particulate filters are banned from entering Area C; the ban is in effect during the day Monday-Friday and does not extend to residents

Results

Total revenue generated in 2012 was €30 million (~\$36 million). These funds are invested in sustainable mobility projects, including:

- €3.8 million (~\$4.5 million) in park and ride facilities on Metro Line 3
- €3 million (~\$3.6 million) in improvements to bike share system
- €10 million (~\$12.2 million) investments in public transport fleets

Area C has seen a 34% decrease in traffic congestion, 24% reduction in road casualties, and 49% reduction in circulation of polluting vehicles. Various pollutants have also been reduced:

- 18% reduction in total PM10
- 10% reduction in exhaust PM10
- 42% reduction in Ammonia
- 18% reduction in nitrogen oxide
- 35% reduction in carbon dioxide



Policy Area

Reducing private vehicle trips and incentivizing vehicle electrification

Costs

€14 million
(~\$17 million)
annual operating cost

Status

Emission charge since 2008, congestion charge since 2012

Action Type

Require results



Workplace Parking Levy: Nottingham



Nottingham's Workplace Parking Levy (WPL) is a congestion charge that encourages employers to reduce the number of free staff parking spaces. Funds raised from this annual fee go directly towards improving the city's transport infrastructure.

Program Overview

In 2012, Nottingham implemented an annual parking levy, which was charged to all employers who provide 11 or more workplace parking places.

- **WPL charges employers an annual fee of £379 (~\$525) per parking space;** the levy affects 42% of Nottingham's parking spaces – a total of 25,000 across the city
- **All revenue generated by the WPL goes directly towards improving the city's public transport infrastructure**
- **WPL is implemented primarily through an online portal, where employers can pay annual fees.** The implementation of the online payment system minimizes costs for the city

Results

The levy raises ~£9 million (~\$12.5k) annually, which is used to fund improvements in the city's transport infrastructure, including:

- Purchase of 45 new fully electric buses
- Doubling the size of the city's tram network
- £6.1 million (~\$8.5 million) investments in improved cycling routes

In its first 3 years of operation, the workplace parking levy:

- Contributed to a 33% overall decline in carbon emissions (compared to 2005 levels) of which 13% is estimated to be as a result of modal shift to public transport, biking, and walking
- Initial academic research has shown the policy has a statistically significant impact on traffic congestion, with an associated 40% rise in public transport use



Policy Area	Mode shift away from private vehicles
Costs	~£500,000 (~\$700,000) annually (<5% of what WPL generates each year)
Status	On-going, began in 2012
Action Type	Mandate action

Conclusion





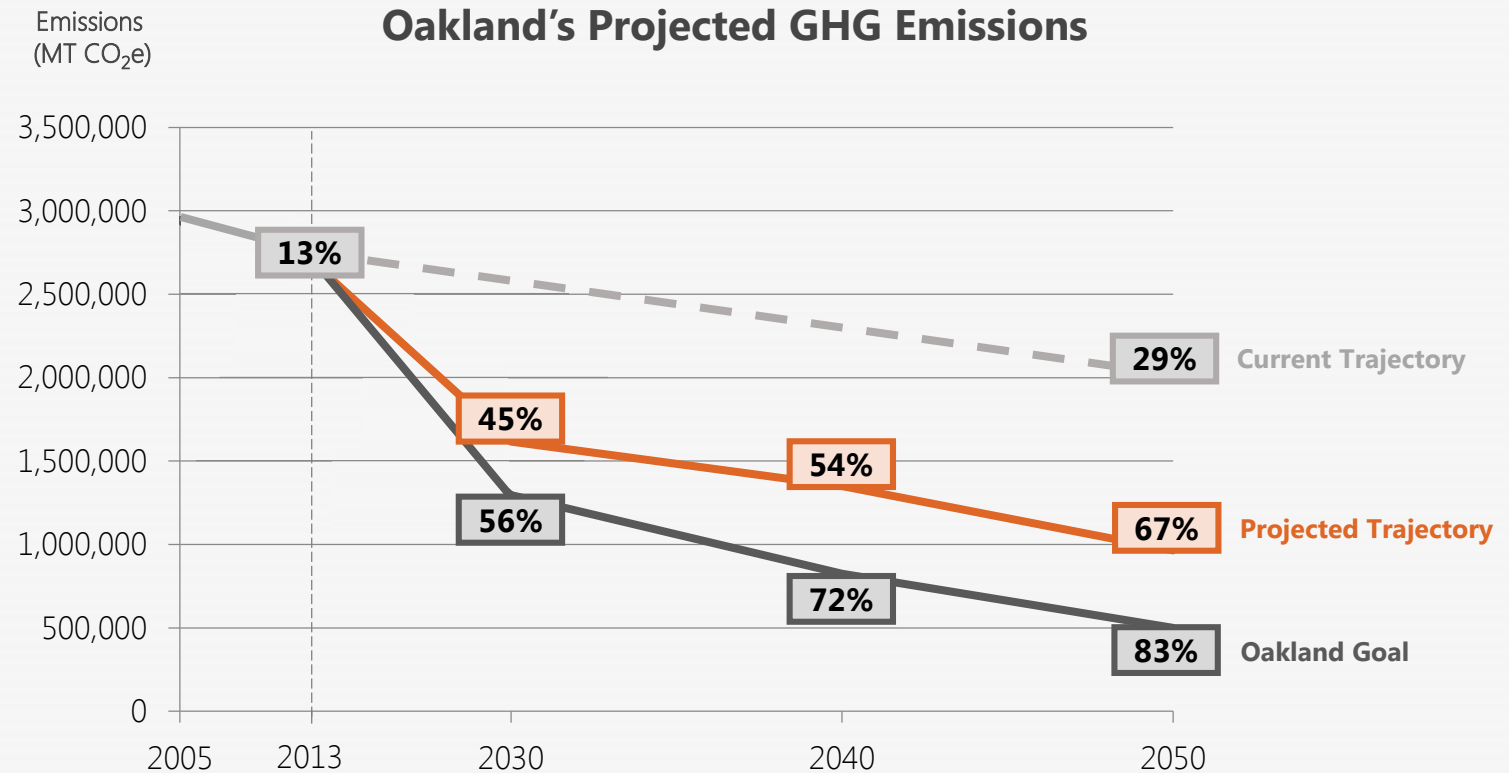
Without additional City action, Oakland will not meet its 2050 GHG reduction goal

BA

In 2013, Oakland's GHG emissions decreased 13% from its 2005 baseline. **If Oakland continues on its Current Trajectory, it will only achieve a 29% decrease in emissions by 2050**, accounting for population and economic growth – far short of its adopted target.

Even accounting for expected changes, including market trends and technological advances, State and Federal policies, and adopted and funded City policies (Projected Trajectory) Oakland will not achieve its 2050 goal.

Meeting the 2050 goal is technically feasible, but will require significant City leadership, investment, and policy changes in both the near-term and long-term.





To meet its 2050 GHG goal, Oakland must take targeted near- and long-term actions to achieve five key changes to its buildings and transportation systems

Five changes need to be achieved to meet Oakland's GHG reduction goal:

- 1 Shift to 100% carbon-free energy
- 2 Eliminate fossil fuels from building heating systems
- 3 Improve building insulation and windows
- 4 Significantly shift people away from private auto trips
- 5 Accelerate the electrification of vehicles



City action is needed to achieve these changes:

Near-Term Actions (2018-2030)

- Update codes for new buildings to eliminate gas heating systems by 2030
- Accelerate the electrification of space heating systems and dramatically improve building envelopes in existing buildings
- Increase mass transit options and coverage
- Continue to build out pedestrian and bike infrastructure.
- Accelerate the electrification of private vehicles and low capacity taxi/TNC vehicles

Long-Term Actions (2030-2050)

- Eliminate fossil fuel use in all buildings
- Continue to support large investments in transit
- Prioritize low carbon modes of transportation in infrastructure investments
- Ensure the electrification of shared mobility vehicles



The actions need to aggressively reduce Oakland's GHG emissions can be implemented through a range of City policies and investments

Serve as the basis for the update of Oakland's Energy and Climate Action Plan (ECAP)

- The action areas identified in this analysis should serve as the focus for policy priorities in the next ECAP, to be released in 2020
- The technical and financial components of this analysis can help justify Oakland's sustainability priorities to Council and the public

Incorporate top CURB actions into the Capital Improvement Program (CIP) prioritization framework

- The changes and actions identified by this analysis provide a clear set of criteria that should be included as one factor in evaluating potential projects for City investments
- Investments that advance one of the priority changes (e.g., shift people from private auto trips) should be given additional credit during project prioritization

Incorporate top CURB actions into other funding processes

- The City should leverage other funding sources (e.g., seismic retrofits, affordable housing) that impact Oakland's buildings and transportation systems to address priority actions where appropriate (e.g., including window upgrades as part of seismic retrofits, ensuring high efficiency heating systems in affordable housing)

Use priorities as key inputs into department-level plans and policies

- Department plans, such as neighborhood-specific plans, should incorporate policies that align with the changes identified by this analysis (e.g., shifting people away from private auto trips)
- Scan citywide codes and policies to identify opportunities to achieve the priority changes (e.g., update the City's Green Building Ordinance with a focus on space heating)

A sepia-toned photograph of a city skyline reflected in water. The skyline features several tall buildings, including a prominent curved skyscraper on the right. A blimp is visible in the sky on the left. The text "Appendix A – Buildings Technical Materials" is overlaid in the center.

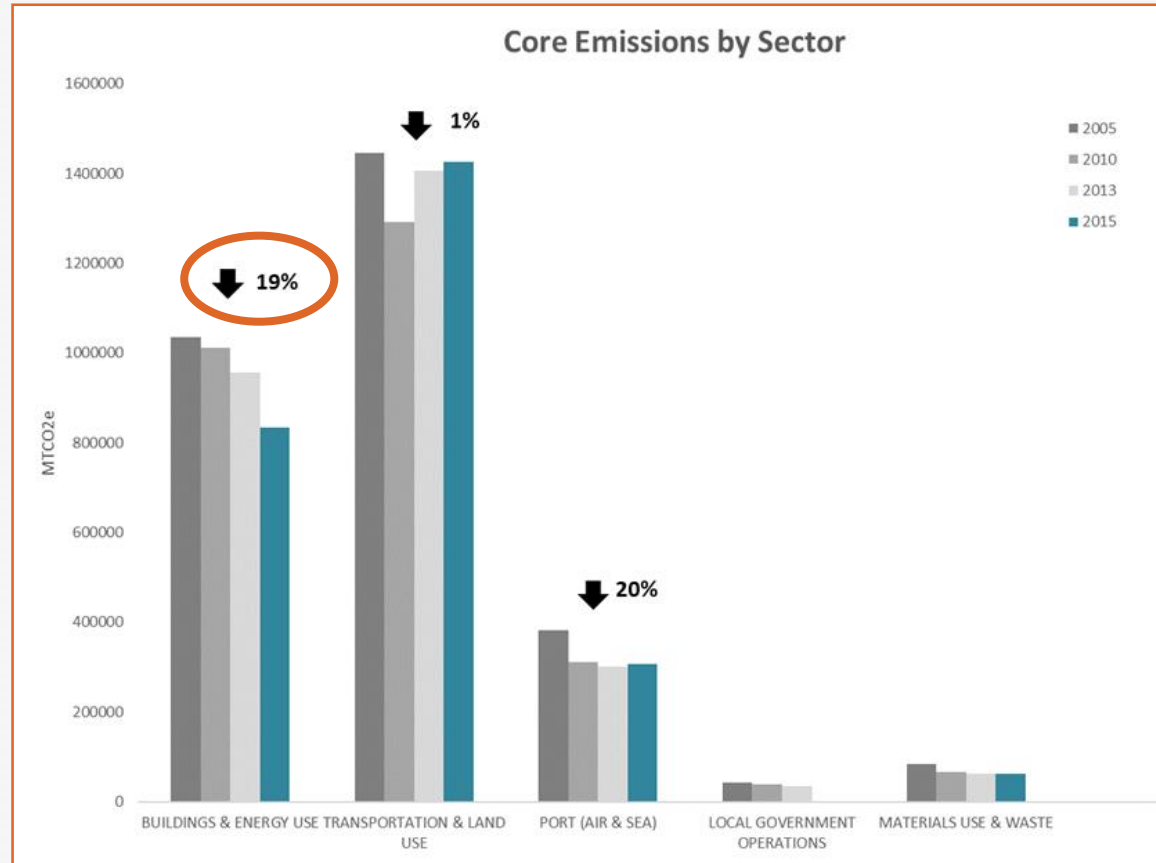
Appendix A – Buildings Technical Materials



Building emissions have fallen significantly from the 2005 baseline



While CURB uses a 2013 baseline and the analysis used that dataset, it is important to acknowledge progress that Oakland has made in more recent years. Oakland's most recent data shows that 2015 emissions from building and energy use were 19% lower than the 2005 baseline.



This progress has been primarily driven by a gradual cleaning of Oakland's electricity mix.



Achieving further reductions will require Oakland to change the specific systems within buildings



CURB provides 28 different options for modeling actions within Oakland's buildings.

CURB categorizes buildings in two ways...

1. **Type:**
Existing or New
2. **Use:**
Residential or Commercial

... and models the impact that **seven building systems** have on building-related GHG emissions:

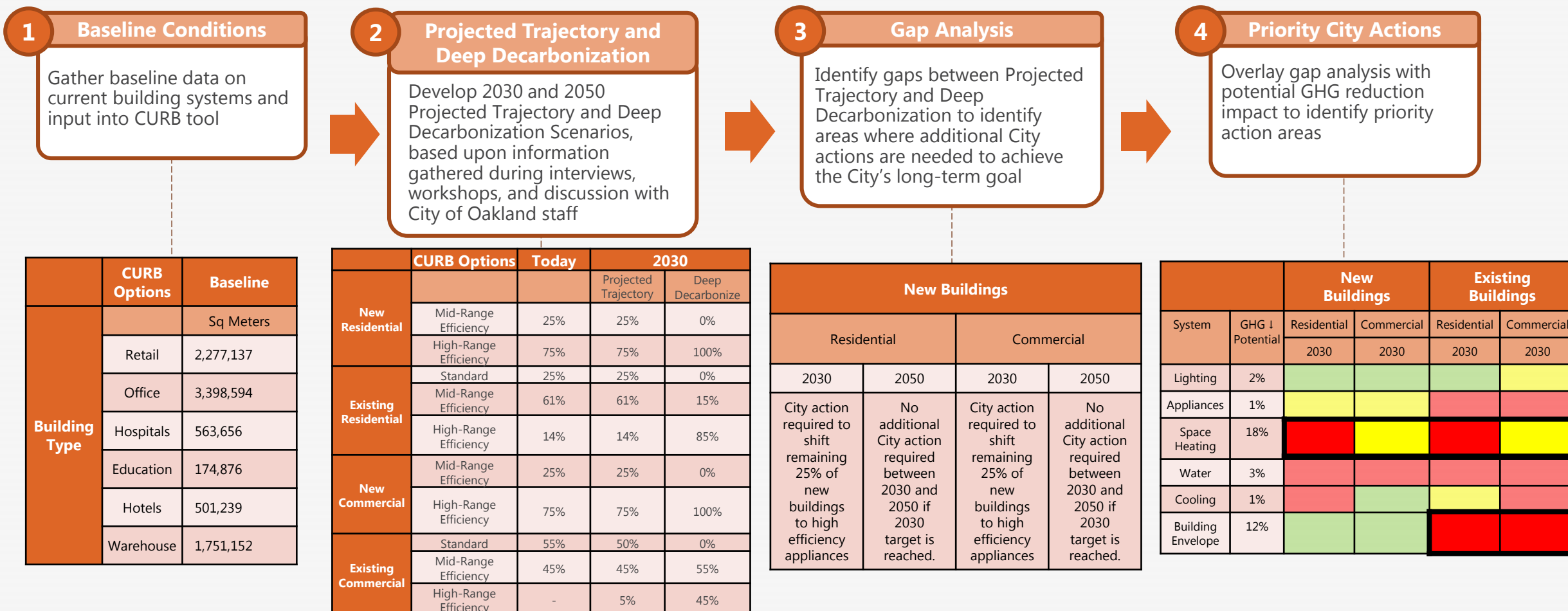
- Lighting
- Appliances
- Space Heating
- Cooling
- Water Heating
- Water Fixtures
- Building Envelope



Methodology

Bloomberg Associates utilized a four-step process to identify where City action is needed to achieve Oakland's GHG goal, based on two scenarios for 2030 and 2050:

- **Projected Trajectory** projects the expected impacts of market forces together with State and Federal policies
- **Deep Decarbonization** projects where the City needs to be to achieve its GHG reduction goals

