City of Piedmont
COUNCIL AGENDA REPORT

DATE: July 16, 2018

TO: Mayor and Council

FROM: Paul Benoit, City Administrator

SUBJECT: Receipt of a Report on the 2016 Greenhouse Gas Emissions Inventory, and the Implementation Status of Piedmont's Climate Action Plan 2.0

RECOMMENDATIONS:

Informational update on the 2016 greenhouse gas emissions inventory; no action required.

BACKGROUND:

On March 19, 2018 Council adopted the Piedmont Climate Action Plan 2.0 (CAP 2.0), which includes the goal of reducing greenhouse gas (GHG) emissions 40% below 2005 levels by 2030 and 80% below 2005 levels by 2050. On January 4, 2016 Council approved joining the Compact of Mayors, a global coalition of mayors and city officials with the mission to reduce local greenhouse gas emissions, enhance resilience to climate change, and track progress publicly. The three-year commitment to the Compact of Mayors is broken down into four phases, including committing to the Compact, annual GHG inventories, assessing potential climate hazards and planning for adaptation, and the creation of an updated CAP and emissions reduction target.

This report provides a 2016 GHG inventory, including estimates for both community and municipal emissions. Compiling annual GHG inventories allows Piedmont to track progress towards meeting its CAP 2.0 goals and also fulfills Compact of Mayors reporting requirements. Previous inventories were completed in 2005, 2010, 2014, and 2015.

PREVIOUS GREENHOUSE GAS EMISSIONS INVENTORIES:

- **2005:** With funds provided by StopWaste.org, Piedmont completed a 2005 Greenhouse Gas Emissions inventory in 2006. The 2005 inventory is used as the City's baseline, against which later inventories are compared in order to measure the City's progress towards meeting its greenhouse gas emissions reduction goal. As data and methodologies pertaining to greenhouse gas emissions were revised and improved in subsequent years, the 2005 inventory was updated when the CAP was adopted in 2010 and again as part of the 2010 inventory. The inventory indicates that in 2005 greenhouse gas emissions in Piedmont totaled approximately 48,818 metric tons of carbon dioxide equivalents (CO_2e). Within this total, municipal facilities emitted approximately 1,025 metric tons of CO_2e.

- **2010:** With funds provided by PG&E's Green Community Program, the Alameda County Waste Management Authority (StopWaste) assisted its member local governments in the completion of municipal and community greenhouse gas emissions inventories for the calendar year 2010. Piedmont completed its 2010 GHG Emissions inventory at the close of 2013. The inventory indicated that GHG emissions in 2010 were 46,901 metric tons of CO_2e, a 5% reduction from 2005 levels. However, 2010 was a "wet" year in comparison to 2005. The greater rainfall provided Pacific Gas and Electricity Company (PG&E) with greater capacity for hydroelectric generation, which reduced PG&E's electricity GHG emissions factor for the year. This is the key factor accounting for a significant portion of Piedmont's 5% emissions reduction shown in that "snapshot." The transportation and residential sectors are responsible for the vast majority of Piedmont's GHG emissions, respectively accounting for 43% and 50% of the community's 2010 emissions. The three other CO_2e-producing sectors in Piedmont – non-residential energy, water, and waste – contributed 7% of the community's 2010 emissions. This is a decrease from 9% of 2005's emissions, largely due to 698 fewer tons of solid waste going to landfills in 2010. The City's municipal activities in 2010 resulted in approximately 1,056 metric tons of CO_2e, a 3% increase since 2005

- **2014:** Through the efforts of the City's 2016 CivicSpark Fellow, Piedmont finalized a 2014 GHG inventory for both community and municipal emissions in mid-2016. In 2014, Piedmont produced approximately 38,724 metric tons of CO_2e, a reduction of 21% below 2005 levels. More than 85% of the GHG reductions between 2010 and 2014 can be attributed to reduced residential gas usage which corresponds closely with a decreased need for heating due to warmer weather. The City's municipal activities in 2014 resulted in approximately 913 metric tons of CO_2e. This was a 14% decrease since the previous 2010 inventory. This decrease occurred despite the addition of the Aquatics Center and the Center for the Arts to the City's municipal portfolio. In 2014, Piedmont reached the 2010 Climate Action Plan goal of 15% reductions in emissions below 2005 baseline emissions by 2020.

- **2015:** Again through the efforts of the City's 2016 CivicSpark Fellow, Piedmont finalized a 2015 GHG inventory for both community and municipal emissions in early 2018. In 2015, Piedmont emitted approximately 38,498 metric tons of CO_2e, a reduction of 21% below 2005 levels. As in 2014, warmer weather in 2015 resulted in a decreased demand for residential heating and, consequently, natural gas usage. Overall, there appeared to have been no significant changes in Piedmont's GHG emissions between 2014 and 2015. Municipal activities resulted in approximately 960 metric tons of CO_2, a 3% decrease since 2005 but a 5% increase since 2014. Community and municipal results from the 2015 GHG inventory were used as the basis for Piedmont's CAP 2.0, having informed the development of its objectives and measures.

2016 GREENHOUSE GAS INVENTORY:

Piedmont completed the 2016 GHG Emissions inventory in the spring of 2018, which was again made possible through the City's participation in the CivicSpark program. For a more detailed

description of the results of the 2016 GHG inventory, please refer to Exhibit A, pages 9-20. In 2016, Piedmont produced approximately 37,025 metric tons of CO_2e, a reduction of 24% below 2005 levels. Both total municipal and community emissions decreased slightly from 2015 to 2016. A large amount of the reduction in emissions from the 2005 baseline is mostly the result of diminished natural gas usage, first observed in 2014.

