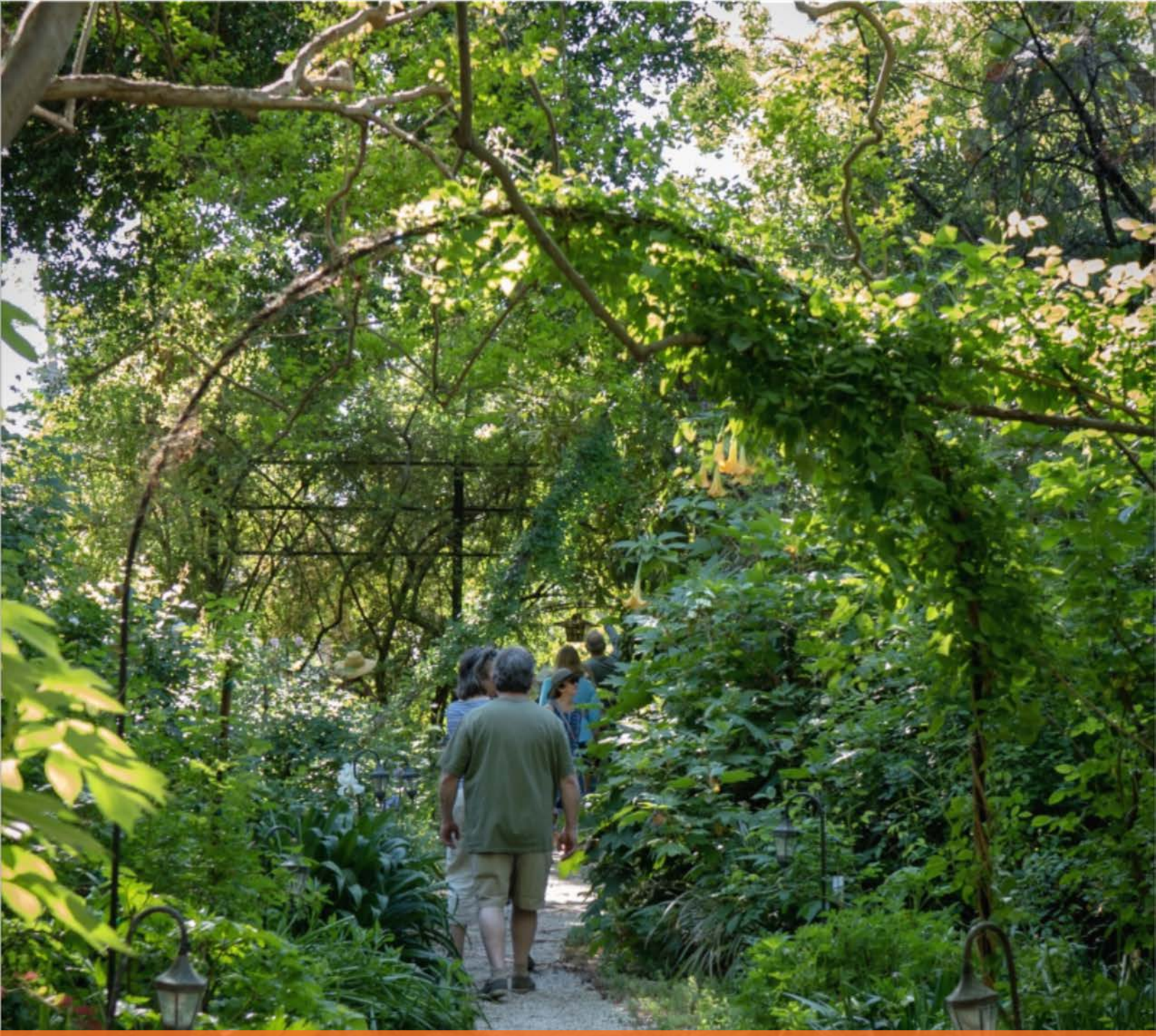

South Pasadena 2020 Draft Climate Action Plan

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South Pasadena 2020 Draft Climate Action Plan

Adopted by City Council:
Date TBD

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Acknowledgements

This Climate Action Plan was a coordinated effort between:

- ✓ South Pasadena Community Members
- ✓ South Pasadena Natural Resource and Environmental Commission (NREC)
- ✓ South Pasadena City Staff
- ✓ Southern California Association of Governments (SCAG)
- ✓ Rincon Consultants, Inc., Iteris, Inc., and BAE Urban Economics

Thank you for participating! We appreciate your feedback, insight, and passion – South Pasadena's Climate Action Plan is better because of you!