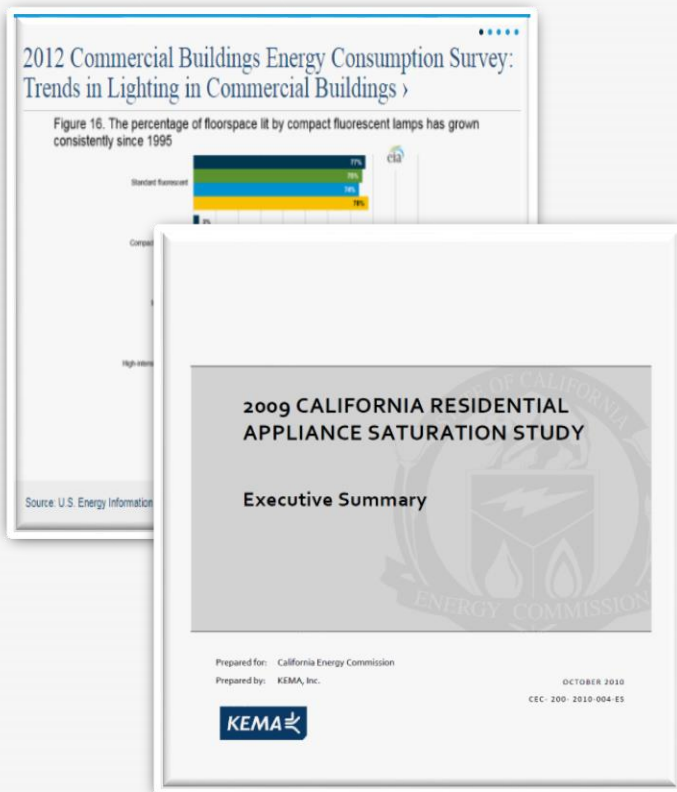




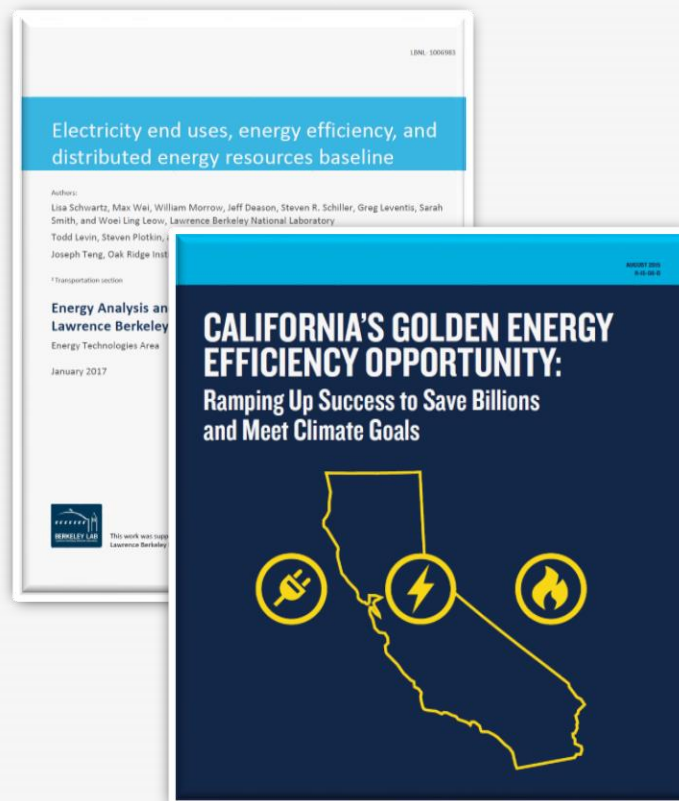
Bloomberg Associates reviewed key documents

Bloomberg Associates reviewed key documents, reports, and white papers to understand the condition of Oakland's building stock and opportunities to reduce emissions from buildings sector.

End Use Surveys



CA-Focused Technical Studies



National Best Practices



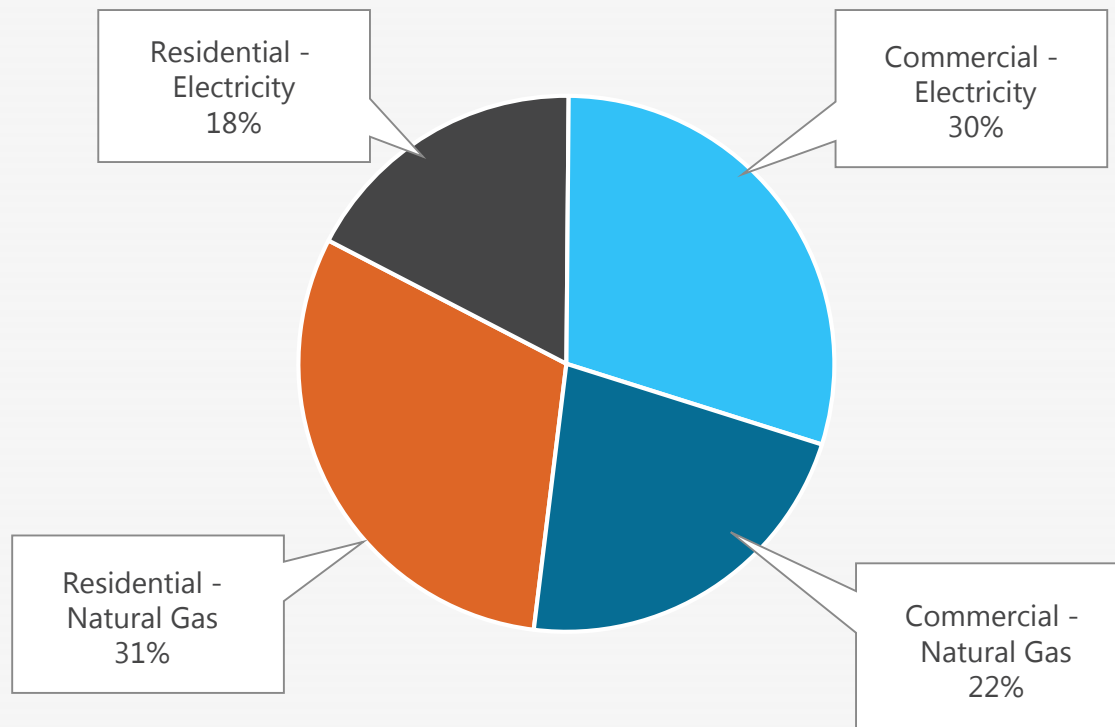


Publically available data provides a broad overview of Oakland's current building stock...



Oakland's current building emissions are evenly divided across four sources.

MT CO₂e Attributable to Oakland's Buildings



Estimated Footprint of Oakland's Buildings

Building Type	Square Meters
Retail	2,277,137
Office	3,398,594
Hospitals	563,656
Education	174,876
Hotels	501,239
Warehouse	1,751,152
Total Commercial	8,666,654
Low Income Res	2,525,842
Low-Med Res	2,545,119
Med-High Res	4,709,659
High Income Res	3,258,703
Residential Total*	13,039,422
Grand Total	21,706,076

*Residential sq. m based on CURB extrapolation from number of housing units



... but must be supplemented by a number of assumptions in CURB



Expert interviews, literature review, and in-person workshops helped refine core assumptions related to Oakland's baseline conditions.

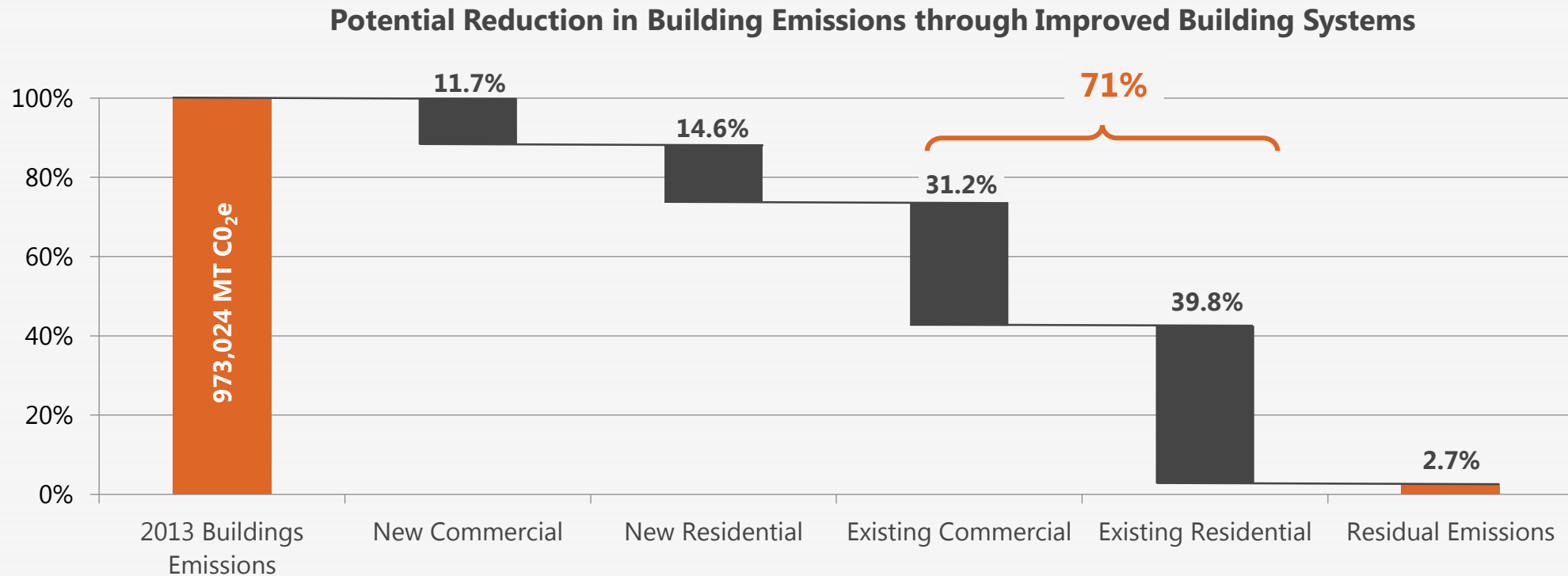
Key Baseline Assumptions Include:

- Population Growth Rates (1.09% per year)
- Increase in Housing Units (0.9% per year)
- Increase in Commercial Sq. Footage (1.2% per year)
- Building Redevelopment Rates (1% per year)
- Proportion of Housing by Housing Type (53% apartment / 47% house)

Based on these baseline conditions, CURB estimates 71% of buildings emissions can be reduced by focusing on the existing building stock



CURB uses these baseline inputs and assumptions to develop a preliminary analysis of where potential emissions reductions could come from. This information can be used to quickly identify which actions are likely to have the greatest impact.





The analysis developed two scenarios for 2030 and 2050 to compare against Oakland's GHG reduction goals



The next step of the analysis develops and compares scenarios for 2030 and 2050 alongside Oakland's GHG reduction goals, to better understand the potential pathways to GHG reductions.

Projected Trajectory Scenario

Estimates for the Projected Trajectory of Oakland's emissions assumed:

- **Projected technological advances & market adoption/penetration** (e.g., market adoption of electric heat pumps)
- **Stated State & Federal policies** (e.g., California Title 24 Building Code updates)
- **Existing City policies and funded programs** (e.g., Community Choice Energy program; NOT unfunded building retrofit plan)
- **Limited City actions responding to market trends** (e.g., revised building codes to legalize new technologies; NOT future programs incentivizing adoption of new building technology)

The Projected Trajectory was then compared with Oakland's goals. Those insights to ground the work with local and national experts to figure out what else needed to happen.

Deep Decarbonization Scenario

Collaboration with local and national experts helped to identify the rate of change required in each building system included in CURB to achieve Oakland's GHG goals and put the City on the pathway to Deep Decarbonization.



Key assumptions for Projected Trajectory scenario



Projecting ahead to 2030 and 2050 inherently involves making assumptions about what the world will look like, based upon the best information available to us today. Below are the key assumptions underlying the buildings Projected Trajectory analysis:

Electricity Mix

- Oakland's electricity grid will be served by 100% renewable energy by 2030

Energy Efficiency Mandates

- California's energy efficiency laws will continue to drive significant improvements in building efficiency, particularly for new buildings
- These mandates should lead to near-zero net energy for all new construction by 2020 for residential buildings and 2030 for commercial properties

Current Renovation Programs

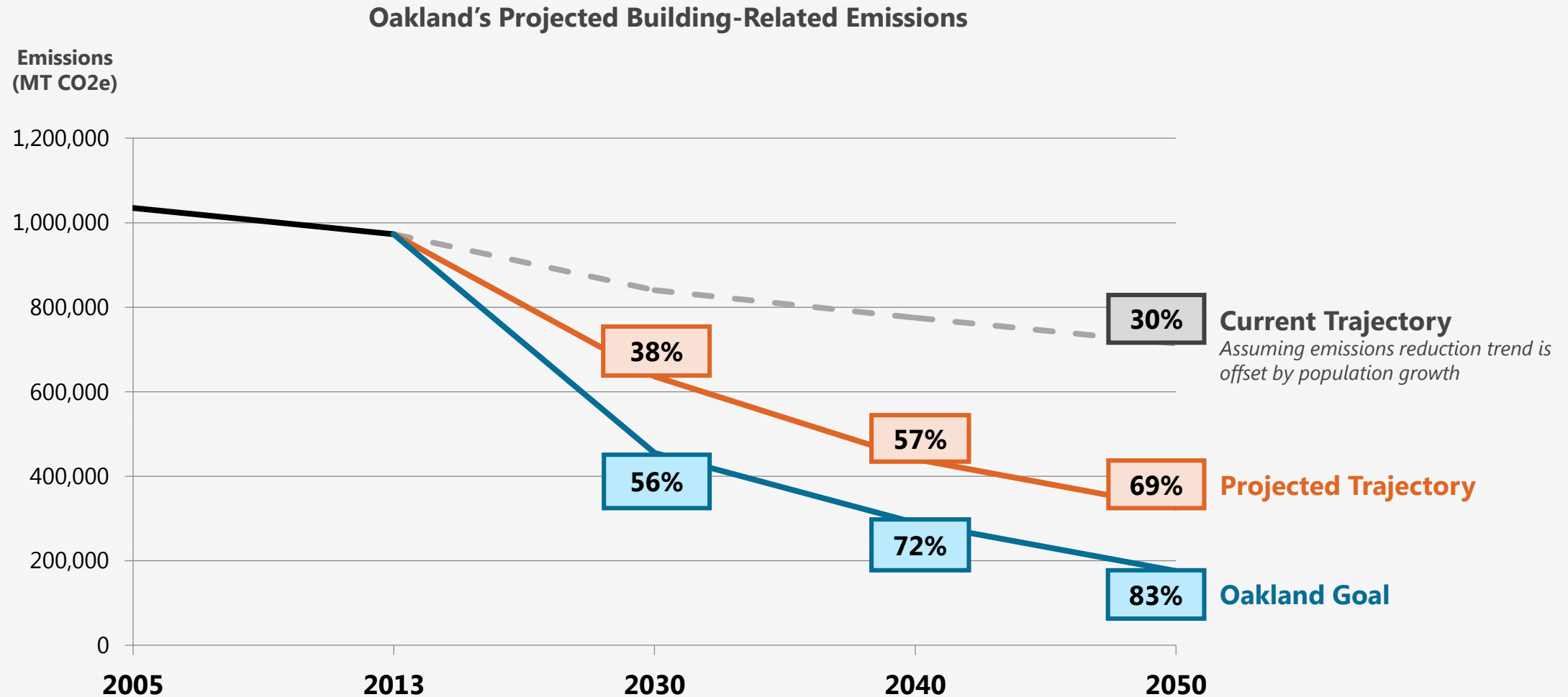
- Oakland's current renovation program is reaching 1-2% of multi family properties per year. At best that gets to 66% of multi family properties by 2050
- The statewide target for retrofitting 50% of existing commercial buildings by 2030 will also drive adoption of energy efficient technologies in existing commercial buildings



Oakland will not achieve its GHG reduction goals on the Projected Trajectory



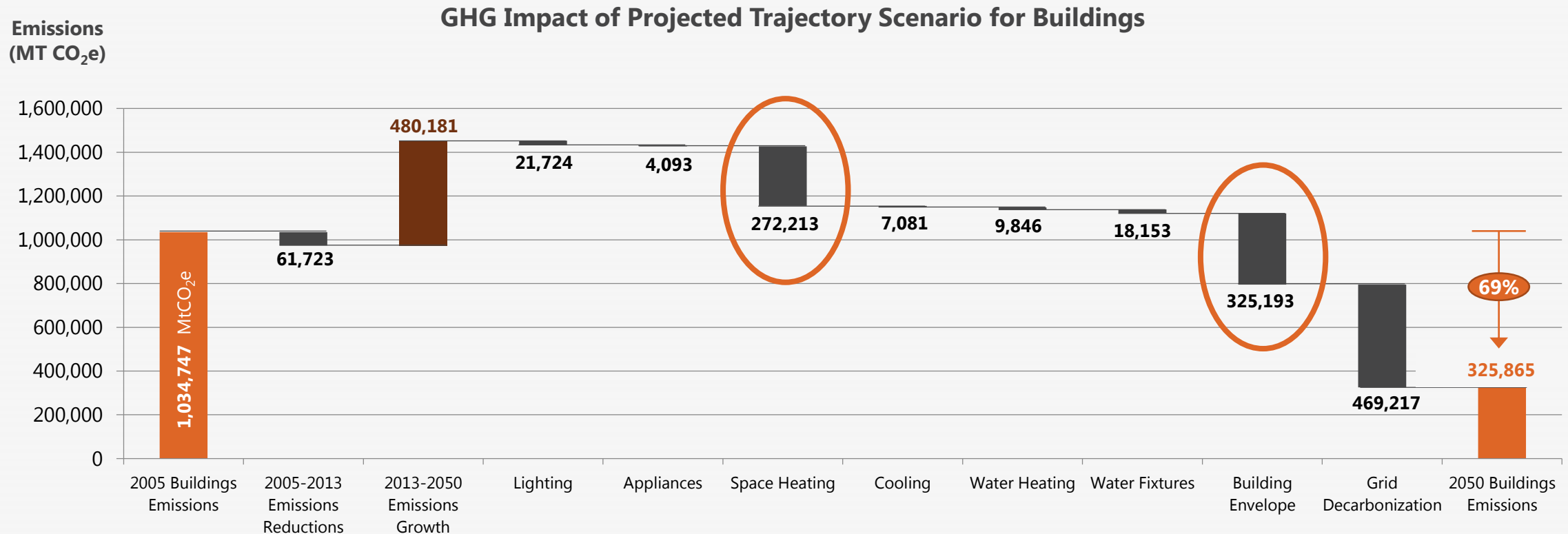
While the Projected Trajectory produces significant reductions from the 2005 baseline, it does not enable the City to meet its reduction targets for the building sector. Oakland needs to take additional actions to close a 18 percentage point gap in 2030 and a 14 percentage point gap in 2050.