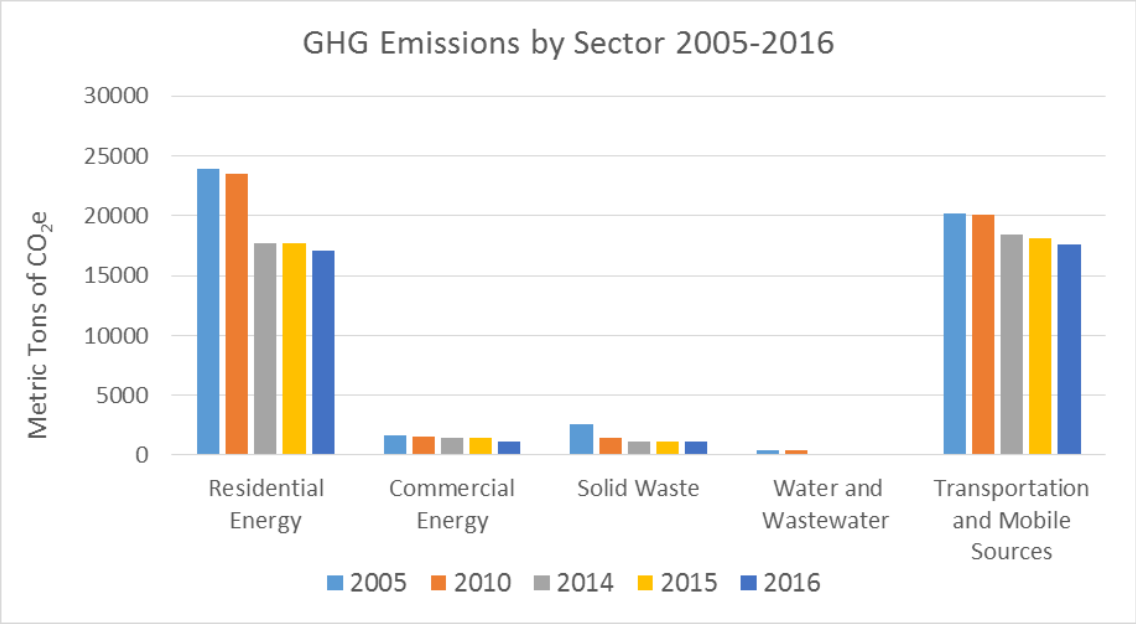

Figure 1

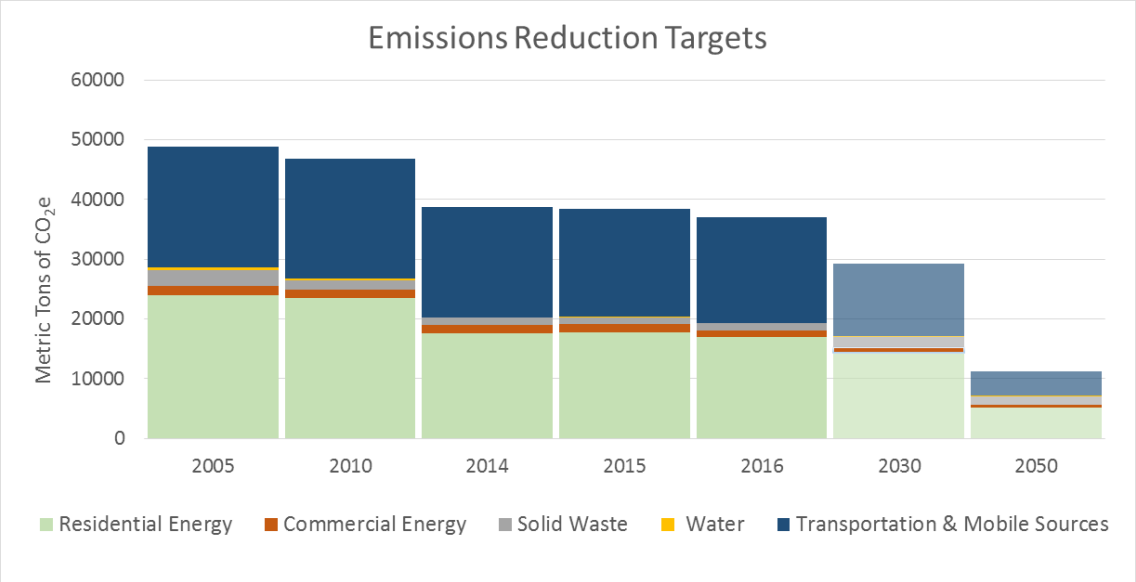

Figure 2

Community Update

In 2017 and 2018, City staff utilized the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories and ICLEI's U.S. Community Protocol to calculate Piedmont's 2016

community emissions. The sectors that contribute most to Piedmont's greenhouse gas emissions are Transportation & Mobile Sources (48%) and Residential Energy (46%). Solid Waste is a distant third, making up only 3% of total emissions. Figure 1, above, breaks down emissions by sector and year. While there are reductions in all sectors since 2005, the most substantial change comes from the residential energy sector.

Emissions associated with residential electricity decreased from 5,018 to 3,613 metric tons of CO_2e between 2015 and 2016, a 28% decrease. Changes in PG&E's energy portfolio, such as an increase in renewable energy, accounts for a substantial portion of the reductions in Piedmont's electricity emissions. In addition, residential electricity use declined 16% since 2005. Many things could contribute to this including residential behavior, energy efficient appliances, energy efficiency programs, and solar photovoltaic (PV) installations. With Piedmont City Council's recent decision to enroll all residential electricity accounts into East Bay Community Energy's 100% Renewable Energy service plan, theoretically there will no longer be appreciable emissions associated with residential electricity use. This is expected to result in an approximate 10% reduction in overall GHGs from 2016 levels.

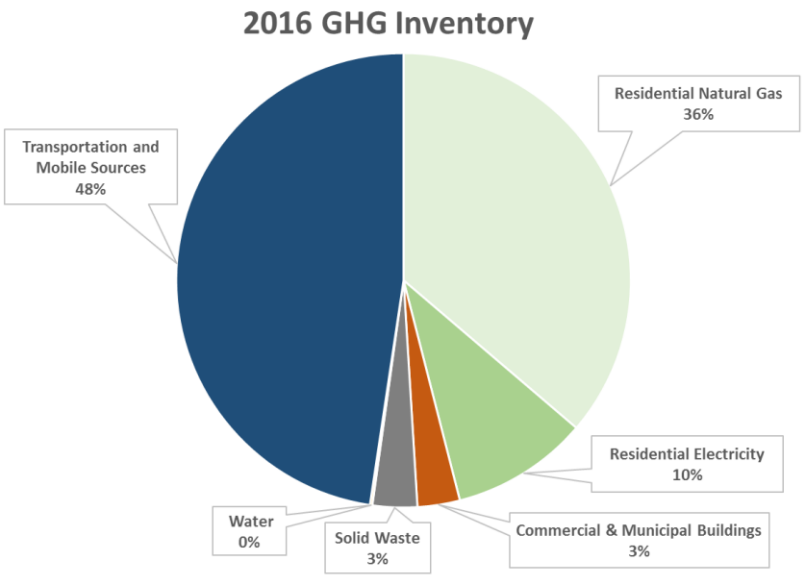

Figure 3

The majority of emissions associated with residential energy come from natural gas consumed for heating (ambient heat, hot water and cooking). Residential heating alone makes up 36% of the total community GHG emissions. While electricity use appears to be declining, natural gas use often fluctuates based on weather. 22% less natural gas was used in 2016 than in 2010. In both 2014 and 2015, significant reductions in natural gas use were responsible for the City meeting its 2010 CAP emissions reduction goal of 15% below baseline emissions by 2020 ahead of schedule. However, Piedmont's natural gas usage has been steadily increasing since 2014. Between 2014

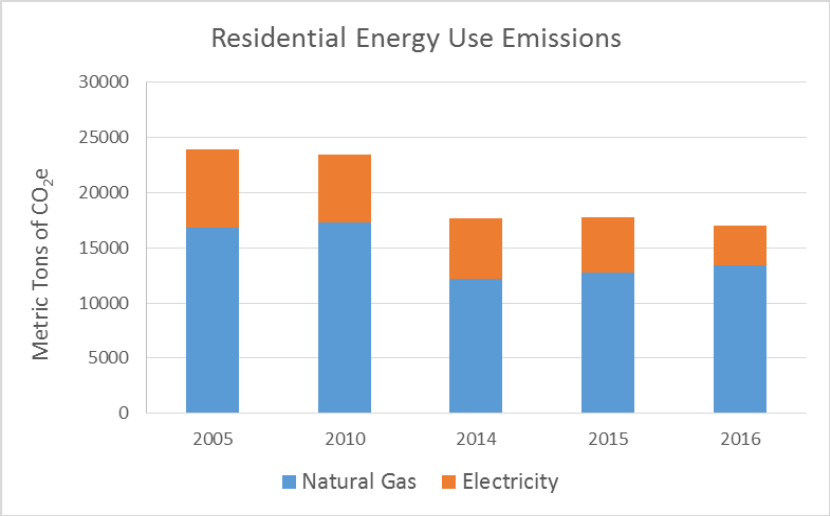

Figure 4

and 2016, natural gas usage increased by 10%. Emissions generated by the transportation sector come from vehicle miles traveled (VMT) and the amount of petroleum consumed by those vehicles, neither of which the City has much ability to control. While there were minor reductions in emissions from gasoline passenger vehicles in 2016, this was due to improvements in vehicle fuel efficiency rather than fewer miles driven. Modeled vehicle miles traveled for Piedmont are slightly higher in 2016 than 2015. However, transportation emissions from Piedmont may be marginally lower than estimates provided by regional models. Piedmont residents are increasingly buying electric vehicles (EV). Based on the California Clean Vehicle Rebate Project, there have been 286 rebates redeemed for EVs in Piedmont between June 2011 and December 2016, equivalent to approximately 7.5% of Piedmont's households. The actual number of EVs in Piedmont is likely greater considering owners may choose not to redeem their rebates, were not eligible for rebates, or purchased their EVs outside the date range analyzed.

Commercial and municipal energy use, water consumption, and solid waste are minor contributors to Piedmont's greenhouse gas portfolio. Combined, these sources account for only 6% of total emissions. Commercial electricity use in 2015 was slightly below the 2005-2015 emissions average and commercial natural gas use data is currently unavailable. In 2016, Piedmont consumed roughly the same amount of water as in 2015, which is almost 20% less than what was consumed in 2014. In total, the Piedmont community used 370 million gallons of water in 2016. Emissions associated with water use come from the transport, delivery, and treatment of wastewater and contribute 62 metric tons of CO_2e. Solid waste emissions come from the breakdown of organic material in landfills. In 2016, Piedmont produced 2,416 tons of solid waste, a 4% increase from 2015. However, over the past few years, Piedmont has consistently diverted a majority of its waste from the landfill to recycling and composting. In 2016, Piedmont diverted 72.5% of its waste from the landfill.