Building-related GHG emissions on the Projected Trajectory (2050)



The Projected Trajectory scenario produces an 69% reduction in buildings-related emissions by 2050. 41% of this reduction is attributable to the shift to a 100% renewable energy electric grid. Other major factors include anticipated improvements in Space Heating and Building Envelopes.

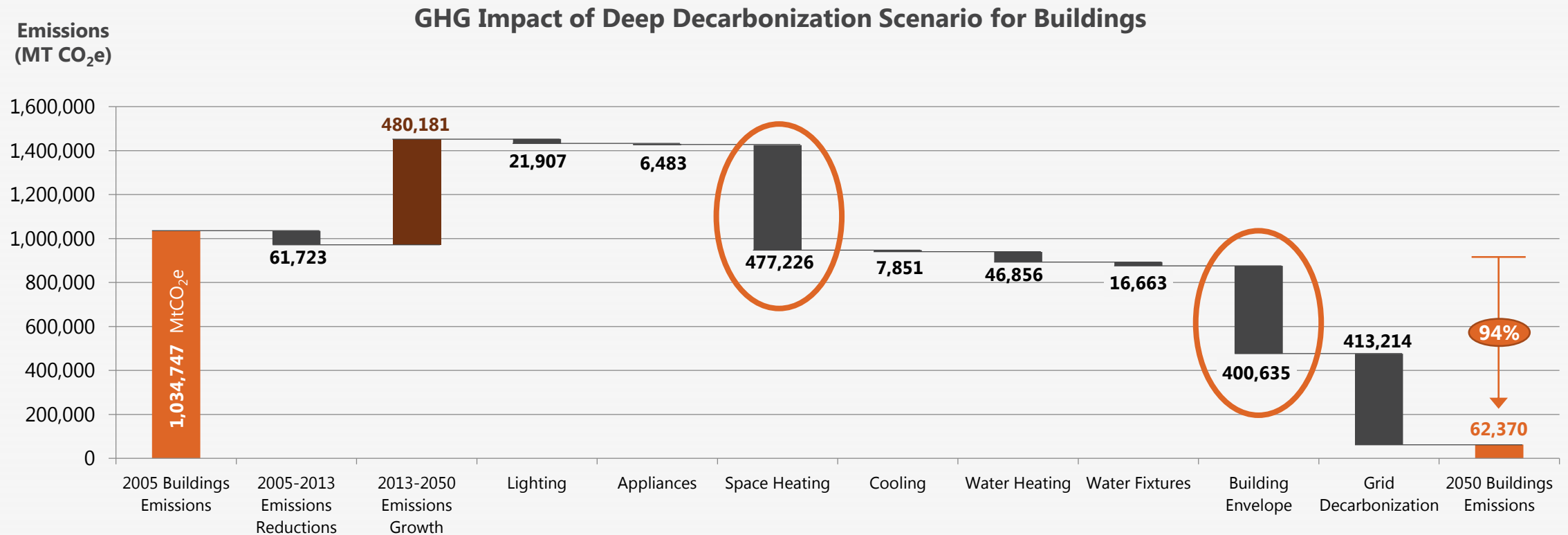




Building-related GHG emissions in the Deep Decarbonization scenario (2050)



The Deep Decarbonization scenario produces a 94% reduction in buildings emissions by 2050. Reductions beyond the Projected Trajectory come primarily from more aggressive actions in Space Heating and the Building Envelope.



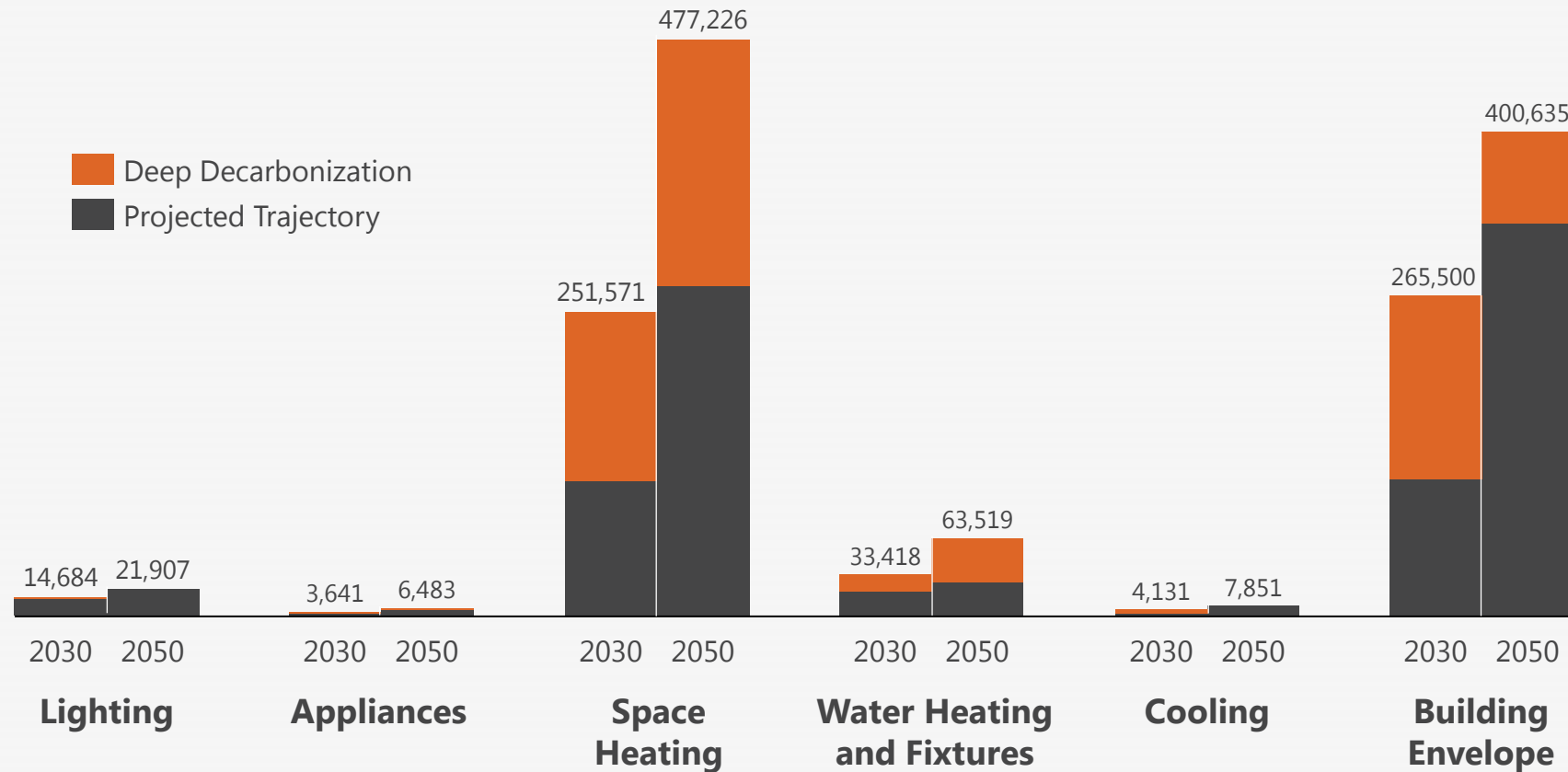


Significant differences are apparent between emissions in the Projected Trajectory and Deep Decarbonization scenarios



City action is needed to produce 55% of the required buildings-related reductions by 2030, but only 33% by 2050. Particular focus is needed on Space Heating systems and the Building Envelope, which account for 90% of buildings-related emissions reductions in 2050.

Annual Emissions Reductions (MT CO₂e) from Oakland's Buildings



Gap analysis methodology

Windows example



Bloomberg Associates identified gaps between the Projected Trajectory (PT) and Deep Decarbonization (DD) scenarios to identify where City action is needed to achieve goals.



	CURB Options	Today	2030			2050		
			PT	DD	Delta	PT	DD	Delta
New Residential	Single Paned		0%	0%	0%	0%	0%	0%
	Double-Glazed		0%	0%	0%	0%	0%	0%
	Double G Low-E		98%	98%	0%	95%	95%	0%
	Triple-Glazed		2%	2%	0%	5%	5%	0%
Existing Residential	Single Paned	86%	46%	30%	-16%	12%	0%	-12%
	Double-Glazed	14%	40%	0%	-40%	40%	0%	-40%
	Low-E	-	10%	70%	60%	43%	95%	52%
	Triple-Glazed		4%	0%	-4%	5%	5%	0%
New Commercial	Single Paned		5%	0%	-5%	3%	0%	-3%
	Double-Glazed		0%	0%	0%	0%	0%	0%
	Double G Low-E		95%	100%	5%	97%	100%	3%
	Triple-Glazed		0%	0%	0%	0%	0%	0%
Existing Commercial	Single Paned	84%	64%	34%	-30%	28%	0%	-28%
	Double-Glazed	16%	27%	0%	-27%	34%	0%	-34%
	Low-E		9%	66%	57%	38%	100%	62%
	Triple-Glazed		0%	0%	0%	0%	0%	0%

Delta = Deep Decarbonization
-
Projected Trajectory

Gaps were color-coded to highlight areas where significant gaps exist:

Low

Minimal City action required to achieve goals

Medium

Moderate City action required to achieve goals

High

Significant City action required to achieve goals



New Buildings				Existing Buildings			
Residential		Commercial		Residential		Commercial	
2030	2050	2030	2050	2030	2050	2030	2050
No city action required	No city action required	City action required to shift 5% of new buildings to Low-E window technology	No city action required	Significant City action required to improve insulation in 30% of homes in need of Low-E window technology	City action required to improve insulation in the remaining 12% of homes in need of Low-E window technology	City action needed to improve insulation in 39% of properties needing to adopt Low-E window technology	City action needed to improve window technologies in 34% of properties

Filtering actions by overall GHG reduction potential enables the City to target its efforts for maximum impact



To reduce building emissions, significant City action is needed to electrify Heating Systems and improve Insulation and Windows in existing buildings.

Extent to which City Action is Required to Achieve Deep Decarbonization

Building System	Overall GHG Reduction Potential	New Buildings				Existing Buildings			
		Residential		Commercial		Residential		Commercial	
		2030	2050	2030	2050	2030	2050	2030	2050
Lighting	2%	Low	Low	Low	Low	Low	Low	Medium	Low
Appliances	1%	Medium	Low	Medium	Low	High	Low	High	High
Space Heating	18%	High	Low	Medium	Low	High	High	Medium	High
Water Heating & Fixtures	3%	High	High	High	High	High	High	High	High
Cooling	1%	High	Low	Low	Low	Medium	Low	High	Medium
Building Envelope	12%	Low	Low	Low	Low	High	High	High	High

Legend

Low Minimal City action required to achieve goals	Medium Moderate City action required to achieve goals	High Significant City action required to achieve goals	 Priority City action area
--	--	---	--



Short-term City actions should focus on space heating and building envelope



		New Buildings		Existing Buildings	
System	Overall GHG ↓ Potential	Residential	Commercial	Residential	Commercial
		2030	2030	2030	2030
Lighting	2%	Low	Low	Low	Medium
Appliances	1%	Medium	Medium	High	High
Space Heating	18%	High	Medium	High	Medium
Water Heating & Fixtures	3%	High	High	High	High
Cooling	1%	High	Low	Medium	High
Building Envelope	12%	Low	Low	High	High

New Buildings City Focus Areas

- City action needed to **increase adoption of electric space heating systems**
- Because new buildings are likely to see slower turnover in their buildings systems, adopting **more ambitious actions in the next ten years can have a disproportionate impact** on emissions by 2050

Existing Buildings City Focus Areas

- While nearly all building systems in most existing buildings require updates, short-term City action should **prioritize retrofits in space heating systems** while also **dramatically improving the building envelope**
- Heating and cooling have a much longer turnover period than other systems (up to 30 years). Prioritizing these in the short term can avoid having to retrofit the same systems before their useful life is up

Legend

Low	= Minimal City action needed to reach goal
Medium	= Moderate City action needed to reach goal
High	= Significant City action needed to reach goal
	= Priority City action area



In the long-term, Oakland must eliminate fossil fuel use in all buildings



System	Overall GHG ↓ Potential	New Buildings		Existing Buildings	
		Residential 2050	Commercial 2050	Residential 2050	Commercial 2050
Lighting	2%	Low	Low	Low	Low
Appliances	1%	Low	Low	Low	Medium
Space Heating	18%	Low	Low	High	High
Water Heating & Fixtures	3%	Medium	Medium	Medium	Medium
Cooling	1%	Low	Low	Low	Medium
Building Envelope	12%	Low	Low	High	High

Existing Buildings City Focus Areas

- Continued progress must be made to **retrofit space heating systems** in existing buildings, while **dramatically improving the building envelope**
- Relative impact of existing buildings will shrink** over time as buildings are torn down and rebuilt; however, existing buildings represent 71% of the cumulative GHG reductions

New Buildings City Focus Areas

- Most actions for new buildings should be prioritized in the short-term
- Continued updates to building codes to account for further technological developments will be important, but are not modeled in CURB

Legend

Low	= Minimal City action needed to reach goal
Medium	= Moderate City action needed to reach goal
High	= Significant City action needed to reach goal
	= Priority City action area

CURB's financial analysis function compares the implementation cost, net present value, and GHG impact of each potential action



Comparing return on investment with GHG impact can help Oakland determine the types of policies it should focus on for a given action.



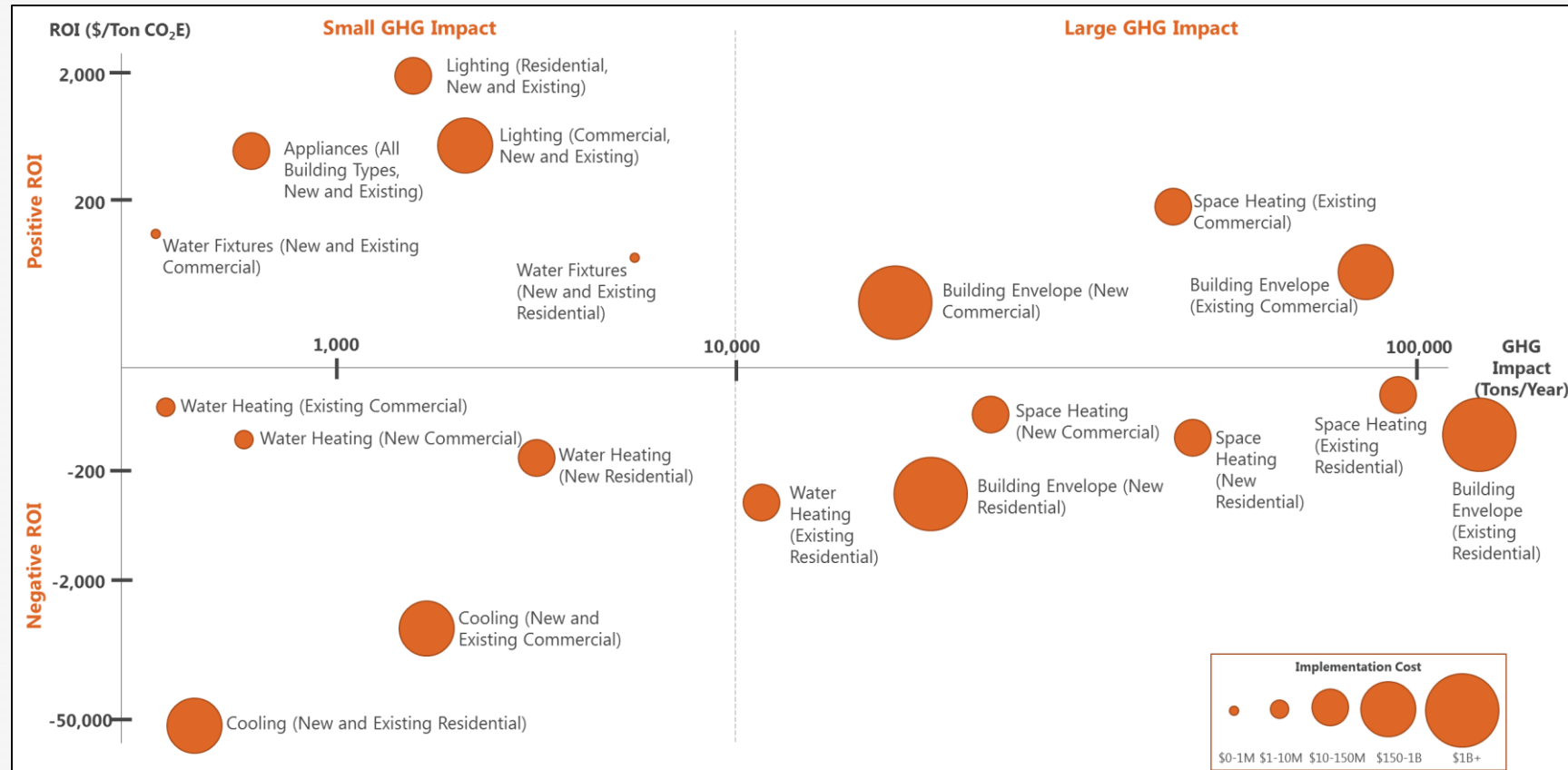


2050 Deep Decarbonization: Cost per ton CO₂e



Within buildings, Building Envelopes, Space Heating, and Residential Water Heating account for 94% of potential reductions for buildings-related emissions. In these categories, Commercial Buildings generally offer a positive ROI.

Return on Investment and Annual GHG Impact of CURB Buildings Actions in Deep Decarbonization Scenario



These actions represent 94% of the GHG abatement potential for Oakland's buildings

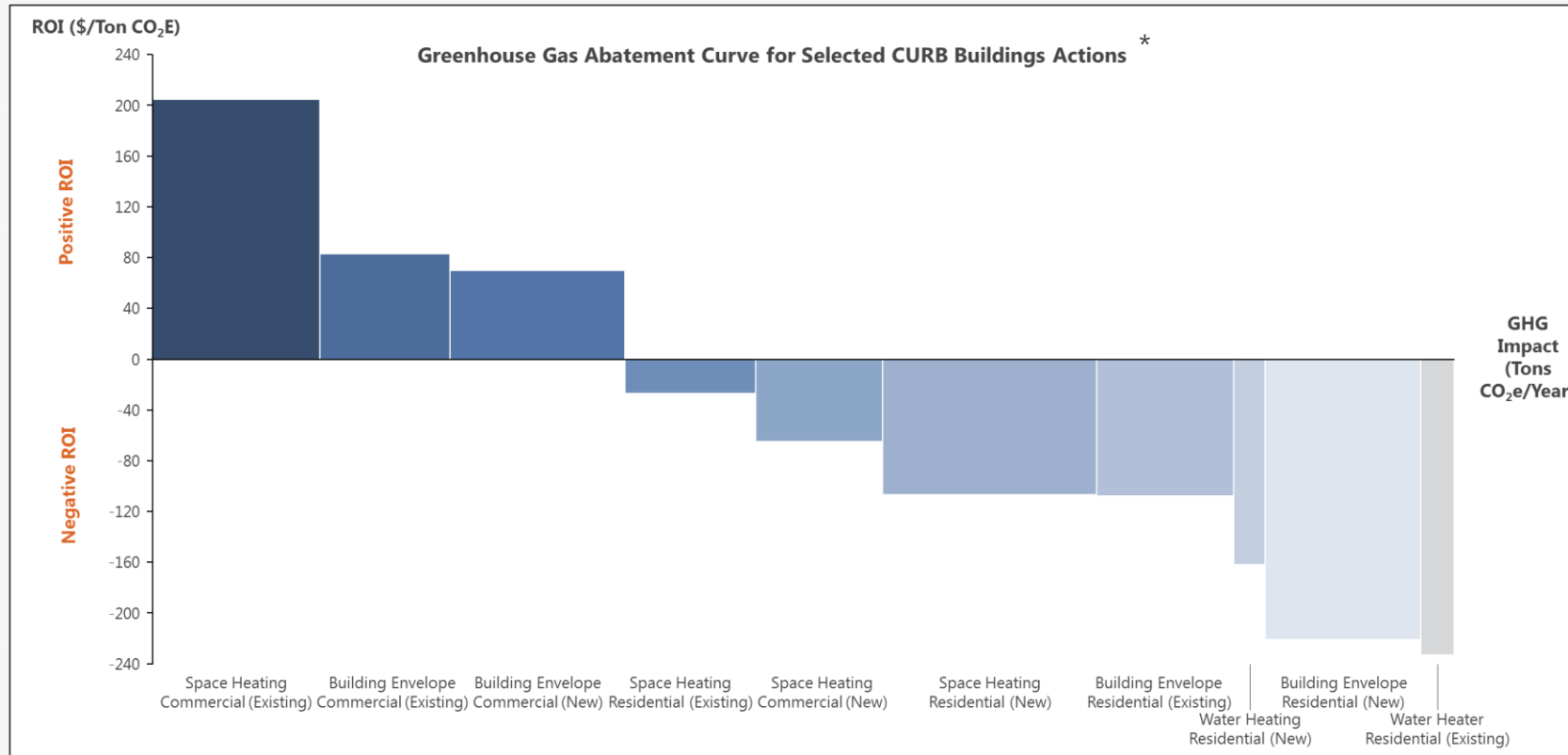
Note: Given wide range of ROI and GHG Impact values, axes and action placement are approximate. Given limited flexibility with cooling technology options available in CURB, cost estimates are likely to be overstated while GHG impact is likely to be understated.

Source: Bloomberg Associates Analysis, CURB

Oakland's GHG Abatement Curve outlines the economic impact of each action with large GHG impact



The GHG Abatement Curve displays economic data for each selected action; however, it does not identify who pays that cost or receives that benefit. Oakland can tailor its policies to adjust the burden for actions with a negative ROI.



*Collectively, all other buildings actions reduce GHG emissions by 32,000 tons of CO₂e per year (6% of total buildings-related reductions), at a weighted average ROI of \$-1,000.

Key Takeaways

- Commercial Buildings actions tend to produce a positive ROI; property owners should be able to take action without additional economic incentives from the City
- Oakland will need to place particular emphasis on the residential building stock – and may need to commit financial resources to incentivize residential retrofits



Estimated implementation costs, savings, and GHG impacts of building system changes in the Deep Decarbonization scenario



Building Type	Building Status	Building System	NPV (cumulative)	Implementation Cost	Annual Savings	Payback Period	Emissions Abatement ('000 tons)	Abatement Cost / Ton
Residential	New	Lighting	\$ (127,874,814)	\$ 59,934,046	\$ 17,060,513	3.5	1,164	\$ (1,919)
		Appliances	\$ (19,930,988)	\$ 58,268,018	\$ 5,588,394	10.4	548	\$ (625)
		Space Heating	\$ 291,404,940	\$ 122,375,585	\$ (6,583,596)	-18.6	55,259	\$ 107
		Cooling	\$ 384,987,157	\$ 493,107,141	\$ 305,746	1612.8	175	\$ 40,091
		Water Heating	\$ 57,037,906	\$ 43,587,995	\$ (436,959)	-99.8	5,387	\$ 162
		Water Fixtures	\$ (19,006,664)	\$ 540,538	\$ 1,621,587	0.3	3,167	\$ (115)
		Building Envelope	\$ 422,973,932	\$ 1,770,744,308	\$ 32,568,252	54.4	35,251	\$ 221
	Existing	Lighting	\$ (199,832,756)	\$ 38,846,212	\$ 11,521,685	3.4	3,960	\$ (1,952)
		Appliances	\$ (12,312,419)	\$ 112,343,908	\$ 3,908,441	28.7	1,863	\$ (288)
		Space Heating	\$ 91,072,716	\$ 99,809,500	\$ 3,067,266	32.5	95,494	\$ 27
		Cooling	\$ 865,630,708	\$ 743,787,069	\$ 182,527	4074.9	605	\$ 55,476
		Water Heating	\$ 111,329,353	\$ 36,025,123	\$ (6,340,932)	-5.7	12,423	\$ 233
		Water Fixtures	\$ (38,790,110)	\$ 611,833	\$ 2,072,737	0.3	11,210	\$ (145)
		Building Envelope	\$ 305,696,587	\$ 1,319,347,008	\$ 27,872,750	47.3	108,555	\$ 108
Commercial	New	Lighting	\$ (131,823,778)	\$ 370,820,221	\$ 34,104,623	10.9	2,526	\$ (877)
		Appliances	\$ (37,322,962)	\$ 48,111,934	\$ 6,964,937	6.9	516	\$ (1,216)
		Space Heating	\$ 109,634,179	\$ 70,676,232	\$ 343,046	206.0	36,766	\$ 65
		Cooling	\$ 223,616,403	\$ 408,498,304	\$ 6,590,848	62.0	1,084	\$ 3,465
		Water Heating	\$ 4,515,844	\$ 3,515,452	\$ 153,606	22.9	639	\$ 130
		Water Fixtures	\$ (404,344)	\$ 10,054	\$ 34,876	0.3	58	\$ (126)
		Building Envelope	\$ (145,908,121)	\$ 1,222,299,628	\$ 64,427,853	19.0	32,725	\$ (70)
	Existing	Lighting	\$ (198,471,060)	\$ 392,236,519	\$ 33,481,463	11.7	7,034	\$ (1,059)
		Appliances	\$ (33,610,974)	\$ 31,748,563	\$ 3,612,503	8.8	714	\$ (1,203)
		Space Heating	\$ (499,463,869)	\$ 43,448,580	\$ 34,535,154	1.3	64,052	\$ (205)
		Cooling	\$ 280,980,323	\$ 315,878,983	\$ 4,419,019	71.5	2,267	\$ 4,019
		Water Heating	\$ 1,547,280	\$ 2,346,273	\$ 20,329	115.4	352	\$ 65
		Water Fixtures	\$ (692,976)	\$ 9,153	\$ 36,892	0.2	182	\$ (159)
		Building Envelope	\$ (208,709,859)	\$ 669,589,062	\$ 15,828,100	42.3	88,969	\$ (83)

Emissions reduction potential of buildings actions



2050 Emissions Reduction from 2013 Baseline Emissions

	New Residential	New Commercial	Existing Residential	Existing Commercial	Total
Lighting	<1%	<1%	<1%	1.0%	1.9%
Appliances	<1%	<1%	<1%	<1%	1.2%
Space Heating	2.3%	2%	7.7%	6%	18%
Water Heating	<1%	<1%	1.5%	<1%	2.4%
Water Fixtures	<1%	0%	<1%	0%	.6%
Cooling	<1%	<1%	<1%	<1%	1.2%
Building Envelopes	1.8%	1.3%	4.9%	4.1%	12.1%
TOTAL	5.6%	4.5%	15.3%	12.0%	37.4%



Detailed Buildings Tables



Lighting

CURB – Emissions Reduction Potential: 1.9%



		CURB Tool Options	Today	2030		2050	
New Residential	Tech			Projected Trajectory	Deep Decarbonize	Projected Trajectory	Deep Decarbonize
		CFL		0%	0%	0%	0%
		LED		100%	100%	100%	100%
	Controls	None		70%	50%	0%	0%
		Occupancy Controls		30%	50%	100%	100%
Existing Residential	Tech	Incandescent	46%	0%	0%	0%	0%
		CFL	54%	10%	0%	0%	0%
		LED	0%	90%	100%	100%	100%
	Controls	None	100%	80%	50%	60%	20%
		Occupancy Controls	0%	20%	50%	40%	80%
New Commercial	Tech	LED		100%	100%	100%	100%
		Fluorescent T-8		0%	0%	0%	0%
	Controls	None		10%	0%	0%	0%
		Occupancy Controls		70%	80%	75%	75%
		Daylighting		10%	0%	0%	0%
		Combined		10%	20%	25%	25%
Existing Commercial	Tech	CFL	6%	0%	0%	0%	0%
		LED	7%	80%	100%	100%	100%
		Fluorescent T-12	20%	0%	0%	0%	0%
		Fluorescent T-8	67%	20%	0%	0%	0%
	Controls	None	67%	59%	44%	24%	0%
		Occupancy Controls	20%	28%	43%	51%	75%
		Daylighting	7%	7%	7%	19%	15%
		Combined	6%	6%	6%	6%	10%



Lighting

CURB – Emissions Reduction Potential: 1.9%



Lighting systems should advance at required rates with minimal City action. Some work is required to increase adoption of occupancy controls.

New Buildings				Existing Buildings			
Residential		Commercial		Residential		Commercial	
2030	2050	2030	2050	2030	2050	2030	2050
LED lighting will be adopted at rates needed to achieve targets. City action needed to shift additional 20% of new buildings to occupancy controls	No City action required. LED lighting and occupancy controls will be adopted at rates needed to achieve targets	LED lighting will be adopted at rates needed to achieve targets City action needed to shift additional 20% of new buildings to occupancy controls	No City action required LED lighting and occupancy controls will be adopted at rates needed to achieve targets	City action required to shift final 10% of existing buildings to LED and to increase use of occupancy controls in additional 30% of existing buildings	LED lighting will be adopted at rates needed to achieve targets City action needed to shift additional 40% of existing buildings to occupancy controls	City action required to shift final 20% of existing buildings to LED and to increase use of occupancy controls in additional 15% of existing buildings	LED lighting will be adopted at rates needed to achieve targets City action needed to shift additional 28% of existing buildings to occupancy controls

Note: Heat Map shading based on gaps in lighting technology only.

Source: Bloomberg Associates Analysis, CURB

Legend

Low

Medium

High

0-10% gap

11-30% gap

>30% gap



Appliances

CURB – Emissions Reduction Potential: 1.2%



	CURB Tool Options	Today	2030		2050	
New Residential			Projected Trajectory	Deep Decarbonize	Projected Trajectory	Deep Decarbonize
	Mid-Range Efficiency		25%	0%	25%	0%
	High-Range Efficiency		75%	100%	75%	100%
Existing Residential	Standard	25%	25%	0%	25%	0%
	Mid-Range Efficiency	61%	61%	15%	61%	5%
	High-Range Efficiency	14%	14%	85%	14%	95%
New Commercial	Mid-Range Efficiency		25%	0%	25%	0%
	High-Range Efficiency		75%	100%	75%	100%
Existing Commercial	Standard	55%	50%	0%	0%	0%
	Mid-Range Efficiency	45%	45%	55%	37%	0%
	High-Range Efficiency	-	5%	45%	63%	100%



Appliances

CURB – Emissions Reduction Potential: 1.2%



City action needed to increase adoption of high efficiency appliances by 2030. Additional work needed on existing commercial buildings through 2050.