Municipal Update

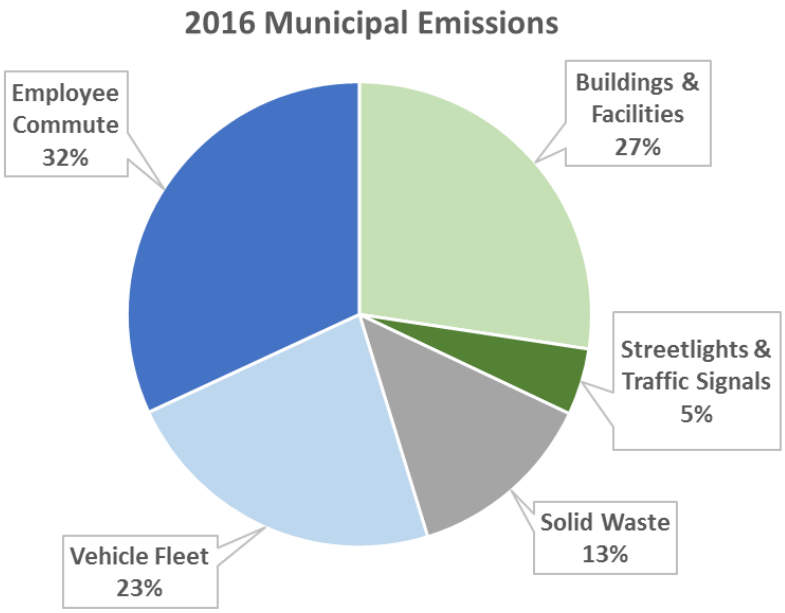

Figure 5

Municipal emissions are a subset of overall community emissions. Municipal activities in 2016 resulted in approximately 862 metric tons of CO_2e, or 2% of total community emissions. From 2015 to 2016 there was a 10% reduction in total municipal emissions. Most of the reductions occurred in the buildings and facilities sector, where emissions decreased 32% since 2015. This can likely be attributed to LED streetlight conversions and an increase in renewable sources in PG&E's energy mix. With Piedmont City Council's recent decision to enroll all municipal electricity accounts into East Bay Community Energy's 100% Renewable Energy service plan, there will theoretically no longer be emissions associated with municipal electricity use. This will result in an approximate 13% reduction in total municipal emissions.

Transportation-based emissions come from the City's vehicle fleet and employee commute. The City of Piedmont's vehicle fleet produces 197 metric tons of CO_2e. Within municipal fleet emissions, the Police Department accounted for 49% of the GHG emissions; the Public Works Department and Fire Department produced 29.5% and 19% respectively. Employee commute emissions contribute 275 metric tons of CO_2e, making up 32% of total municipal GHGs.

CONCLUSIONS:

The 2016 GHG inventory reveals that the Piedmont community is continuing to decrease its emissions, despite an increase in natural gas use since 2015. This progress seems to be mainly due to outside factors, particularly the increase in renewable sources in PG&E's energy mix. This has caused significant decreases in emissions in both the residential and commercial electricity sectors since 2015. With City Council's recent decision to source 100% renewable energy for the City's residents and municipal buildings, the emissions associated with electricity use will theoretically no longer occur. This is expected to further reduce total emissions by 10% below 2016 levels. With

100% renewable energy on the horizon, the City can now begin to shift its focus toward encouraging residents and businesses to switch from gas appliances to electric alternatives. Whereas warmer weather in 2014 and 2015 led to dramatic decreases in natural gas use and, as a result, decreases in overall emissions, colder weather in the future could lead to significant increases in natural gas use and overall community emissions. Switching to electric appliances that are powered by 100% renewable energy is one of the most impactful actions that building owners can take. In addition to promoting electrification, the City can begin shifting its focus to addressing transportation emissions. The transportation sector emits nearly half of the City's total emissions and remains a sector that is difficult for a local jurisdiction to address. However, possible actions include the installation of public electric vehicle chargers in the City to encourage electric vehicle adoption and continued implementation of the Pedestrian and Bicycle Master Plan (PBMP), which would encourage residents to increase the number of trips they make on foot, bike, and public transportation. These actions, coupled with statewide action and improving fuel efficiency standards, should help Piedmont achieve its 2030 and 2050 emissions reduction goals.

CAP 2.0 IMPLEMENTATION UPDATE:

Since CAP 2.0 was adopted in March 2018, the City has made progress on a number of measures and priorities detailed in the plan's executive summary. Exhibit B (Pages 21-26) contains a detailed list of the City's progress on the CAP 2.0 measures listed below.

Completed Actions/Actions in Progress

On March 21, 2018, City Council voted to automatically enroll all Piedmont residents into East Bay Community Energy's 100% Renewable Energy service plan. In doing so, the City achieved Building Energy Measure 3.3, which directs the City to increase the amount of renewable energy delivered through the grid. Similarly, on June 4, 2018, City Council voted to automatically enroll all municipal electricity accounts into the same 100% Renewable Energy service plan. This action, along with the City's efforts to install rooftop solar at the Corporation Yard, fulfills Municipal Measure M-2.3, which calls for the City government to increase its amount of renewable energy on-site and through the grid.

Ongoing municipal projects that also align with CAP 2.0 measures include converting the City's decorative post top streetlights to LEDs and exploring the possibility of installing public electric vehicle chargers within the City. Within a year, the City hopes to create an online, GHG reduction tracking platform where residents can log and track their actions. Creation of this online platform is referred to in Building Energy Action-1.2G, Solid Waste Action-1.2F, and Water and Wastewater Action-1.2D. The City also plans to collaborate with Piedmont Connect on creating a condensed, graphically-appealing version of the CAP 2.0 for residents and on hosting community engagement and education events.

Although not a measure within CAP 2.0, the City will soon participate in the Climate Corps Fellowship program, thereby continuing to expand staff capacity to achieve CAP 2.0 measures. Staff has executed an agreement with the Climate Corps program manager, Bay Area Community Resources, and a new fellow will begin their 2018-2019 term on September 4, 2018. Also, the City will continue to conduct frequent GHG inventories to track its progress in meeting the 2030 emissions reduction goal. This will also serve to sustain awareness of the CAP 2.0 and help identify

areas of improvement. As the GHG inventorying methodology advances to include consumption-based emissions, staff will try to incorporate these emissions into future community inventories.

ATTACHMENTS:

Exhibit A	Pages 9-20	City of Piedmont 2016 Greenhouse Gas Emissions inventory
Exhibit B	Pages 21-26	City of Piedmont CAP 2.0 Implementation Progress

By: Mira Hahn, Assistant Planner
Cody Ericksen, CivicSpark Fellow

City of Piedmont: 2016 Greenhouse Gas Emissions Inventory Update

Executive Summary

In 2010, the City of Piedmont adopted its Climate Action Plan (CAP), which set a goal of reducing greenhouse gas (GHG) emissions 15% below 2005 levels by 2020. In 2014 and 2015, the City of Piedmont met its 15% reduction target, however in both years this was principally the result of extensive reductions in natural gas use in response to warmer weather. In 2018, the City of Piedmont adopted its Climate Action Plan (CAP) 2.0, which provided an update to the original plan. CAP 2.0 sets new emissions reduction goals of reducing GHG emissions 40% below 2005 levels by 2030 and 80% below 2005 levels by 2050.

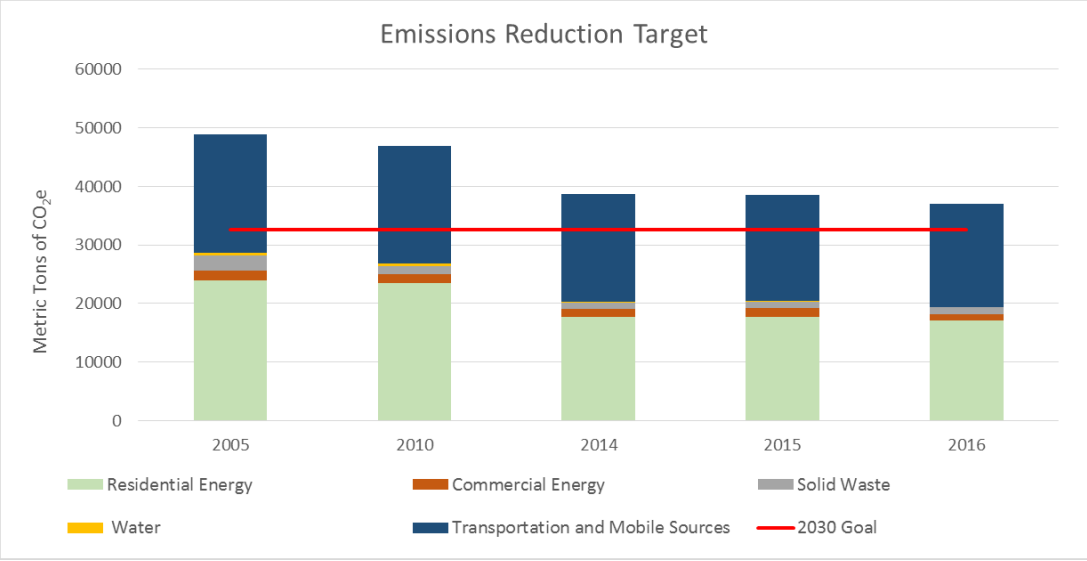

Figure 1

In order to determine the City's progress in meeting both the previous and current emissions reduction goals, a greenhouse gas inventory was conducted in 2005 in order to establish a baseline emissions level. Subsequent inventories were completed for the years 2010, 2014, 2015, and most recently 2016. Performing frequent GHG inventories helps fulfill the City's commitment to the Compact of Mayors.

Compact of Mayors and Climate Action Plan 2.0

On January 4, 2016 the City has become a signatory to the Compact of Mayors to better identify the impact of individual measures and more accurately track progress toward achieving future Climate Action Plan goals. This three-year commitment, which began in 2016, requires more frequent GHG inventory updates, a new GHG reduction target, and an updated CAP that includes new adaptation strategies for addressing climate hazards. Yearly GHG inventories satisfy the requirements of the Compact of Mayors and provides a record of Piedmont's emissions.

As part of meeting the Compact of Mayors requirements, the City of Piedmont adopted a Climate Action Plan (CAP) 2.0 on March 19, 2018. This CAP 2.0 defined new GHG emissions reduction target of decreasing annual emissions 40% below 2005 levels by 2030 and 80% below 2005 levels by 2050. The CAP 2.0 also contains an adaptation section and outlines a series of strategies to achieve these emissions reduction goals, including addressing building energy efficiency, fuel switching from natural gas to electric appliances, renewable energy, vehicle miles traveled, water conservation, recycling, and consumption. Since adoption, city staff has been working to implement these strategies.

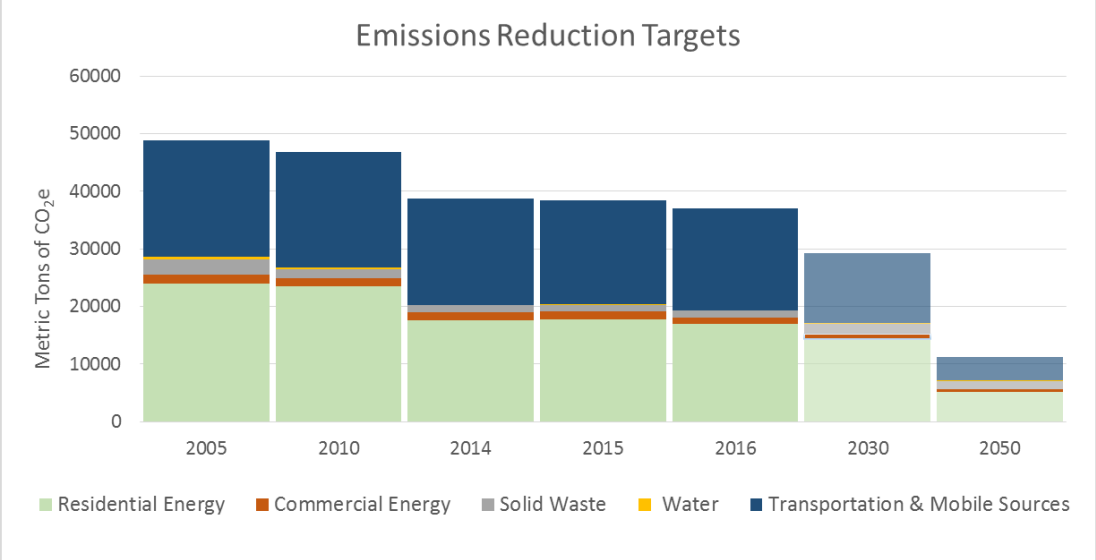

Figure 2

Previous Inventories

A base year GHG inventory for the City of Piedmont was completed by independent consultant AECOM for the year 2005. The results of this inventory indicated activities in the community of Piedmont resulted in approximately 48,444 metric tons of CO_2e. As a primarily residential community, Piedmont's largest source of emissions was residential energy consumption. The second largest contributor was the transportation sector. Together, non-residential energy use, water consumption, and waste sent to landfills contributed less than 10% to the overall inventory.

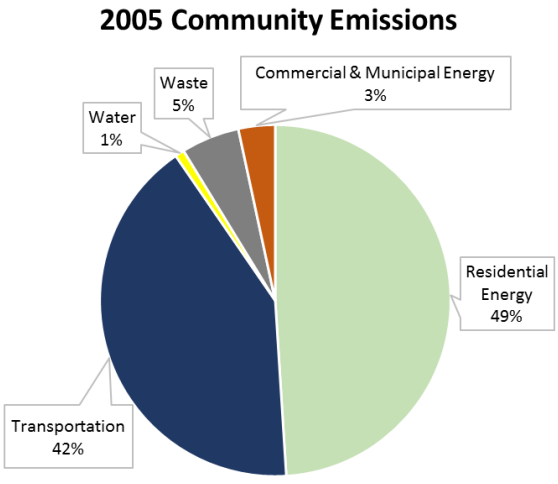

Figure 3

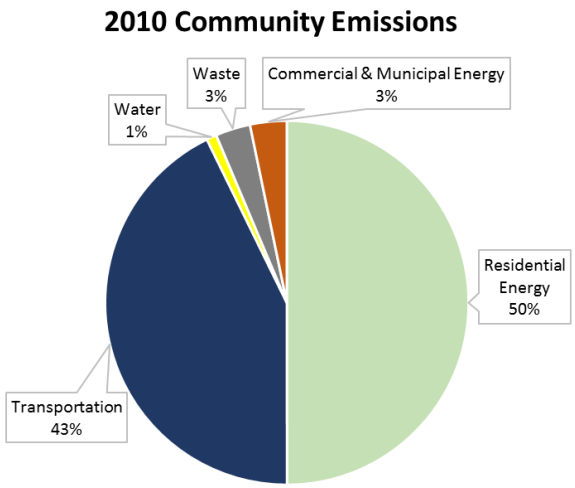

Figure 4

In 2010, a new methodology for inventorying government and community GHG emissions, the U.S. Community Protocols for Accounting and Local Government Operating Protocols, was adopted as the standard across the San Francisco Bay Area. The new methodology was applied to the 2005 inventory and baseline emissions were updated to 48,818 metric tons of CO_2e. Using this calculation method in 2010, community activities resulted in approximately 46,901 metric tons of CO_2e. This was an approximate 4% reduction in GHG emissions from 2005 levels and was largely attributed to an increase in hydropower in Pacific Gas and Electric Company's (PG&E) energy mix during this "wet" year. As seen in Figure 3, the distribution by sector was similar to 2005 with a slight decrease in waste produced by the community as a result of the 2008 roll-out of new recycling and organic waste programs.

In 2014, Piedmont produced 38,724 metric tons of CO_2e, a reduction of 21% below 2005 levels. 2014's substantial drop in emissions was attributed to a reduction in natural gas usage throughout the City. Approximately 85% of the reductions were the result of decreased natural gas usage between 2010 and 2014. It is encouraging that Piedmont has tentatively reached its 2020 goal in 2014. However, emissions reductions dependent on weather fluctuations do not portend long term success.

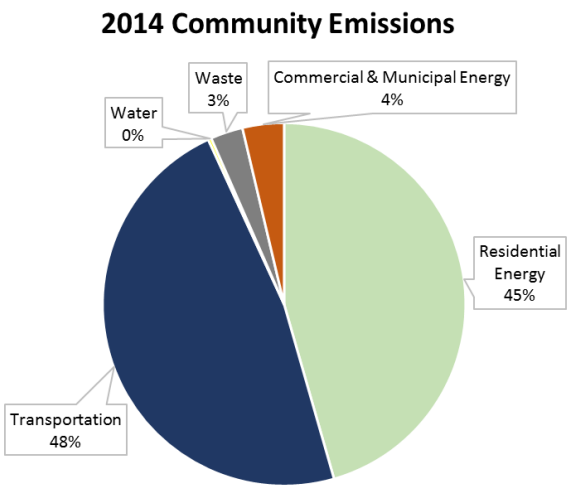

Figure 5

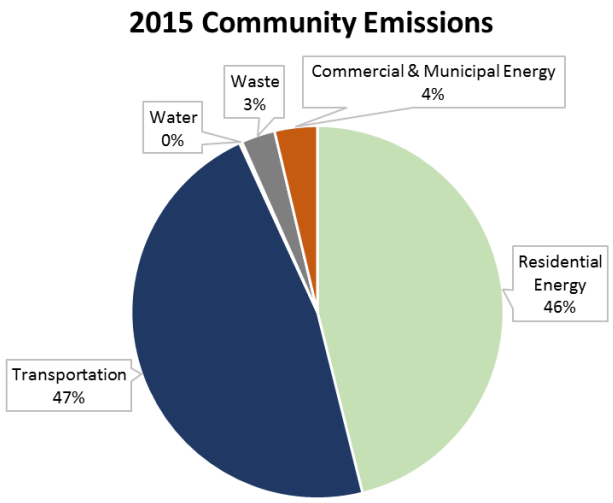

Figure 6

In 2015, Piedmont completed the 2015 GHG Emissions inventory in the winter of 2016, once again made possible through the City's participation in the CivicSpark program. In 2015, Piedmont produced approximately 38,497 metric tons of CO_2e, a reduction of 21% below 2005 levels. This indicates that for the second year in a row Piedmont has reached its 2020 GHG reduction target. Both total municipal and community emissions decreased from 2014 to 2015. The reduction in emissions from the 2005 baseline is mostly the result of the continued trend in decreased natural gas usage, as observed in 2014. However, it should be noted that Piedmont's natural gas usage did increase 5% from between 2014 and 2015.