New Buildings				Existing Buildings			
Residential		Commercial		Residential		Commercial	
2030	2050	2030	2050	2030	2050	2030	2050
City action required to shift remaining 25% of new buildings to high efficiency appliances	No additional City action required between 2030 and 2050 if 2030 target is reached	City action required to shift remaining 25% of new buildings to high efficiency appliances	No additional City action required between 2030 and 2050 if 2030 target is reached	Significant City action required to shift 71% of existing buildings to high efficiency appliances	City action required between 2030 and 2050 to shift additional 10% of existing homes to high efficiency appliances , if 2030 target is reached	Significant City action needed to shift 50% of existing buildings from standard appliances to mid-range and high efficiency	After achieving 2030 targets, significant additional City action required between 2030 and 2050 to shift an additional 45% of existing commercial buildings to high efficiency

Legend

Low

Medium

High

0-10% gap
11-30% gap
>30% gap



Space Heating

CURB – Emissions Reduction Potential: 18%


	CURB Tool Options	Today	2030		2050	
			Projected Trajectory	Decarbonize	Projected Trajectory	Decarbonize
New Residential	Low Efficiency Boiler		5%	0%	0%	0%
	Standard Efficiency Boiler (T24)		0%	0%	0%	0%
	High Efficiency Boiler Gas		45%	0%	20%	0%
	High Efficiency Boiler Electric		0%	50%	25%	45%
	Electric Heater		0%	0%	0%	0%
	Electric Heat Pump		50%	50%	55%	55%
Existing Residential	Low Efficiency Boiler (Below Standard)	74%	11%	0%	0%	0%
	Standard Efficiency Boiler	-	35%	10%	20%	0%
	High Efficiency Boiler Gas	8%	36%	15%	35%	0%
	High Efficiency Boiler Electric		0%	35%	15%	35%
	Electric Heater	18%	9%	10%	10%	5%
	Electric Heat Pump		9%	30%	20%	60%
New Commercial	Low Efficiency Boiler		9%	0%	0%	0%
	Standard Efficiency Boiler (T24)		16%	5%	5%	0%
	High Efficiency Boiler Gas		0%	0%	0%	0%
	High Efficiency Boiler Electric		40%	40%	40%	40%
	Electric Heater		3%	5%	0%	0%
	Electric Heat Pump		32%	50%	55%	60%
Existing Commercial	Low Efficiency Boiler	28%	16%	10%	8%	0%
	Standard Efficiency Boiler	56%	54%	35%	37%	0%
	High Efficiency Boiler Gas		10%	10%	10%	0%
	High Efficiency Boiler Electric	-	0%	10%	15%	40%
	Electric Heater	10%	10%	5%	10%	0%
	Electric Heat Pump	5%	10%	30%	20%	60%



Space Heating

CURB – Emissions Reduction Potential: 18%



Significant City action required to electrify heating systems in all building types by 2030. Continued action required through 2050 for existing buildings.

New Buildings				Existing Buildings			
Residential		Commercial		Residential		Commercial	
2030	2050	2030	2050	2030	2050	2030	2050
Significant City action required to shift an additional 50% of new residential buildings to electric systems	Assuming 2030 targets are met, no City action required for new residential buildings	Significant City action required to electrify heating systems in an additional 20% of new commercial buildings	Limited City action required to shift remaining 5% of existing buildings to heat pumps	Significant City action required to shift an additional 55% of existing residential buildings to electric heating systems	City action required to shift remaining 30% of existing residential buildings to heat pumps	Significant City action required to shift an additional 30% of existing commercial buildings to electric heating systems	Significant City action needed to shift an additional 55% of existing buildings to electric heating and increase efficiency of electric systems in another 10%

Legend

Low

Medium

High

0-10% gap
11-30% gap
>30% gap



Water Heating

CURB – Emissions Reduction Potential: 2.4%



	CURB Tool Options	Today	2030		2050	
			Projected Trajectory	Decarbonize	Projected Trajectory	Decarbonize
New Residential	Standard Efficiency Gas Boiler		13%	0%	4%	0%
	High Efficiency Gas Boiler		79%	46%	90%	0%
	High Efficiency Electric Boiler		0%	46%	0%	50%
	Electric Heat Pump		6%	8%	5%	50%
	Solar Hot Water		2%	0%	1%	0%
Existing Residential	Standard Efficiency Gas Boiler	87%	71%	40%	60%	0%
	High Efficiency Gas Boiler	5%	9%	30%	20%	0%
	Electric Heat Pump	5%	12%	20%	13%	100%
	Solar Hot Water	8%	8%	10%	7%	0%
New Commercial	Standard Efficiency Gas Boiler		0%	0%	0%	0%
	High Efficiency Gas Boiler		95%	51%	95%	0%
	Electric Heater		0%	19%	0%	40%
	Electric Heat Pump		0%	25%	0%	51%
	Solar Hot Water		5%	5%	5%	9%
Existing Commercial	Standard Efficiency Gas Boiler	95%	65%	22%	30%	0%
	High Efficiency Gas Boiler	-	30%	44%	65%	0%
	Electric Heater	-	0%	29%	0%	40%
	Electric Heat Pump	5%	2%	2%	0%	50%
	Solar Hot Water		3%	3%	5%	10%



Water Fixtures

CURB – Emissions Reduction Potential: .6%



	CURB Tool Options	Today	2030		2050	
			Projected Trajectory	Decarbonize	Projected Trajectory	Decarbonize
New Residential	Standard		5%	0%	5%	0%
	Low-Flow		95%	100%	95%	100%
Existing Residential	Standard	86%	20%	0%	5%	0%
	Low-Flow	14%	80%	100%	95%	100%
New Commercial	Standard		0%	0%	5%	0%
	Low-Flow		100%	100%	95%	100%
Existing Commercial	Standard	54%	10%	0%	5%	0%
	Low-Flow	46%	90%	100%	95%	100%



Water Fixtures

CURB – Emissions Reduction Potential: 3%



Significant City action required to electrify water heating systems in all building types in both 2030 and 2050.

New Buildings				Existing Buildings			
Residential		Commercial		Residential		Commercial	
2030	2050	2030	2050	2030	2050	2030	2050
City action needed to shift 46% of new buildings to electric boilers City action also needed to install low flow water systems in additional 5% of new homes	City action needed to shift remaining 46% of new buildings to electric heat pumps	City action needed to electrify additional 44% of new commercial buildings by 2030	City action required to electrify remaining 51% of new commercial buildings	Significant City action required to electrify water heating systems in 10% of existing homes while increasing the efficiency of gas boilers in 21% of existing homes City action needed to install low flow water systems in additional 20% of existing homes	Significant City action required to shift remaining 70% of existing buildings to heat pumps	City action needed to electrify 29% of existing buildings by 2030, while increasing efficiency of gas boilers in 14% of existing buildings City action required to increase adoption of low flow water systems in 10% of existing properties	Significant City action required to electrify water heating systems in remaining 66% of buildings

Legend

Low

Medium

High

0-10% gap

11-30% gap

>30% gap



Cooling

CURB – Emissions Reduction Potential: 1.2%



	CURB Tool Options	Today	2030		2050	
			Projected Trajectory	Decarbonize	Projected Trajectory	Decarbonize
New Residential	High Efficiency Chillers		45%	14%	45%	14%
	Air Source Heat Pumps (mini splits)		10%	6%	10%	6%
	Ground / Water Source Heat Pumps		45%	80%	45%	80%
Existing Residential	Low Efficiency Chillers			0%	0%	0%
	Medium Efficiency Chillers	14%	7%	0%	0%	0%
	High Efficiency Chillers		7%	5%	5%	0%
	Air Source Heat Pumps / (A/C)	86%	8%	5%	0%	0%
	Ground Source Heat Pumps		78%	90%	95%	100%
New Commercial	High Efficiency Chillers		59%	59%	59%	60%
	Air Source Heat Pumps (RTU)		41%	36%	0%	0%
	Ground Source Heat Pumps		0%	5%	41%	40%
Existing Commercial	Low Efficiency Chillers	20%	11%	4%	4%	0%
	Medium Efficiency Chillers	13%	16%	6%	7%	0%
	High Efficiency Chillers		10%	23%	26%	37%
	Air Source Heat Pumps	67%	63%	40%	0%	0%
	Ground Source Heat Pumps		0%	27%	63%	63%



Cooling

CURB – Emissions Reduction Potential: 1.2%



Short-term City action required most to increase use of higher efficiency cooling systems. Limited additional action required between 2030 and 2050.

New Buildings				Existing Buildings			
Residential		Commercial		Residential		Commercial	
2030	2050	2030	2050	2030	2050	2030	2050
City action required to shift 35% of new buildings to ground source heat pumps	No City action required, assuming 2030 targets are met	City action required to shift 5% of new buildings to ground source heat pumps	No additional action required for new commercial buildings.	City action required to shift 12% of existing buildings to ground source heat pumps	Limited City action required to increase shift remaining 5% of existing buildings to heat pumps	City action required to shift 40% of existing buildings to higher efficiency cooling systems	City action required to shift 11% of existing buildings to high efficiency chillers

Legend

Low

Medium

High

0-10% gap
11-30% gap
>30% gap



Building Envelope

CURB – Emissions Reduction Potential: 12.1%



Wall Insulation

		Today	2030		2050	
			PT	DD	PT	DD
New Residential	No Insulation		0%	0%	0%	0%
	Improved 1		5%	0%	0%	0%
	Improved 2		5%	5%	5%	0%
	Advanced		90%	95%	95%	100%
Existing Residential	No Insulation	54%	46%	0%	36%	0%
	Improved 1	21%	24%	46%	23%	0%
	Improved 2	25%	16%	24%	22%	50%
	Advanced	-	4%	30%	14%	50%
New Commercial	No Insulation		0%	0%	0%	0%
	Improved 1		16%	5%	16%	0%
	Improved 2		0%	0%	0%	0%
	Advanced		84%	95%	84%	100%
Existing Commercial	No Insulation	84%	76%	30%	56%	0%
	Improved 1	16%	16%	42%	16%	0%
	Improved 2	-	8%	8%	16%	50%
	Advanced	-	0%	20%	12%	50%

PT = Projected Trajectory Scenario
DD = Deep Decarbonization Scenario

Roof Insulation

		Today	2030		2050	
			PT	DD	PT	DD
New Residential	No Insulation		0%	0%	0%	0%
	Improved 1		5%	0%	0%	0%
	Improved 2		5%	0%	5%	0%
	Advanced		90%	100%	95%	100%
Existing Residential	No Insulation	14%	10%	0%	5%	0%
	Improved 1	61%	60%	20%	52%	0%
	Improved 2	25%	20%	50%	22%	50%
	Advanced	-	10%	30%	21%	50%
New Commercial	No Insulation		0%	0%	0%	0%
	Improved 1		5%	0%	0%	0%
	Improved 2		5%	0%	5%	0%
	Advanced		90%	100%	95%	100%
Existing Commercial	No Insulation	57%	50%	20%	34%	0%
	Improved 1	43%	41%	30%	28%	0%
	Improved 2	-	9%	34%	31%	50%
	Advanced	-	0%	16%	7%	50%



Building Envelope

CURB – Emissions Reduction Potential: 12.1%



Windows

		Today	2030		2050	
			Projected Trajectory	Deep Decarbonize	Projected Trajectory	Deep Decarbonize
New Residential						
	Single Paned		0%	0%	0%	0%
	Double-Glazed		0%	0%	0%	0%
	Double G Low-E		98%	98%	95%	95%
	Triple-Glazed		2%	2%	5%	5%
Existing Residential	Single Paned	86%	46%	30%	12%	0%
	Double-Glazed	14%	40%	0%	40%	0%
	Low-E	-	10%	70%	43%	95%
	Triple-Glazed		4%	0%	5%	5%
New Commercial	Single Paned		5%	0%	3%	0%
	Double-Glazed		0%	0%	0%	0%
	Double G Low-E		95%	100%	97%	100%
	Triple-Glazed		0%	0%	0%	0%
Existing Commercial	Single Paned	84%	64%	34%	28%	0%
	Double-Glazed	16%	27%	0%	34%	0%
	Low-E		9%	66%	38%	100%
	Triple-Glazed		0%	0%	0%	0%



Building Envelope

CURB – Emissions Reduction Potential: 12.1%



Continued City action required to improve insulation in existing buildings for both 2030 and 2050.

New Buildings				Existing Buildings			
Residential		Commercial		Residential		Commercial	
2030	2050	2030	2050	2030	2050	2030	2050
City action required to improve insulation in small number of new buildings (wall insulation in 5% of buildings, roof insulation in 10% of buildings)	City action required to improve wall insulation in 5% of new buildings	City action required to shift 11% of new buildings to advanced wall insulation, 10% of new buildings to advanced roof insulation, and 5% of new buildings to Low-E window technology	City action required to shift remaining 5% of buildings to advanced wall insulation	Significant City action required to improve insulation in the 46% of homes with no wall insulation, 50% of homes with no/poor roof insulation, and 60% of homes in need of improved windows	City action required to improve insulation in the remaining 46% of homes with poor wall insulation, 20% of homes with poor roof insulation, and 25% of homes in need of improved windows	City action needed to improve insulation in 46% of properties with no wall insulation, 30% of properties with no roof insulation, and 57% needing to install improved windows	City action needed to improve wall insulation in 64% of properties, roof insulation in 50% of properties, and window technologies in 34% of properties

Legend

Low

Medium

High

0-10% gap

11-30% gap

>30% gap



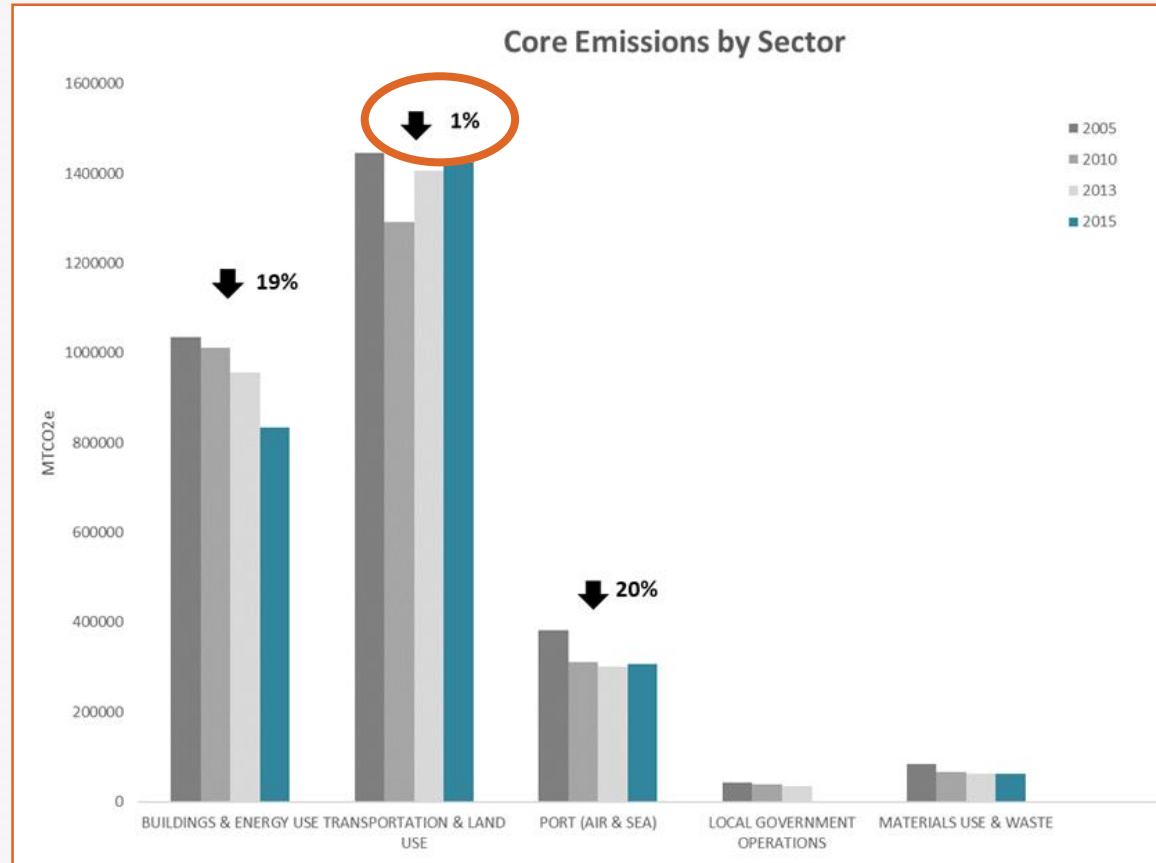
Appendix B – Transportation Technical Materials



Transportation emissions are trending down, but slower than other sectors



While CURB uses a 2013 baseline and the analysis used that dataset, it is important to acknowledge progress that Oakland has made in more recent years. Oakland's most recent data shows that 2015 emissions from the transportation sector were only 1% lower than the 2005 baseline.



Transportation emissions went down during the 2008 recession but are now trending upwards. Growth in population is driving an increase in transportation-related emissions.