2016 Greenhouse Gas Inventory

37,025 Metric Tons of CO_2e
3.8% decrease from 2015
24% decrease from 2005

Piedmont completed the 2016 GHG Emissions inventory in the winter of 2018, once again made possible through the City's participation in the CivicSpark program. In 2016, Piedmont produced approximately 37,025 metric tons of CO_2e, a reduction of 24% below 2005 levels. This indicates that for the third year in a row Piedmont has reached its 2020 GHG reduction target. Both total municipal and community emissions decreased from 2015 to 2016. Although natural gas usage in 2016 was still significantly lower than in 2010, it should be noted that natural gas usage since 2014 has been slowly increasing. Between 2014 and 2016, the emissions associated with Piedmont's natural gas usage increased 10%. The reduction between 2015 and 2016 is largely the result of an increase in hydropower in Pacific Gas and Electric Company's (PG&E) energy mix. As a result, between 2015 and 2016 the emissions associated with residential electricity use decreased by 28%.

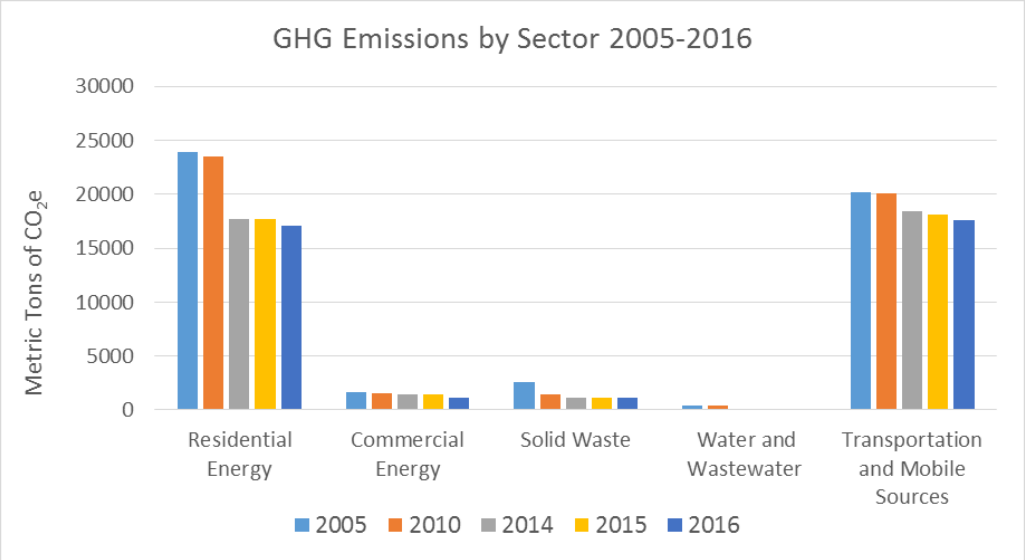

Figure 7

To calculate emissions, City staff utilized ICLEI's U.S. Community Protocol and the Global Protocol for Community-Scale Emissions (GPC), as well as the greenhouse gas global warming potentials found in the most recent Intergovernmental Panel on Climate Change (IPCC) report.[1] In 2016, community emissions were 37,025 metric tons of CO_2e and municipal activities, a subset of community emission, contributed 862 metric tons of CO_2e to the community's total. Municipal activities represent only about 2% of Piedmont's total emissions. The sectors that contribute the most to Piedmont's greenhouse gas emissions are Transportation & Mobile Sources (48%) and Residential Energy (46%). Commercial energy, which also includes municipal energy, water consumption, and solid waste are minor contributors, comprising only 6% of total emissions.

Community Emissions

Transportation

17,636 Metric Tons of CO_2e
48% of 2016 total emissions
3% decrease from 2015

Transportation sector emissions, modeled by Metropolitan Transit Commission (MTC), are the result of travel that begins or ends in the City, or is associated with Piedmont residents' activity. This includes personal vehicle travel, commercial transport within the City, and Piedmont residents' use of public transportation, AC Transit and BART. In the 2014, 2015, and 2016 GHG inventories, transportation sector emissions contributed more to the community's total

[1] The use of the most recent IPCC values is standard in the United States. The EPA uses the most recent, 100 year GWP values for greenhouse gas inventories. https://www.epa.gov/ghgemissions/understanding-global-warming-potentials

than any other sector. This is in contrast to years 2005 and 2010 where residential energy was the biggest contributor.

Transportation emissions come predominantly from personal vehicle travel. Gasoline passenger vehicles alone account for 15,085 metric tons of CO_2e. Figure 7, below, shows the emissions contribution of each form of transportation. Public transit contributes very little to overall transportation-based emissions.

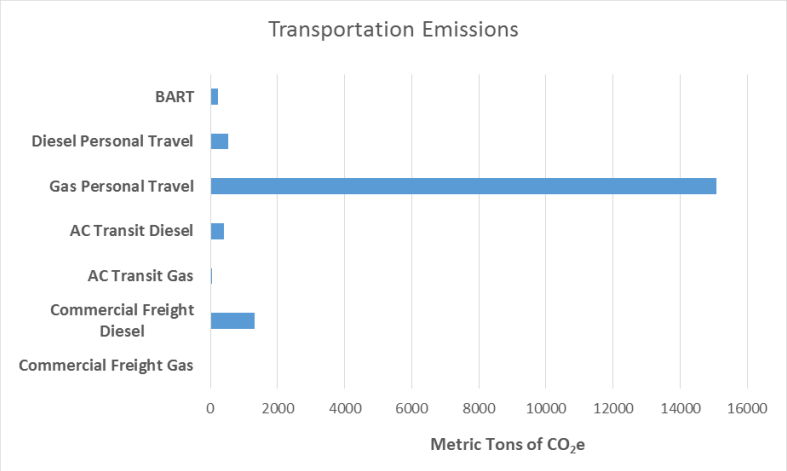

Figure 8

The factors used to calculate vehicle emissions are vehicle miles traveled (VMT) and on-road emissions factors (grams CO2/mile). The reductions in transportation sector emissions from 2015 to 2016 were due to improvements in vehicle fuel efficiency (on-road emissions factors) rather than lower VMT. Piedmont's vehicle miles traveled, modeled by MTC, were actually higher in 2016 than in 2015.

It should be noted that fuel efficiency emissions are based on county-wide vehicle portfolios. Piedmont's actual transportation emissions may be marginally lower due to high rates of electric vehicle ownership. Piedmont residents are increasingly buying electric vehicles (EV). Based on the California Clean Vehicle Rebate Project, there have been 286 rebates redeemed for EVs in Piedmont between June 2011 and December 2016, equivalent to 7.5% of Piedmont's households. The actual number of EVs in Piedmont is likely greater considering those car owners who chose not to redeem their rebates, were not eligible for rebates, or purchased their EVs outside the date range analyzed.

Residential Energy

Greenhouse gas emissions associated with residential energy come from electricity and natural gas. These are measured in kilowatt hours for electricity and therms for natural gas.

17,036 Metric Tons of CO2e
46% of 2016 total emissions
4% decrease from 2015

Emissions from residential electricity went from 5,018 to 3,616 metric tons of CO_2e between 2015 and 2016, a 28% reduction. The carbon intensity of electricity emissions are represented by PG&E's electricity Emissions Factor (EF). Over the past decade, PG&E has added more renewable

electricity to its energy portfolio; this accounts for a substantial portion of reductions in Piedmont's residential emissions.

The residential sector's downward trend in electricity use is steady and substantial. Between 2005 and 2016 electricity use declined by 16%. This can be attributed to changes in residential behavior, energy efficient appliances, energy efficiency programs, and solar photovoltaic (PV) installations. As of December 2016 there were 312 permits issued for solar energy.[2] Out of a total of 3,801 households, this is 8.2% of Piedmont homes.[3] By generating renewable energy, residents lower total community emissions.

On May 21, 2018 Piedmont City Council voted to enroll all residential electricity accounts into East Bay Community Energy's 100% Renewable Energy service plan. With the majority of Piedmont residents soon to be sourcing their electricity from carbon-free and renewable sources, there will theoretically no longer be emissions associated with residential electricity use. This will result in an approximate 10% reduction in Piedmont's overall GHGs.

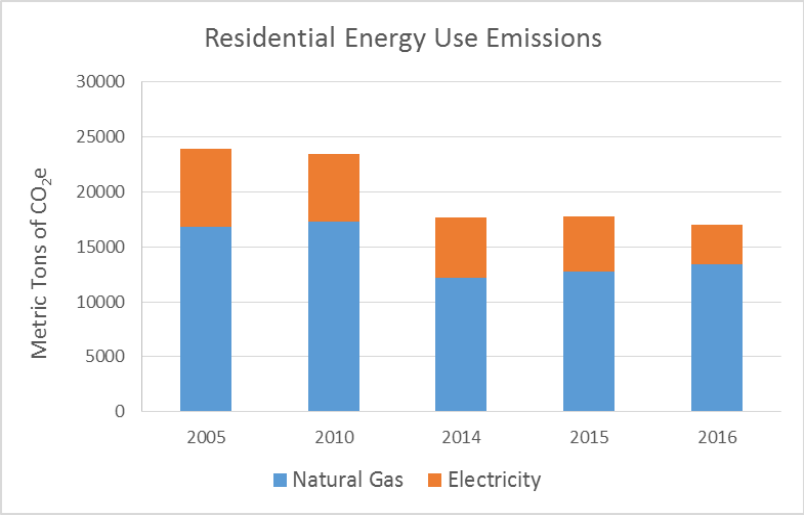

Figure 9

Residential heating alone makes up 36% of total GHG emissions. While electricity use appears to be declining, natural gas use often fluctuates based on weather. In 2014, unusually low natural gas use was responsible for the City meeting its 2020 goal ahead of schedule. This was again true in 2015. Figure 8 demonstrates the dramatic reduction in natural gas usage starting in 2014 and continuing until 2016.

It is likely that warmer weather resulted in the majority of the reductions in natural gas use. Heating degree days can be an indicator of the effect of weather on residential heating. Heating degree days are the number of estimated days a house will require heating based on the outside temperature. There were 30% fewer heating degree days in 2016 than in 2010.[4] This corresponds to 22% less natural gas used in 2016 than 2010. It is likely that the increase in warmer weather

[2] From Solar Permits_excluding voided and expired Collected on December 13, 2016
[3] Household data from http://www.bayareacensus.ca.gov/cities/Piedmont.htm
[4] Total heating degree days in 2010 were 2,670 while in 2016 there were far fewer, only 1,846. https://www.wunderground.com/history/airport/KOAK/2015/1/1/CustomHistory.html?dayend=31&monthend=12&yearend=2015&req_city=&req_state=&req_statename=&reqdb.zip=&reqdb.magic=&reqdb.wmo=

and corresponding fewer heating degree days between 2014 and 2016 was the primary factor in Piedmont meeting its original CAP 2020 reduction target. While natural gas use was significantly lower in 2016 than in 2010, it has been increasing since 2014. Between 2014 and 2016 natural gas use has increased 10%.

Commercial Energy

1,115 Metric Tons of CO_2e
3% of 2016 total emissions
22% decrease from 2015

Piedmont's nonresidential buildings include commercial, multi-family buildings, and schools. Commercial electricity use in 2016 was 7% below the 2005-2016 electricity use average.[5] While electricity use is slowly declining, the emissions associated with electricity use is declining more significantly. Between 2015 and 2016, electricity emissions decreased by 32%. Again, this is primarily due to the increase in hydropower and other renewable sources in Pacific Gas and Electric Company's (PG&E) energy mix.

Data on actual 2016 commercial natural gas use is currently unavailable due to changes in PG&E's policy on releasing information.[6]

Solid Waste

1,175 Metric Tons of CO_2e
3% of 2016 total emissions
4% Increase from 2015

Solid waste generates methane when organic material decomposes in anaerobic landfill settings. According to Republic Services' 2016 report, Piedmont produced 2,416.9 tons of waste.[7] Over the past eight years, Piedmont has consistently diverted a majority of its waste from landfill to recycling and composting facilities. In 2016, Piedmont diverted 72.5% of its waste, slightly below 2015's all-time high of 74%.[8] As a result, the emissions associated with solid waste disposal remain low. The characterization of materials in Piedmont's waste comes from a 2008 StopWaste study.

Water & Wastewater

63 Metric Tons of CO2e
0.2% of 2016 total emissions
31% Decrease from 2015

The transportation, treatment, and delivery of potable water requires substantial energy input. While EBMUD boasts a low ratio of kilowatt-hours used per million gallons delivered, this process does generate greenhouse gas emissions. Piedmont consumed roughly 370 million gallons of water in 2016. The creation of wastewater also generates greenhouse gas emissions. While

[5] Average commercial electricity use for 2005-2016 is 4,759,499 kwh. Commercial electricity use for 2016 was 4,391,828 kwh.
[6] From Incorporated City of Piedmont Non-Residential Customer Segment Impact_Tableau file from PGE Green Communities Website
[7] From Republic Services 2016 Annual Report
[8] From Republic Services 2016 Annual Report

treating wastewater releases methane, this renewable energy can be put to good use. EBMUD has led the country in producing electricity through the anaerobic digestion of wastewater. As a result, the emissions associated with Piedmont's wastewater are minimal; they come from fugitive methane and nitrous oxide.[9] Between 2014 and 2015, there was a noticeable difference in greenhouse gas emissions due to a change in methodology. In 2014, data from an EBMUD study was utilized to estimate emissions. In 2015 and 2016, ICLEI's population-based estimate of wastewater emissions was used. This accounts for the decrease in measured emissions. However, there is also a noticeable 31% decrease in emissions between 2015 and 2016, which again is due to the increase in renewable sources in PG&E's energy mix.

Consumption Based Emissions Estimate

In 2016, the Bay Area Air Quality Management District and UC Berkeley released a consumption based greenhouse gas emissions inventory for all households in the Bay Area. The CAP 2.0 contains a section focused on Piedmont's consumption-based GHG emissions based on this inventory that presents various strategies that residents can take to lower their carbon footprint. The study used a life-cycle analysis of GHG emissions embodied in goods and services. Historically, the in-boundary GHG emissions methodology has counted emissions from activities under the City's control or within its boundaries, including a limited set of emissions that occur outside of the City (power plants and landfills). A consumption-based approach expands the scope to more comprehensively include out-of-boundary emissions that are attributable to activities of the local community. It attributes GHG emissions produced across the world to the location of the consumer of the goods and services and places accountability for emissions with the source of the demand rather than the supplier.

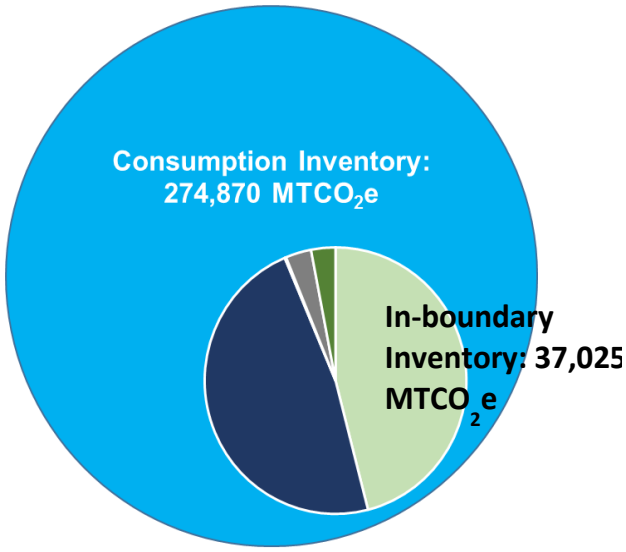

Figure 10

While Piedmont's in-boundary GHG emissions are very low, the study shows that Piedmont's rates of consumption corresponds to a significant quantity of GHGs released globally. [10] Figure 10 shows that Piedmont's total consumption-based emissions are seven times the amount

[9] Fugitive emissions are gasses that escape during processing.
http://www.ebmud.com/wastewater/recycling-water-and-energy/

[10] Data from the study available for download here: http://www.baaqmd.gov/research-and-data/emission-inventory/consumption-based-ghg-emissions-inventory

measured in a traditional, in-boundary inventory. However, the consumption inventory total in Figure 10 accounts for transportation and housing, which are already accounted for in the in-boundary inventory. However, even if we focus on the consumption sectors not already accounted for in the in-boundary inventory (food, goods, and services), the total emissions are 153,000 MT CO_2e. Food, goods, and services alone are four times the amount of Piedmont's entire in-boundary emissions. While initially disheartening, Piedmont's high consumption-based emissions serve to demonstrate the power Piedmont residents yield globally with their purchasing decisions. While both inventory types can provide useful insight, Piedmont will continue to utilize the in-boundary model because it is the standard regionally and internationally. However, there are indicators that GHG inventories in the future may include consumption emissions.

Municipal

Municipal facilities, transportation, and waste contribute 862 metric tons of CO_2e to total community emissions. These activities account for 2% of community emissions. This is a 10% reduction from 2015's municipal emissions.