Achieving further reductions will require Oakland to transition to less carbon-intensive vehicles and shift passengers to more efficient modes of travel



CURB organizes its transportation inputs into four sets of potential 'actions' influencing future GHG emissions:

1. **Transit-Oriented Development**
2. **Passenger Mode Shift**
3. **Vehicle Electrification**
4. **Vehicle Fuel Efficiency**

As a result, discussions have focused on ways to reduce GHG emissions based on three associated 'actions':

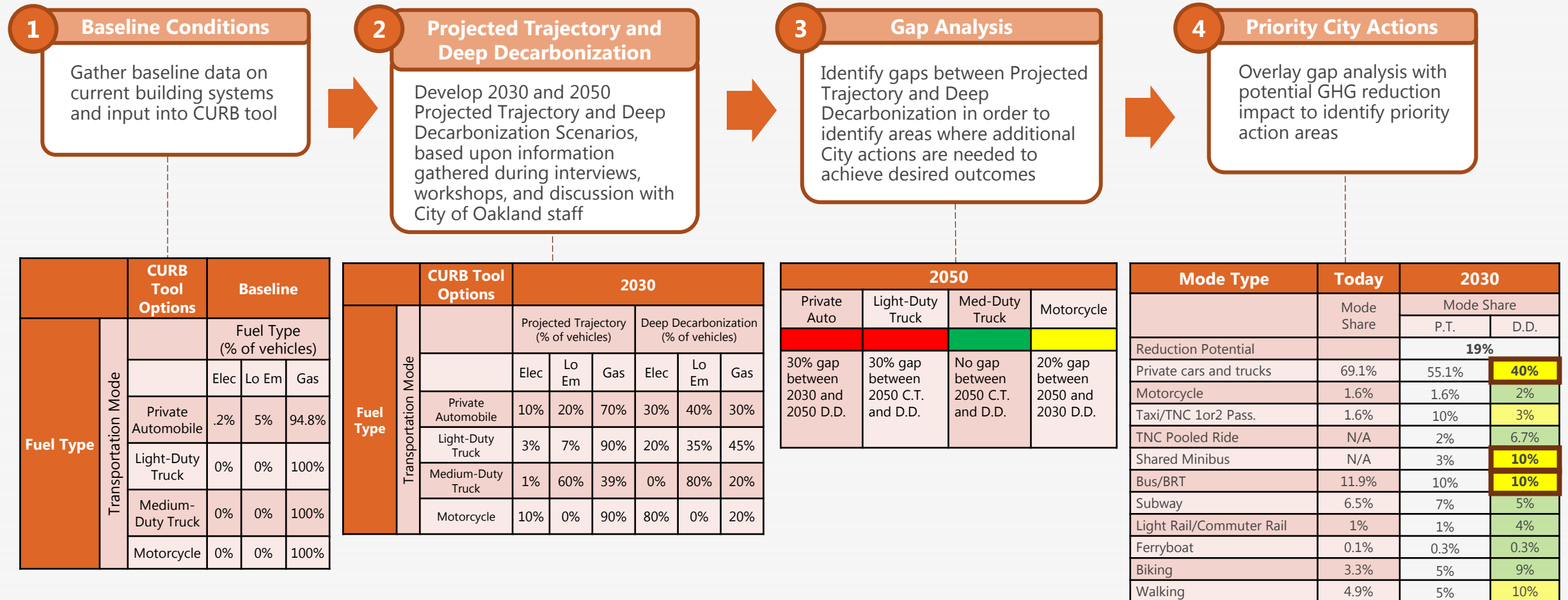
1. **Reduce average trip length** via urban design
2. **Reduce per capita emissions per trip** via **increasing load factor**
3. **Reduce emissions per trip** by **shifting to lower carbon modes or fuels**

Developing scenarios for 2030 and 2050



Bloomberg Associates utilized a four-step process to develop scenarios for 2030 and 2050 in CURB to generate GHG estimates.

- **Projected Trajectory** projects the expected impacts of market forces together with State and Federal policies
- **Deep Decarbonization** projects where the City needs to be to achieve it's GHG reduction goals



Bloomberg Associates reviewed key documents



Bloomberg Associates reviewed key documents, reports, white papers, and articles to better understand the current state of transportation in Oakland and opportunities to reduce the carbon intensity of the transportation sector.

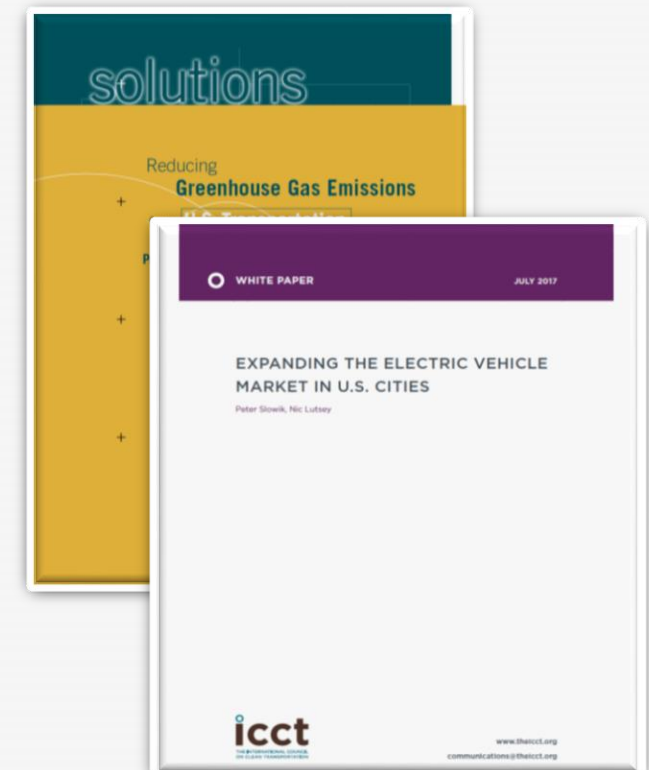
Bay Area Planning Studies



CA-Focused Technical Studies



National Best Practices





Publically available data provides a broad overview of Oakland's current transportation system...



The current transportation system in Oakland relies heavily on private automobiles for over 2/3 of all trips. While public transit has significant ridership, the introduction of TNCs is threatening to reduce transit ridership and add more car trips to the road.

The current mode share distribution in Oakland is dominated by private auto use:

	Transportation Mode	Mode Share
Baseline Mode Share	Private Autos and Trucks	69.1%
	Motorcycle	1.6%
	Taxi/TNC 1or2 pass.	1.6%
	TNC Pooled Ride	Not avail.
	Shared Minibus	Not avail.
	Standard Bus/BRT	11.9%
	BART	6.5%
	Amtrak	1%
	Ferryboat	0.1%
	Biking	3.3%
	Walking	4.9%

The current makeup of vehicles in Oakland is largely gas-powered, with some hybrid vehicles:

	Vehicle Types	Fuel Type (% of vehicles)		
		Electric	Low Emission	Gas
Baseline Vehicle Fuel Types	Private Autos	0.2%	5%	94.8%
	Light-Duty Truck	0%	0%	100%
	Medium-Duty Truck	0%	0%	100%
	Motorcycle	0%	0%	100%
	Taxi	1%	15%	84%
	TNC Pool	1%	15%	84%
	Shared Minibus	0%	4%	96%
	Standard Bus/BRT	0%	2%	98%



... but must be supplemented by a number of detailed assumptions in CURB



Expert interviews, literature review, and the in-person workshop helped refine core assumptions related to Oakland's baseline conditions.

Key Baseline Assumptions Include:

- Population Growth Rates (1.09% per year)
- Current TOD trends will continue (~2/3 of new units are transit-oriented)
- Adoption rates for EVs will increase over historical trends (% of total sales: today=5%, 2030=40%, 2050=90%)
- AVs will be a normalized part of the transportation system by 2050



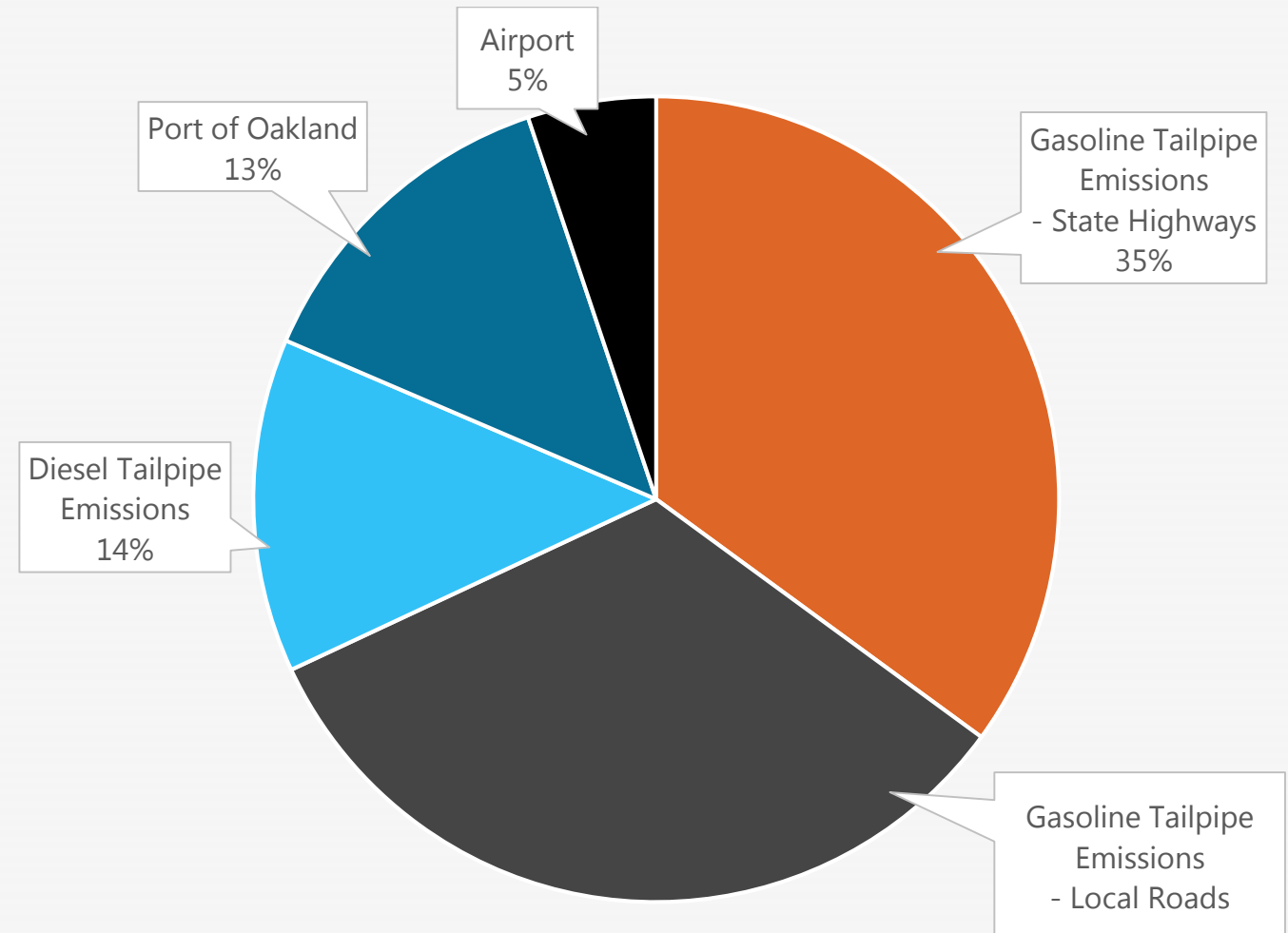
Oakland's transportation emissions are driven by gasoline tailpipe emissions



Oakland 2013 Transportation Emissions

According to the Oakland GHG Inventory, the largest sources of transportation emissions are:

- Gasoline tailpipe emissions on State Highways in Oakland represent **35%** of total Transportation and Mobile Source emissions
- Gasoline tailpipe emissions on local roads in Oakland represent **33%** of total Transportation and Mobile Source emissions
- The other largest sources of emissions are: diesel tailpipe emissions on local roads (14%), the Port of Oakland (13%), and the airport (5%)





Transportation actions have the potential to significantly reduce Oakland's GHG emissions



CURB uses these baseline inputs and assumptions to develop a preliminary analysis of where potential emissions reductions could come from. This information can be used to quickly identify which actions are likely to have the greatest impact. For transportation, multiple actions can produce the same GHG impact (e.g., with a carbon-free grid, shifting a vehicle trip to walking has the same impact as electrifying the private automobile that would have been used for that trip). As a result, the total GHG emissions reduction potential is greater than 100%.

Transit-Oriented Development	10% Potential reduction in transportation-related GHG emissions
Passenger Mode Shift	68% Potential reduction in transportation-related GHG emissions
Vehicle Electrification	87% Potential reduction in transportation-related GHG emissions

Note: CURB does not currently include functionality to provide this preliminary analysis for the Vehicle Fuel Efficiency action

Source: Bloomberg Associates Analysis, CURB



The analysis developed two scenarios for 2030 and 2050 to compare against Oakland's GHG reduction goals



The next step of the analysis develops and compares scenarios for 2030 and 2050 alongside Oakland's GHG reduction goals, to better understand the potential pathways to GHG reductions.

Projected Trajectory Scenario

The estimated the Projected Trajectory of Oakland's emissions assumed:

- **Projected technological advances & market adoption/penetration** (e.g., market adoption of electric vehicles)
- **Stated State & Federal policies** (e.g., US EPA/CARB fuel economy standards)
- **Existing City policies and funded programs** (e.g., Community Choice Energy program; NOT unfunded bike/walk plans)
- **Limited City actions responding to market trends** (e.g., revised building codes to enable electric vehicle chargers; NOT future programs incentivizing adoption of chargers in residential buildings)

The Projected Trajectory was then compared with Oakland's goals. Those insights were used to ground the work with local and national experts to figure out what else needed to happen.

Deep Decarbonization Scenario

Collaboration with local and national experts helped to identify the rate of change required to achieve Oakland's GHG goals and put the City on the pathway to Deep Decarbonization.



Key assumptions for the Projected Trajectory scenario (1 of 2)



Projecting ahead to 2030 and 2050 inherently involves making assumptions about what the world will look like, based upon the best information available to us today. Below are the key assumptions underlying the Transportation Projected Trajectory analysis:

Transit-Oriented Development

- Transit-oriented development patterns will continue along current trends, based upon availability of buildable sites in the transit-accessible core of Oakland
- A 'transit-oriented household' is defined as: Development within ¼ mile of a transit stop, including BART stations, rapid bus routes, BRT stations, and bus stops served by a frequency of service interval of 15 minutes or less during AM and PM peak commutes

Passenger Mode Shift

- Mode share is currently shifting from private autos and buses to TNCs
- 2030 projections don't account for autonomous vehicles due to uncertainty over near-term technological and regulatory hurdles; by 2050 AVs will be a normalized part of the transportation system
- Reductions in private autos by 2030 is due to shift to 1 to 2 passenger TNC trips, expansion of other TNC trip types (TNC Pooled Rides and Shared Minibus), and introduction of bike share and electric bicycles
- Early growth of TNC mode share was driven by low-efficiency TNC trips (1 or 2 passengers in passenger vehicles) but the greatest GHG reduction potential is a shift to more efficient TNC mode share, both pooled rides (>2 passengers in passenger vehicles) and shared minibus (multi passenger rides in larger vehicles)
- Mode share for buses is being lost to TNCs as they expand market saturation and options to travelers. Planned BRT corridors will likely not reverse this trend, and bus share will continue to shift to TNC modes
- Planned BART's core capacity improvements will likely result in modest increases in mode share for subway
- Investments in improving walkability and pedestrian infrastructure outlined in the OakDOT Strategic Plan will help achieve 2030 goal, but additional actions are required to achieve 2050 goals



Key assumptions for the Projected Trajectory scenario (2 of 2)



Projecting ahead to 2030 and 2050 inherently involves making assumptions about what the world will look like, based upon the best information available to us today. Below are the key assumptions underlying the Transportation Projected Trajectory analysis:

Vehicle Electrification

- California incentives for zero/low emission vehicles will increase adoption rate for private autos and light-duty trucks over historical trends: estimates for new sales of electric/low emissions vehicles increase from current 5% of total sales to 40% by 2030 and 90% by 2050
- Shared minibus vehicles (passenger vans) will likely be owned by TNC companies rather than drivers, leading to a faster fleet transition to zero and low-emissions vehicles
- Average age of vehicles on the road is 10.8 years
- Charging infrastructure is essential for transition to EVs; Initial buildout of charging network will be led by private sector but requires City and Utility action to accelerate siting and permitting
- CARB Advanced Clean Transit regulations (once finalized), together with continued improvement in fuel cell and electric bus technologies, will shift bus fleet to zero and low emissions vehicles
- 'Gas' includes both gasoline (petrol) and diesel, in percentages corresponding to baseline through 2030, beyond 2030 assume diesel passenger vehicles are phased out