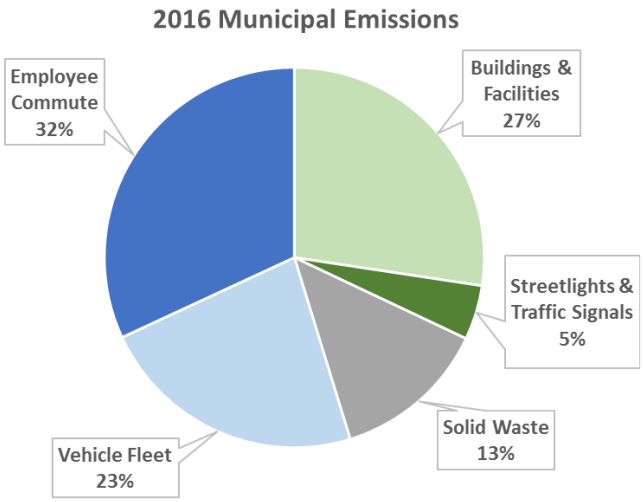

Figure 11

Energy consumption: Buildings and Lights

Municipal building emissions decreased between 2015 and 2016. In particular, emissions associated with building electricity use declined by 32% since 2015. This is mainly due to the increase in renewable sources in PG&E's energy mix. However, there was an overall increase in building emissions since 2005. The 2014, 2015, and 2016 municipal GHG inventories displayed a significant rise in building emissions. This is due to the addition of the Aquatics Center and the Piedmont Center for the Arts to the City's building portfolio. All other buildings have demonstrated substantial reductions in energy consumption from 2005. Evaluating years 2014, 2015, and 2016 provides the most accurate comparison.

Streetlight and traffic signal electricity use declined by 41% since 2014. During this time, the City has continued its efforts to convert streetlights to LEDs, which is responsible for the decrease in emission observed. These conversions to less energy intensive LED light bulbs will continue throughout the upcoming years.

Vehicle Fleet

The vehicle fleet, made up of police, fire, public works, and recreation vehicles, continued to contribute a substantial portion of the City's GHG emissions. In addition, contractor vehicles, including services by the Cleary Brothers for landscape services and Richmond Sanitary Services for waste collection, contributed to vehicle fleet emissions. Combined, these vehicles account for 23% of total municipal emissions. Emissions estimates for these departments were calculated using vehicle fuel efficiency and miles driven.

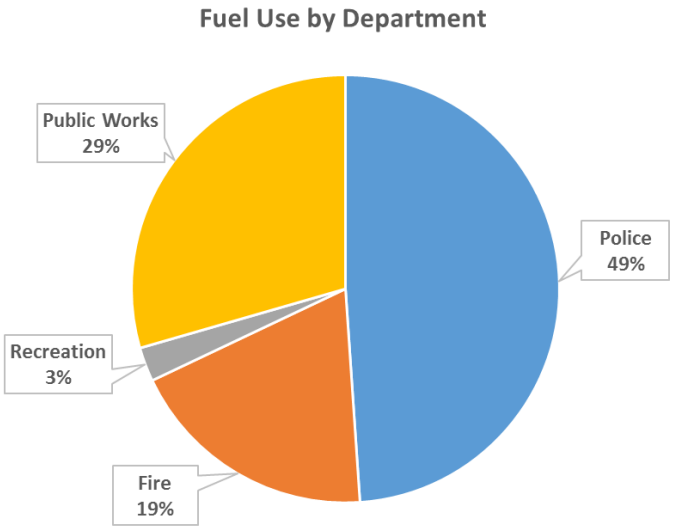

Figure 12

Employee Commute

Last year, a survey distributed to City employees gathered information on how employees transported themselves to work and how many miles were traveled. The results of this survey indicate there were approximately 275 metric tons of CO_2e generated by employees' commutes. This is equivalent to roughly a third of the entire municipal inventory.

Solid Waste Facilities

The City created an estimated 262 tons of waste in the year 2016. This is based on the size of trash receptacles and rates of pick-up. The City as a whole continued to achieve a high diversion rate of 72.5% in 2016.

Conclusion

GHG Emissions Inventories going forward

Piedmont demonstrated GHG emissions reductions of 4% in 2010, 21% in 2014, 21% in 2015, and 24% in 2016. In 2014 and 2015, these reductions were sufficient to meet the City's goal of 15% below 2005 levels by 2020. This achievement is encouraging, and while great work has been made by residents and the municipality to reduce emissions, factors outside of the City's control have also made significant contributions to its success. Namely, the bulk of emissions reductions in 2014 and 2015 were the result of decreased natural gas usage due to warm weather reducing the demand for residential heating. Although natural gas usage in 2016 is still significantly lower than

before 2014, it has been slowly increasing since 2014. Increased renewables in PG&E's energy mix also heavily contributed to the reductions achieved, particularly in the residential sector, between 2015 and 2016. With the majority of residents soon sourcing 100% renewable energy through East Bay Community Energy in late 2018, overall community emissions are expected to decrease by 10%.

Aside from the increase due to the addition of two buildings to its portfolio, municipal GHG emissions indicate improvement between 2005 and 2016, especially between 2015 and 2016. City initiatives such as energy audits, streetlight conversions to LEDs, and pool covers at the swim center and increased renewables in PG&E's energy mix have contributed to this change. Potential future municipal projects including upgrades to the aquatic center, continued LED streetlights conversions, and rooftop solar may considerably lower municipal emissions.

Overall, there appears to be a slight decrease in Piedmont's GHG emissions from 2015 to 2016. Minor reductions in emissions may be the result of changing methodology and availability of data, such as using an average for commercial natural gas usage due to changes in PG&E's privacy policy. Many external factors contributed to the difference in emissions, like PG&E's electricity mix, more stringent vehicle fuel efficiency standards, and weather. This demonstrates that without City and resident action, it is possible that our progress could plateau or even be reversed in the coming years. In fact, if a colder winter requires heating at 2005 or 2010 levels, it is likely that the City's emissions may begin to increase, bringing us further away from our 2030 emissions reduction goal. However, recent City actions, such as enrolling the community into East Bay Community Energy's 100% Renewable Energy service plan, indicate that further reductions can be expected moving forward.

Both the City and its residents should continue its successful decline in emissions while continuing to implement new strategies and policies presented in the CAP 2.0 to meet the current 2030 emissions reduction goal. This, coupled with increased residential engagement and involvement would position the community well to reach its ambitious 2050 emissions goal.

CAP 2.0 Implementation Progress

The following list provides information on the progress the City has made on certain CAP 2.0 measures. Cost estimates and estimated potential GHG reductions for these measures are also provided to help prioritize actions and provide guidance on which measures are most impactful. The potential GHG reductions are not exact measurements. Instead, they are based on current best estimates and rely on a range of assumptions. In addition to progress made on measures within the CAP 2.0, the City has also made progress on a number of actions that will support CAP 2.0 implementation. These actions include:

- Participating in the Climate Corps Fellowship Program for the upcoming 2018-2019 service year, which will expand staff capacity to implement CAP 2.0 measures
- Planning to collaborate with Piedmont Connect on producing a condensed, graphically appealing version of the CAP 2.0 for residents and on hosting community engagement events
- Continuing the City's commitment to the Compact of Mayors, which involves continued frequent GHG inventories to track the City's progress toward meeting its emissions reduction goals

Cost Delineations

The cost brackets for the Planning and Public Works departments were designed to fit within the brackets of the City's purchasing policy. A few CAP 2.0 measures rely heavily on private costs. Some private costs would be very low, like a building energy disclosure ordinance, which would cost at least $300 at the time of home sale. CAP measures that would require MED or HIGH private costs could be designed to be triggered only for large building projects. For example, if a $250,000 building project is undertaken, a CAP 2.0 measure that requires $5,000 would only add an additional 2% to the overall project cost. All CAP 2.0 measures that suggest private costs also result in private savings on energy bills. Many CAP 2.0 measures address actions the Piedmont Unified School District (PUSD) can take to contribute to CAP 2.0 implementation, and its cost brackets are delineated the same way as the Planning and Public Works Department's cost brackets.

Cost Categories	Planning	Public Works	Private	PUSD
LOW	<$5,000	<$75,000	<$500	<$5,000
MED	<$75,000	<$300,000	<$5,000	<$75,000
HIGH	>$75,000	>$300,000	>$5,000	>$75,000

Figure 1

Types of Costs

Marketing & Outreach Campaigns typically cost upwards of $75,000, a "HIGH" cost action. However, bundling together multiple CAP 2.0 measures and running one marketing campaign could reduce the *cost per measure* to "LOW" or "MED." Marketing & Outreach campaigns can be grouped by topic to focus messaging and use resources effectively. For example, an outreach campaign could address both solid waste and consumption measures.

Combined, there are about 20 measures in the solid waste and consumption sectors that require marketing and outreach, which would reduce the cost per measure to $5,000 within a $100,000 campaign.