Vehicle Fuel Efficiency

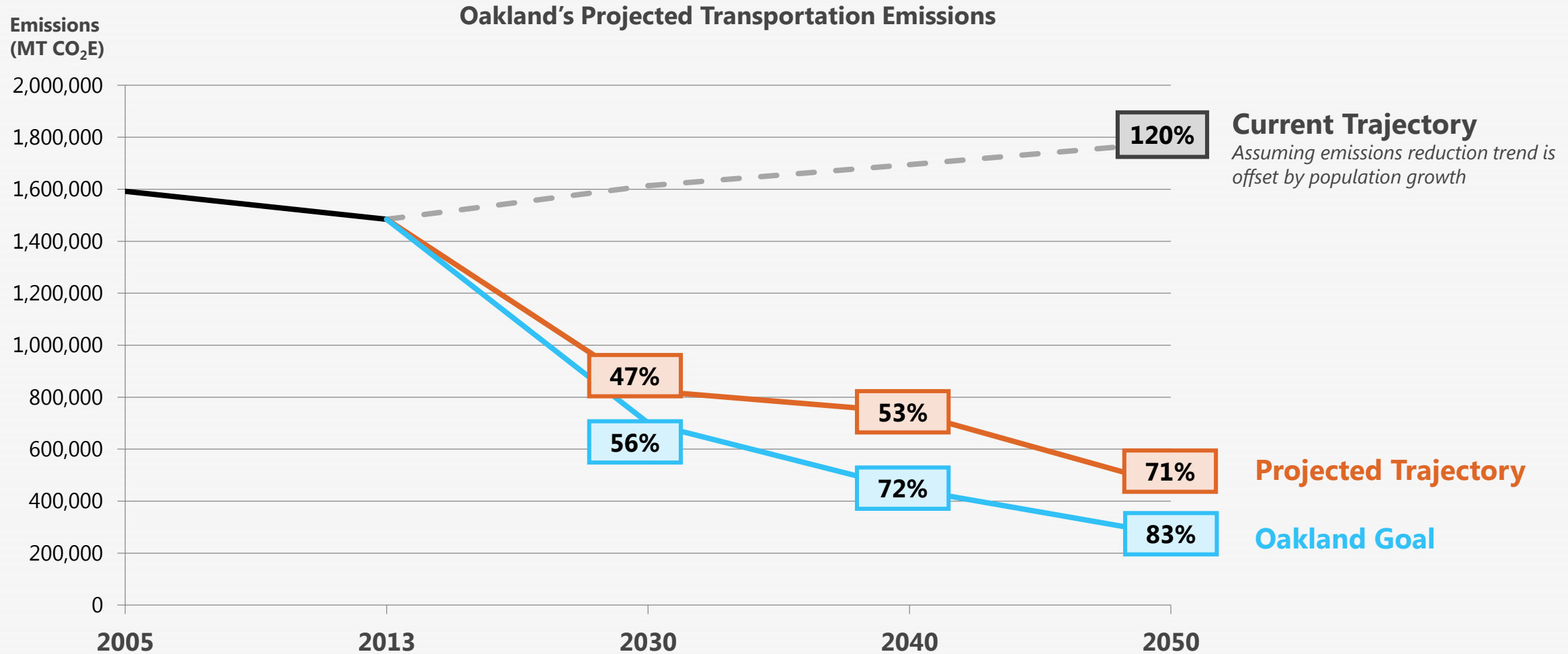
- While it is difficult to project fuel efficiency improvement rates over the long-term, there are likely decreasing efficiency gains over time
- Average age of vehicles on the road is 10.8 years
- Efficiency gains for taxi and TNC pool cars will be driven by Corporate Average Fuel Economy (CAFE) standards set by the State of California and the Federal Government, together with incentives to speed the adoption of electric and fuel efficient vehicles
- CA will likely adopt a renewable diesel standard for 2030, helping improve fuel efficiency for medium-duty trucks



Oakland will not achieve its GHG reduction goals on the Projected Trajectory



While the Projected Trajectory produces significant reductions from the 2005 baseline, it does not enable the City to meet its reduction targets for the transportation sector. Oakland needs to take additional actions to close a nine percentage point gap in 2030 and a 12 percentage point gap in 2050.

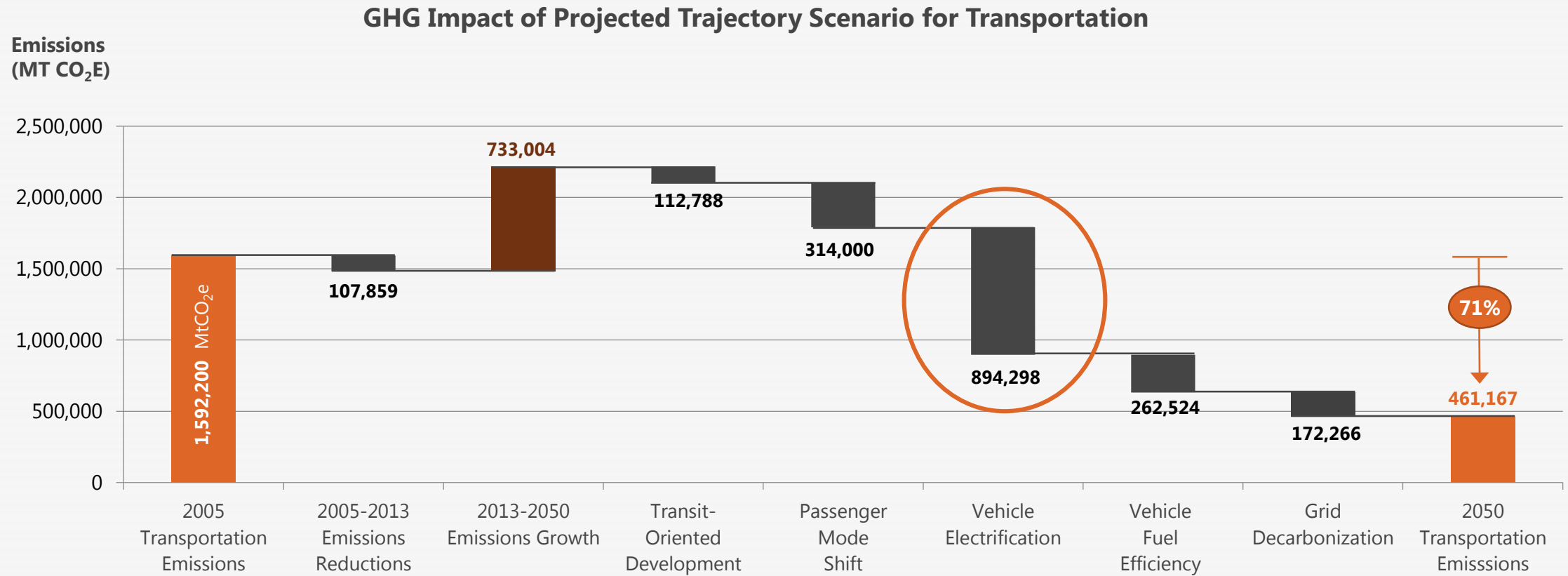




Projected Trajectory of transportation emissions to 2050



The Projected Trajectory scenario produces a 71% reduction in transportation emissions by 2050. This reduction is primarily due to the switch to electric and hybrid vehicles.

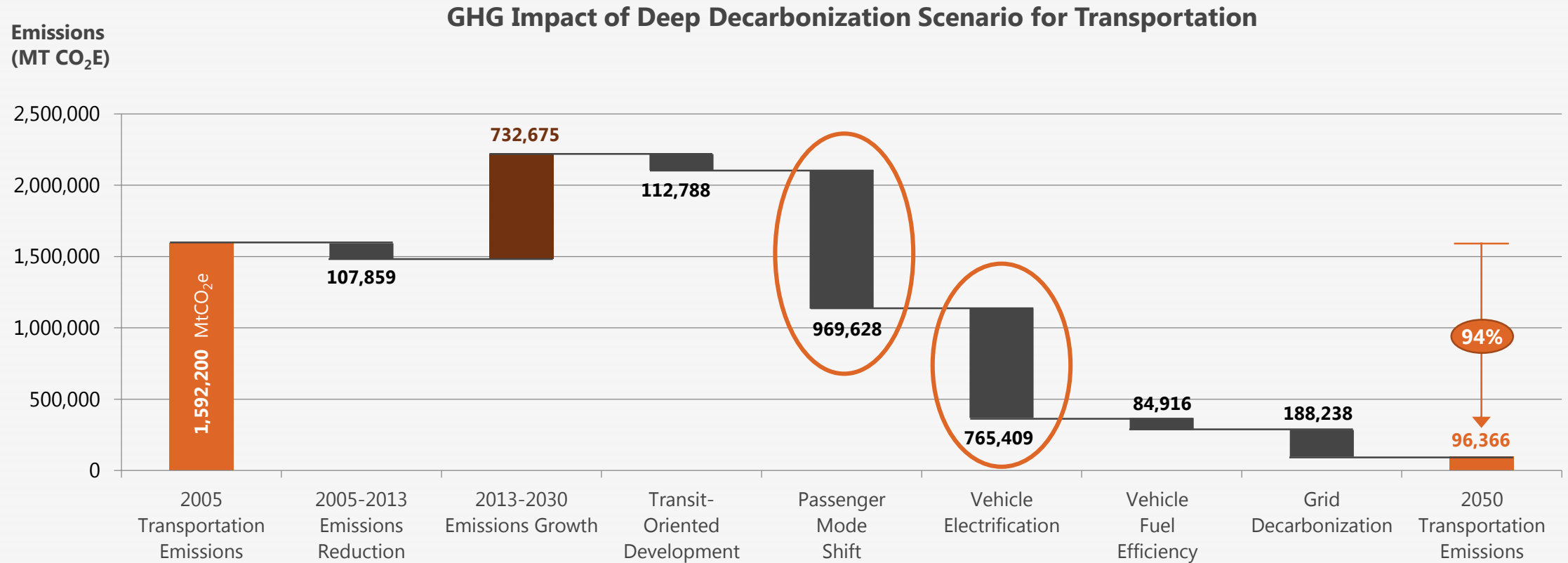




Deep Decarbonization of transportation emissions to 2050



The Deep Decarbonization scenario produces a 94% reduction in transportation emissions by 2050. Reduction beyond the Projected Trajectory come primarily from more aggressive actions in passenger mode shift and vehicle electrification.





Gap analysis methodology

Vehicle electrification example



Bloomberg Associates identified gaps between the Projected Trajectory and Deep Decarbonization scenarios to identify where City action is needed to achieve goals.



		CURB Tool Options	Baseline			2030						Delta		
Vehicle Electrification	Transportation Mode		Fuel Type (% of vehicles)			Projected Trajectory (% of vehicles)			Deep Decarbonization (% of vehicles)			% Gap		
			Elec	Lo Em	Gas	Elec	Lo Em	Gas	Elec	Lo Em	Gas	Elec	Lo Em	Gas
		Private Automobile	0.2%	5%	94.8%	10%	20%	70%	30%	40%	30%	20%	20%	-40%
		Light-Duty Truck	0%	0%	100%	3%	7%	90%	20%	35%	45%	17%	28%	-45%
		Medium-Duty Truck	0%	0%	100%	1%	60%	39%	0%	80%	20%	-1%	20%	-19%
		Motorcycle	0%	0%	100%	10%	0%	90%	80%	0%	20%	70%	0%	-70%

Delta
=
Deep Decarbonization
-
Projected Trajectory

Gaps were color-coded to highlight areas where significant gaps exist:

Low

Minimal City action required to achieve goals

Medium

Moderate City action required to achieve goals

High

Significant City action required to achieve goals



2030							
Private Auto	Light-Duty Truck	Med-Duty Truck	Motorcycle	Taxi	TNC Pool	Shared Minibus	Bus
20% gap between Projected Trajectory and Deep Decarbonization; City action needed to speed adoption of electric vehicles	17% gap between Projected Trajectory and Deep Decarbonization; City action needed to speed adoption of electric vehicles	1% gap between Projected Trajectory and Deep Decarbonization; However limited City action needed given CA is likely to adopt a renewable diesel standard for 2030	70% gap between Projected Trajectory and Deep Decarbonization; However, limited potential for City actions to speed adoption of electric motorcycles	15% gap between Projected Trajectory and Deep Decarbonization; City action needed to speed adoption of electric vehicles	15% gap between Projected Trajectory and Deep Decarbonization; City action needed to speed adoption of electric vehicles	No gap between Projected Trajectory and Deep Decarbonization; no City action needed to speed adoption of electric vehicles	5% gap between Projected Trajectory and Deep Decarbonization; CARB Advanced Clean Transit rules will likely require the bus fleet will transition at rates needed to achieve goals



Summary transportation gap analysis



To reduce transportation emissions, significant City action is needed to provide viable public transit alternatives to private vehicles and to speed electrification for key vehicles types.

Extent to which City Action is Required to Achieve Deep Decarbonization

		Mode Share		Vehicle Electrification	
Overall GHG Reduction Potential		39.8%		50.6%	
Mode Type	Current Mode Share	2030	2050	2030	2050
Private Autos and Trucks	69.1%	40%	20%		
Motorcycle	1.6%				
Taxi or 1-2 Passenger TNC	1.6%	3%			
TNC Pooled Ride	N/A				
Shared Minibus	N/A				
Bus/BRT	11.9%	15%			
BART	6.5%		14%		
Amtrak	1%				
Ferryboat	0.1%				
Biking	3.3%				
Walking	4.9%		12.5%		

Legend

Low Minimal City action required to achieve targets
 Medium Moderate City action required to achieve targets
 High Significant City action required to achieve targets
 = Priority City action area

Note: This analysis is predicated on the assumption of 100% carbon-free energy grid by 2030

Source: Bloomberg Associates Analysis, CURB



Short-term City actions needed to reduce private vehicle trips



Short-term City focus should be on areas with large GHG reduction potential, a high gap between the Projected Trajectory and Deep Decarbonization scenarios, and to avoid “lock in” of high-carbon technologies.

Mode Type	Today Mode Share	2030			
		Mode Share		Vehicle Electrification	Fuel Efficiency
		Projected Trajectory	Deep Decarbonization		
Overall GHG Reduction Potential		39.8%		50.6%	n/a
Private Autos and Trucks	69.1%	55.1%	40%		
Motorcycle	1.6%	1.6%	1.6%		
Taxi or 1-2 Passenger TNC	1.6%	10%	3%		
TNC Pooled Ride	N/A	2%	5%		
Shared Minibus	N/A	3%	9%		
Bus/BRT	11.9%	10%	15%		
BART	6.5%	7%	8%		
Amtrak	1%	1%	3%		
Ferryboat	0.1%	0.3%	0.4%		
Biking	3.3%	5%	7.5%		
Walking	4.9%	5%	7.5%		

	2030
GHG Reduction Potential	5.6%
New TOD Households	

Vehicle Electrification City Focus Areas

- In the short-term, City action needed to increase electrification of private vehicles and 1 to 2 passenger taxis and TNC vehicles

Legend

Low	= Minimal City action required to achieve goals
Medium	= Moderate City action required to achieve goals
High	= Significant City action required to achieve goals
Priority City Action Area	

Mode Share City Focus Areas

- City action needed to reduce private auto trips and 1 to 2 passenger taxi/TNC trips and increase bus trips

Note: Priority City actions predicated on assumption of 100% renewable electric grid



Long-term City action needed to electrify key vehicle types and shift to low-carbon travel modes



Because the City must take an “all of the above” approach to reach its GHG goals, longer-term actions should focus on areas with lower GHG impact or where the Projected Trajectory will have a lower impact between 2030 and 2050.

Mode Type	Today	2050			
	Mode Share	Mode Share		Vehicle Electrification	Fuel Efficiency
		Projected Trajectory	Deep Decarbonization		
Overall GHG Reduction Potential		39.8%		50.6%	n/a
Private Autos and Trucks	69.1%	48%	20%		
Motorcycle	1.6%	1.6%	1.6%		
Taxi or 1-2 Passenger TNC	1.6%	5%	3%		
TNC Pooled Ride	N/A	5%	5%		
Shared Minibus	N/A	10%	10%		
Bus/BRT	11.9%	8%	19.9%		
BART	6.5%	8%	14%		
Amtrak	1%	2%	3%		
Ferryboat	0.1%	0.4%	1%		
Biking	3.3%	6%	10%		
Walking	4.9%	6%	12.5%		

	2030
GHG Reduction Potential	5.6%
New TOD Households	

Vehicle Electrification City Focus Areas

- In the longer term, continued City action needed to increase electrification of private vehicles and shared minibus vehicles

Legend

Low	= Minimal City action required to achieve goals
Medium	= Moderate City action required to achieve goals
High	= Significant City action required to achieve goals
Priority City action area	

Mode Share City Focus Areas

- Even when vehicles are electrified, continued City action needed to reduce private vehicle trips and increase public transit and walking

Note: Priority City actions predicated on assumption of 100% renewable electric grid



Detailed Transportation Tables



Baseline, Projected Trajectory and Deep Decarbonization – Transit-Oriented Development



	CURB Tool Options	Today	2030		2050	
			Projected Trajectory	Deep Decarbonization	Projected Trajectory	Deep Decarbonization
Proportion of New Households	New Transit-Oriented Development Households	43%	65%	65%	65%	65%
	Transit-Oriented Development Trip Reduction Factor*	25%	25%	25%	25%	25%

* CURB Tool allows a maximum 25% trip reduction factor



Gap Analysis – Transit-Oriented Development

CURB – Emissions Reduction Potential: 5.6%



There is no gap between Projected Trajectory and Deep Decarbonization for transit-oriented development: Current development trends and policy direction will achieve goals for proportion of new households located in transit accessible areas.

2030	2050
No gap between Projected Trajectory and Deep Decarbonization; No additional City action needed to meet TOD goals.	No gap between Projected Trajectory and Deep Decarbonization; No additional City action needed to meet TOD goals.