Staff Time costs include hiring a staff member dedicated to sustainability. This would be a "HIGH" cost action, but it is assumed that such expenditures could contribute to multiple measures, resulting in "LOW" cost estimates per action. Currently, the City of Piedmont participates in the Local Government Commission's CivicSpark program, which provides a full-time sustainability AmeriCorps fellow to Piedmont for $5,000 per year.

Incentive programs, administered through the Planning Department, are highly flexible and can be adjusted depending on funds available. For example, providing a small incentive for local businesses to improve energy efficiency may be a very low cost measure. In contrast, capital improvement project costs vary greatly. Installing bike racks would be "LOW" cost, but large complete street projects could be considered "HIGH" cost. For each measure, there is also a brief description of the kind of cost, such as staff time, incentives, and marketing. Figure 5.2 shows cost breakdowns by responsible party.

Infrastructure projects are typically far more expensive than any other kind of CAP 2.0 implementation, with a few exceptions. However, including CAP 2.0 infrastructure projects in larger City initiatives could minimize the cost of CAP 2.0 implementation. Note that infrastructure project costs would likely fall to the Public Works Department, rather than the Planning Department.

Private costs would be incurred by residents or businesses, and would be little to no cost for the City. Only a few CAP 2.0 measures rely on substantial private costs.

	Measures and actions by sector	2030 GHG Reduction Potential (MTCO2e)	Kind of Cost	Lead Actor	Cost	Status/Priority
	Buildings and Energy					
	Objective: Reduce Residential Building Energy Use					
BE-1.1	**Measure: Disclose building energy consumption**	304				
	Develop a single-family and/or multi-family residential unit energy assessment ordinance requiring disclosure at the time of sale, major remodel, rental, or other trigger point		Staff Time, Private	Residents	LOW	Mid-term
	Partner with home energy audit providers to develop public outreach and community engagement programs on residential energy assessment opportunities and energy efficiency retrofits, with a focus on post audit follow-through		Marketing & Outreach	Planning	LOW	Ongoing, meeting with Piedmont Connect to work on marketing strategy
	Increase knowledge of and encourage residents to use PGE's "My Energy" online tool to compare and understand energy and natural gas use		Marketing & Outreach	Planning	LOW	Ongoing, a hyperlink to the My Energy online tool is provided on the Climate Action Program webpage of the City's website.
BE-1.2	**Measure: Reduce electricity and natural gas consumption**	1602				
	Encourage utilities' to develop and implement demand-side management programs		Staff Time	Planning	LOW	
	Promote and incentivize residential energy conservation and efficiency retrofits (i.e. insulation, energy-efficient windows, etc.) for existing buildings through competitions, case studies, rebates, and educational/community engagement events on statewide code changes, financing options, and the benefits of GHG reduction methods.		Marketing & Outreach, Incentive	Planning	MED-HIGH	Ongoing, looking into ways to create an interactive online tool to enhance and incentivize local action for residential energy conservation and retrofits. Also, coordinating with StopWaste and Piedmont connect to find best ways to market programs.
	At point of replacement, consider requiring the installation of energy conserving appliances and fixtures, such as on-demand tank-less water heaters, Energy Star appliances, and LED lightbulbs		Staff Time, Private	Residents	LOW-HIGH	
	Investigate developing an online, GHG reduction tracking platform for Piedmont residents to track their actions that may affect their carbon footprint and to participate in community-wide GHG reduction challenges		Staff Time	Planning	LOW	Ongoing, looking into ways to incorporate this online platform within the City of Piedmont's new website, which will be launching late 2018.
	Provide case studies/awards/highlights for property owners who set good sustainability examples (i.e. solar, LEED, drought-tolerant landscape, etc.)		None	Planning	LOW	
BE-1.3	**Measure: Switch from natural gas to electric appliances, paired with renewable energy**	14083				

	Educate residents on the options and incentives for electric appliances, such as furnaces, water heaters, dryers, stoves, and more, as well the importance of pairing electrification with the installation of renewable energy		Marketing & Outreach	Planning	LOW	
	Consider requiring electric appliances for new construction		Staff Time, Private	Residents	MED	
	Provide incentives to convert existing residences from natural gas to electric appliances		Incentive	Planning	MED	
	Transportation					
	Objective: Increase number of trips made by biking and walking					
T-1.1	Measure: Encourage walking and biking safety					
	Install sidewalk railings on the Oakland Avenue bridge*		Infrastructure	Public Works	LOW	Ongoing, the City has secured funding through the Alameda County Transportation Commission and is currently in the design phase of the project. Project estimated to be completed fall 2018.
	Enhance street crossing safety through crosswalks, flashing pedestrian lights, and signage*		Infrastructure	Public Works	MED-HIGH	
	Provide safety education led by the Police or Public Works Department (traffic safety messages on city buildings and online)		Staff Time	Public Works	LOW	
	Consider transitioning streets to one-way traffic to add bike lanes in residential areas		Infrastructure	Public Works	MED-HIGH	
	Implement traffic calming measures*		Infrastructure	Public Works		
T-1.2	Measure: Provide access to bicycles and bicycle paths	1340				
	Pursue the installation of a Bay Area Bike Share station in the Grand Ave commercial district*		Staff Time	Planning		Ongoing, staff is actively searching for grants and other funding opportunities
	Enhance bike infrastructure along bikeway network designated in Piedmont's Pedestrian and Bicycle Master Plan (PBMP)*		Infrastructure	Public Works	HIGH	
	Install additional bike parking racks at key destinations		Infrastructure	Public Works	LOW	Ongoing, staff is actively searching for grants and other funding opportunities

	Implement Highland road diet (restripe the lanes to have one car and one bike lane in each direction)*		Infrastructure	Public Works	LOW	
	Coordinate with Oakland on the planning, design and funding of inter-city bikeways, particularly on Grand, Moraga and Wildwood Avenues and on Park Boulevard and the creation of a map that shows these networks*		Staff Time	Planning	LOW	
	Introduce traffic signal controls that prioritize bicycles		Infrastructure	Public Works	LOW	
	Provide bicycle parking at city sponsored events		Infrastructure	Public Works	LOW	Ongoing, staff is actively searching for grants and other funding opportunities
	Implement physical bike protection, separation, or warning infrastructure like Botts' dots, 5in concrete dome curb extensions, or pop ups		Infrastructure	Public Works	LOW	
	Facilitate Bike to Work Day and other bike promotion and educational/community engagement events		Staff Time	Planning	LOW	
	Objective: Support the adoption of ZEVs and the growth of EV charging stations					
T-4.1	**Measure: Support the growth of EV charging infrastructure**	5181				
	Install EV chargers in the Civic Center area, Grand Avenue commercial zone, and other commonly traveled locations in Piedmont		Infrastructure	Public Works	LOW	Ongoing, City staff has been identifying potential locations for EV chargers and possible funding opportunities
	Develop an ordinance to require EV charger pre-wiring in any garage remodel		Staff Time, Private	Residents	HIGH	
	Require pre-wiring for EV charging in new construction		Staff Time, Private	Residents	HIGH	
	Municipal					
	Objective: Reduce emissions from City buildings and energy supply					
M-2.1	**Measure: Reduce energy use in city buildings**					
	When remodeling or repairing City buildings, include opportunities for energy efficiency retrofits or green building certification		Infrastructure	Public Works	MED	Ongoing, the City has a Civic Green Building Ordinance that resides in chapter 5 of the Piedmont Municipal Code.
	Construct new City buildings to ZNE and green building certification standards		Infrastructure	Public Works	MED	
	Increase the energy efficiency of lighting and appliances in City buildings as opportunities arise		Infrastructure	Public Works	LOW	Ongoing, the City has already converted all cobra head streetlights to LEDs and will soon be converting the remaining decorative post top streetlights to LEDs.
	Switch from natural gas to electric appliances once the electricity supply nears 100% and the technology becomes affordable		Staff Time	Public Works	TBD	
	Investigate strategies for reducing energy use at the City aquatic facilities		Staff Time	Public Works	TBD	Ongoing, however, staff is waiting to until planned renovations at the community pool take place

M-2.3	Measure: Increase the amount of renewable energy on-site and through the grid					
	Evaluate the potential for and install cost-effective renewable energy systems on City Properties		Staff Time	Planning		Ongoing, the City is in the process of finding a contractor to install a rooftop solar system at the Corporation Yard.
	Commit to 100% renewable energy through EBCE.			Public Works	LOW	Completed, on June 4, 2018 City Council voted to enroll all municipal electricity accounts in East Bay Community Energy's 100% Renewable Energy service plan.
M-2.4	Measure: Reduce emissions from high global warming potential gases					
	Enforce the ban on petroleum powered leaf blowers and maintenance equipment		No additional cost	Public Works	LOW	Ongoing, the City and its contractors have switched to electric equipment, making it easier for the Police Department to enforce the ban.
	Replace high GWP refrigerant air conditioners and dispose of them properly		Infrastructure	Public Works	LOW	