Baseline, Projected Trajectory and Deep Decarbonization – Passenger Mode Shift



		CURB Tool Options	Today	2030 Projected Trajectory	2030 Deep Decarbonization	2050 Projected Trajectory	2050 Deep Decarbonization
Mode Share	Transportation Mode	Private Autos and Trucks	69.1%	55.1%	40.0%	48.0%	20.0%
		Motorcycle	1.6%	1.6%	1.6%	1.6%	1.6%
		Taxi/TNC 1or2 pass.	1.6%	10.0%	3.0%	5.0%	3.0%
		TNC Pooled Ride	Not avail.	2.0%	5.0%	5.0%	5.0%
		Shared Minibus	Not avail.	3.0%	9.0%	10.0%	10.0%
		Standard Bus/BRT	11.9%	10.0%	15.0%	8.0%	19.9%
		BART	6.5%	7.0%	8.0%	8.0%	14.0%
		Amtrak	1%	1.0%	3.0%	2.0%	3.0%
		Ferryboat	0.1%	0.3%	0.4%	0.4%	1.0%
		Biking	3.3%	5.0%	7.5%	6.0%	10.0%
		Walking	4.9%	5.0%	7.5%	6.0%	12.5%



Gap Analysis - Passenger Mode Shift

CURB – Emissions Reduction Potential: 39.8%



City action needed to achieve targeted reductions in low-efficiency TNC and private automobile trips.

2030										
Private Auto and Trucks ↓	Motorcycle	Taxi/TNC 1or2 Pass.	TNC Pooled Ride ↓	Shared Minibus ↑	Bus/BRT ↑	BART	Amtrak	Ferryboat	Biking ↑	Walking ↑
15% gap between Projected Trajectory and Deep Decarbonization; some City action needed to shift away from private autos	No gap between Projected Trajectory and Deep Decarbonization; no City action required	7% gap between Projected Trajectory and Deep Decarbonization ; City action needed to shift trips away from less efficient TNC modes	3% gap between Projected Trajectory and Deep Decarbonization; some City action needed to shift towards high-capacity TNC ride types	6% gap between Projected Trajectory and Deep Decarbonization; some action needed to shift towards high-capacity TNC ride types and larger vehicles	5% gap between Projected Trajectory and Deep Decarbonization; City action required to increase ridership	1% gap between Projected Trajectory and Deep Decarbonization; no City action required	2% gap between Projected Trajectory and Deep Decarbonization; no City action required	<1% gap between Projected Trajectory and Deep Decarbonization; no City action required	2.5% gap between Projected Trajectory and Deep Decarbonization, some City action needed to increase bicycling trips	2.5% gap between Projected Trajectory and Deep Decarbonization, some City action needed to increase walking trips
2050										
Private Auto and Trucks ↓	Motorcycle	Taxi/TNC 1or2 Pass.	TNC Pooled Ride	Shared Minibus ↑	Bus/BRT ↑	BART ↑	Amtrak	Ferryboat ↑	Biking ↑	Walking ↑
20% gap between 2030 and 2050 Deep Decarbonization; Aggressive City action needed to reduce private auto mode share	No gap between 2050 Projected Trajectory and Deep Decarbonization; no City action needed from 2030 to 2050	No gap between 2030 Projected Trajectory and 2050 Deep Decarbonization ; no City action needed from 2030 to 2050	No gap between 2030 and 2050 Deep Decarbonization; limited City action needed to shift towards high-capacity TNC ride types	No gap 2050 Projected Trajectory and Deep Decarbonization; some City action needed after 2030 to shift towards high-capacity TNC ride types in larger vehicles	4.9% gap between 2030 and 2050 Deep Decarbonization; Limited City action needed to shift trips onto buses	6% gap between 2050 Projected Trajectory and Deep Decarbonization; Limited City action needed to shift trips onto subway (BART)	No gap between 2030 and 2050 Deep Decarbonization; limited City action needed to shift trips onto rail	<1% gap between 2050 Projected Trajectory and Deep Decarbonization; limited City action needed to shift trips onto ferryboats	2.5% gap between 2030 and 2050 Deep Decarbonization; limited City action needed to increase bicycling trips	5% gap between 2030 and 2050 Deep Decarbonization; Some City action needed after 2030 to increase walking trips

Legend **Low** 0-4% point gap **Medium** 5-15% point gap **High** >15% point gap ↑ ↓ Indicates if mode share is **increasing** or **decreasing**

Source: Bloomberg Associates Analysis, CURB

Baseline, Projected Trajectory, and Deep Decarbonization: Private Vehicles – Vehicle Electrification



		CURB Tool Options	Baseline			2030						2050					
Fuel Type	Transportation Mode		Fuel Type (% of vehicles)			Projected Trajectory (% of vehicles)			Deep Decarbonization (% of vehicles)			Projected Trajectory (% of vehicles)			Deep Decarbonization (% of vehicles)		
			Elec	Lo Em	Gas	Elec	Lo Em	Gas	Elec	Lo Em	Gas	Elec	Lo Em	Gas	Elec	Lo Em	Gas
		Private Automobile	0.2%	5%	94.8%	10%	20%	70%	30%	40%	30%	50%	15%	35%	70%	30%	0%
		Light-Duty Truck	0%	0%	100%	3%	7%	90%	20%	35%	45%	34%	33%	33%	70%	30%	0%
		Medium-Duty Truck	0%	0%	100%	1%	60%	39%	0%	80%	20%	30%	70%	0%	40%	60%	0%
		Motorcycle	0%	0%	100%	10%	0%	90%	80%	0%	20%	25%	0%	75%	100%	0%	0%



Baseline, Projected Trajectory and Deep Decarbonization: Commercial Vehicles – Vehicle Electrification



		CURB Tool Options	Baseline			2030						2050					
Fuel Type	Transportation Mode		Fuel Type (% of vehicles)			Projected Trajectory (% of vehicles)			Deep Decarbonization (% of vehicles)			Projected Trajectory (% of vehicles)			Deep Decarbonization (% of vehicles)		
			Elec	Lo Em	Gas	Elec	Lo Em	Gas	Elec	Lo Em	Gas	Elec	Lo Em	Gas	Elec	Lo Em	Gas
		Taxi	1%	15%	84%	25%	50%	25%	40%	60%	0%	75%	25%	0%	80%	20%	0%
		TNC Pool	1%	15%	84%	25%	50%	25%	40%	60%	0%	75%	25%	0%	80%	20%	0%
		Shared Minibus	0%	4%	96%	25%	25%	50%	25%	50%	25%	50%	50%	0%	80%	20%	0%
		Standard Bus/BRT	0%	2%	98%	40%	40%	20%	35%	65%	0%	50%	50%	0%	50%	50%	0%



Gap Analysis - Vehicle Electrification

CURB – Emissions Reduction Potential: 50.6%



City actions needed to shift to electric vehicles in both short- and long-terms.

2030							
Private Auto	Light-Duty Truck	Med-Duty Truck	Motorcycle	Taxi	TNC Pool	Shared Minibus	Bus
20% gap between Projected Trajectory and Deep Decarbonization; City action needed to speed adoption of electric vehicles	17% gap between Projected Trajectory and Deep Decarbonization; City action needed to speed adoption of electric vehicles	No gap between Projected Trajectory and Deep Decarbonization; Limited City action needed given CA is likely to adopt a renewable diesel standard for 2030	70% gap between Projected Trajectory and Deep Decarbonization; However, limited potential for City actions to speed adoption of electric motorcycles	15% gap between Projected Trajectory and Deep Decarbonization; City action needed to speed adoption of electric vehicles	15% gap between Projected Trajectory and Deep Decarbonization; City action needed to speed adoption of electric vehicles	No gap between Projected Trajectory and Deep Decarbonization; no City action needed to speed adoption of electric vehicles	5% gap between Projected Trajectory and Deep Decarbonization; CARB Advanced Clean Transit rules will likely require the bus fleet will transition at rates needed to achieve goals
2050							
Private Auto	Light-Duty Truck	Med-Duty Truck	Motorcycle	Taxi	TNC Pool	Shared Minibus	Bus/BRT
20% gap between Projected Trajectory and Deep Decarbonization; City action needed to speed adoption of electric vehicles	36% gap between Projected Trajectory and Deep Decarbonization; City action needed to speed adoption of electric vehicles	10% gap between Projected Trajectory and Deep Decarbonization; However limited City action needed given CA is likely to adopt a renewable diesel standard for 2030	20% gap between 2030 and 2050 Deep Decarbonization; However, limited potential for City actions to speed adoption of electric motorcycles	5% gap between 2030 and 2050 Deep Decarbonization; no City action needed to speed adoption of electric vehicles	5% gap between 2030 and 2050 Deep Decarbonization; no City action needed to speed adoption of electric vehicles	30% gap between 2050 Projected Trajectory and Deep Decarbonization; City action needed to speed adoption of electric vehicles	No gap between 2030 and 2050 Deep Decarbonization; CARB Advanced Clean Transit rules will likely require the bus fleet will transition at rates needed to achieve goals

Legend

Low	0-10% gap	Medium	10-20% gap	High	>20% point gap
------------	-----------	---------------	------------	-------------	----------------



Baseline, Projected Trajectory and Deep Decarbonization: Private Vehicles – Fuel Efficiency



		CURB Tool Options	2030						2050					
Fuel Efficiency	Transportation Mode		Projected Trajectory (% improvement)			Deep Decarbonization (% improvement)			Projected Trajectory (% improvement)			Deep Decarbonization (% improvement)		
			Elec	Lo Em	Gas	Elec	Lo Em	Gas	Elec	Lo Em	Gas	Elec	Lo Em	Gas
		Private Automobile	14%	60%	60%	14%	60%	60%	22%	44%	44%	22%	44%	44%
		Light-Duty Truck	14%	60%	60%	14%	60%	60%	22%	44%	44%	22%	44%	44%
		Medium-Duty Truck	14%	16%	16%	14%	16%	16%	22%	37%	37%	22%	37%	37%
		Motorcycle	14%	60%	60%	14%	60%	60%	22%	44%	44%	22%	44%	44%

Baseline, Projected Trajectory and Deep Decarbonization: Commercial Vehicles – Fuel Efficiency



		CURB Tool Options	2030						2050					
Fuel Efficiency	Transportation Mode		Projected Trajectory (% improvement)			Deep Decarbonization (% improvement)			Projected Trajectory (% improvement)			Deep Decarbonization (% improvement)		
			Elec	Lo Em	Gas	Elec	Lo Em	Gas	Elec	Lo Em	Gas	Elec	Lo Em	Gas
		Taxi	14%	60%	60%	14%	60%	60%	22%	44%	44%	22%	44%	44%
		TNC Pool	14%	60%	60%	14%	60%	60%	22%	44%	44%	22%	44%	44%
		Shared Minibus	14%	16%	16%	14%	16%	16%	22%	37%	37%	22%	37%	37%
		Standard Bus/BRT	14%	21%	21%	14%	21%	21%	22%	35%	35%	22%	35%	35%

Gap Analysis - Vehicle Fuel Efficiency



There is no gap between Projected Trajectory and Deep Decarbonization for private vehicle fuel efficiency: Current and projected fuel efficiency standards at State and Federal levels together with market forces will achieve goals.

2030 + 2050							
Private Auto	Light-Duty Truck	Medium-Duty Truck	Motorcycle	Taxi	TNC Pool	Shared Minibus	Bus/BRT
No gaps between Projected Trajectory and Deep Decarbonization; The private automobile fleet will achieve fuel efficiency improvements at rates at or near what is required to achieve goals	No gaps between Projected Trajectory and Deep Decarbonization; The light-duty truck fleet will achieve fuel efficiency improvements at rates at or near what is required to achieve goals	No gaps between Projected Trajectory and Deep Decarbonization; The medium-duty truck fleet will achieve fuel efficiency improvements at rates at or near what is required to achieve goals	No gaps between Projected Trajectory and Deep Decarbonization; The motorcycle fleet will achieve fuel efficiency improvements at rates at or near what is required to achieve goals	No gaps between Projected Trajectory and Deep Decarbonization; The taxi vehicle fleet will achieve fuel efficiency improvements at rates at or near what is required to achieve goals	No gaps between Projected Trajectory and Deep Decarbonization; The TNC pool vehicle fleet will achieve fuel efficiency improvements at rates at or near what is required to achieve goals	No gaps between Projected Trajectory and Deep Decarbonization; The shared minibus vehicle fleet will achieve fuel efficiency improvements at rates at or near what is required to achieve goals	No gaps between Projected Trajectory and Deep Decarbonization; The bus fleet will achieve fuel efficiency improvements at rates at or near what is required to achieve goals

Legend

Low

0-10% gap

Medium

10-20% gap

High

>20% point gap

A sepia-toned photograph of a city skyline reflected in water. The skyline features several tall buildings, including a prominent curved skyscraper on the right. A blimp is visible in the sky on the left. The text "Appendix C – Stakeholder Engagement" is overlaid in the center.

Appendix C – Stakeholder Engagement



Bloomberg Associates interviewed 30 experts



Bloomberg Associates interviewed local, regional, and national experts to develop estimates for the existing conditions in building and transportation systems and to identify the key opportunities to reduce the carbon intensity of those sectors.

Buildings Interviewees

Cliff Rechtschaffen, **CA Office of the Governor**
 Johanna Partin, **Climate Neutral Cities Alliance**
 Mariana DiMascio, **Appliance Standards Awareness Project**
 Ariella Maron, **Buro Happold**
 Chris Rhine, **Buro Happold**
 Julina Parsley, **Buro Happold**
 Chris Garvin, **Terrapin Bright Green**
 Jim Edelson, **New Buildings Institute**
 Laurie Kerr, **Urban Green Council**
 Hillary Firestone, **National Resources Defense Council**

Transportation Interviewees

Chris Benner, **UC Santa Cruz**
 Austin Brown, **UC Davis Policy Institute for Energy, Env, & Economy**
 Emily Castor, **Lyft**
 Erin Cooper, **EMBARQ**
 Stacy Davis, **Oak Ridge National Laboratory**
 Jessie Denver, **SF Dept. of Environment**
 Gina Goodhill, **Tesla**
 Susan Handy, **UC Davis**
 Shruti Hari, **Metropolitan Transportation Commission**
 Sal Llamas, Chief Operating Officer, **AC Transit**
 Nick Nigro, **Atlas Public Policy**
 Val Menotti, **BART**
 Nic Lutsey, **International Council on Clean Transportation**
 Joel Ramos, **TransForm**
 Steve Raney, **Joint Venture Silicon Valley**
 Andrew Salzberg, **Uber**
 Dan Sperling, **Institute for Transportation Studies at UC Davis**
 Cathleen Sullivan, **Alameda Co. Transportation Commission**
 Glen Tepke, **Metropolitan Transportation Commission**
 Egon Terplan, **SPUR**



Bloomberg Associates convened two sector-specific workshops with experts



Bloomberg Associates convened 30+ Bay Area experts to develop the existing and projected conditions of Oakland's building and transportation systems for CURB and to identify the key opportunities to reduce the carbon intensity of Oakland's those sector.

Buildings Workshop Attendees

Norm Bourassa, **Lawrence Berkeley National Lab**
 Amy Dryden, **Build It Green**
 Shayna Hirshfield Gold, **Public Works, City of Oakland**
 Daniel Hamilton, **Public Works, City of Oakland**
 Miya Kitahara, **DNV-GL**
 Cole Roberts, **Arup**
 Meg Waltner, **Arup**
 Wes Sullens, **US Green Building Council**
 Andrea Traber, **Integral Group**
 Scott Wentworth, **Former City of Oakland**
 Alison Williams, **Lawrence Berkeley National Lab**
 Kerem Yilmaz, **Global Covenant of Mayors**

Transportation Workshop Attendees

Ratna Amin, **SPUR**
 Richard Battersby, **Public Works, City of Oakland**
 Dave Burch, **Bay Area Air Quality Management District**
 Danielle Dai, **OakDOT**
 Becky Dowdakin, **Public Works, City of Oakland**
 Michael Ford, **OakDOT**
 Ellen Greenberg, **Caltrans**
 Jason Haight, **A3 Gig Car Share**
 Daniel Hamilton, **Public Works, City of Oakland**
 Dermot Hikisch, **A3 Gig Car Share**
 Amanda Leahy, **Kittleson & Associates**
 Hugh Louch, **Alta Planning and Design**
 Ruth McLachlin, **Greenfield Labs**
 Melanie Nutter, **Nutter Consulting**
 Ed Pike, **Energy Solutions**
 Robert Rees, **Fehr and Peers**
 Ryan Russo, **OakDOT**
 Peter Slowik, **International Council on Clean Transportation**
 Emily Stapleton, **Ford GoBike Bay Area**
 Iris Starr, **OakDOT**
 Amruta Sudhalkar, **AECOM**
 Fern Uennatornwarangoon, **Environmental Defense Fund**
 Francesca Wahl, **Tesla**