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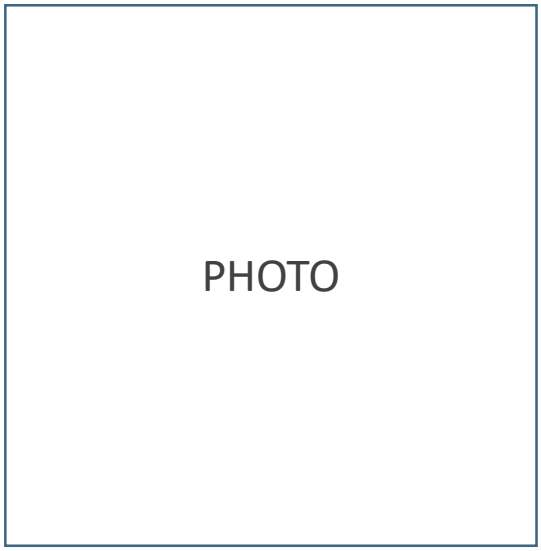
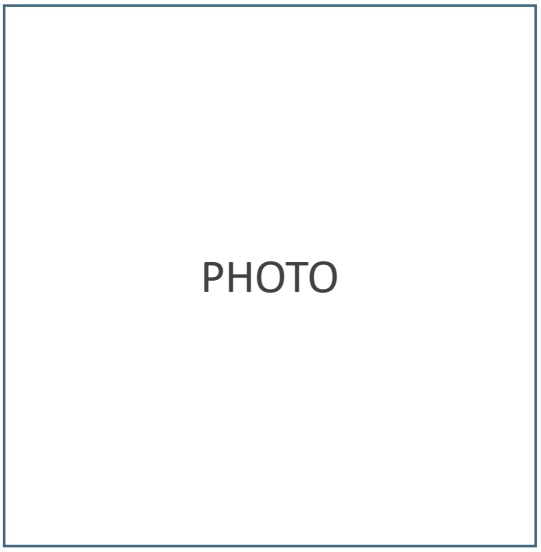
Message from City Council



Message from City Manager



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Appendix B – Technical Appendix: Cal-Adapt
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Appendix D –Technical Appendix: Substantial Evidence
Appendix E – Funding Strategy
Appendix F – CEQA Document

Glossary

Term	Definition
Adaptation	Adjustment or preparation of natural or human systems to a new or changing environment which moderates harm or exploits beneficial opportunities.
Anthropogenic	Made by people or resulting from human activities; usually used in the context of emissions that are produced as a result of human activities
CAP	Climate Action Plan – comprehensive roadmap that outlines the specific activities that an agency will undertake to reduce greenhouse gas emissions
CARB	California Air Resources Board – the lead agency for climate change programs and oversees all air pollution control efforts in California to attain and maintain health-based air quality standards
Carbon-neutrality	Achieving net-zero carbon dioxide (CO_2) emissions by balancing carbon emissions with carbon removal
Carbon Dioxide (CO_2)	A naturally occurring gas and a by-product of burning fossil fuels and biomass, as well as land-use changes and other industrial processes.
Carbon Dioxide Equivalent (CO_2e)	A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP)
Climate	The average of weather patterns over a long period of time (usually 30 or more years)
Climate Change	a change in the average conditions — such as temperature and rainfall — in a region over a long period of time
Co-Benefit	The benefits of policies that are implemented for various reasons at the same time including climate change mitigation acknowledging that most policies designed to address greenhouse gas mitigation also have other, often at least equally important, rationales (e.g., related to objectives of development, sustainability, and equity)
COVID-19	Coronavirus disease 2019 – a novel disease that was first identified in 2019 and spread throughout the rest of the world in 2020, leading to an economic shutdown in many countries.
Emissions	The release of a substance (usually a gas when referring to the subject of climate change) into the atmosphere
Environmental Justice	The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies
EV	Electric Vehicle – a vehicle that uses one or more electric motors or traction motors for propulsion
Fossil Fuel	A general term for fuel formed from decayed plants and animals that have been converted to crude oil, coal, natural gas, or heavy oils by exposure to heat and pressure in the Earth's crust
GHG	Greenhouse Gas – a gas that absorbs infrared radiation, traps heat in the atmosphere, and contributes to the greenhouse effect

Greenhouse Effect	A process that occurs when gases in Earth's atmosphere trap the Sun's heat
GWP	Global Warming Potential - total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1
ICLEI	International Council for Local Environmental Initiatives – emissions estimates were calculated using ICLEI's best available methodologies
IPCC	United Nations Intergovernmental Panel on Climate Change – prepares comprehensive Assessment Reports about the state of scientific, technical and socio-economic knowledge on climate change, its impacts and future risks, and options for reducing the rate at which climate change is taking place
Methane (CH_4)	A hydrocarbon that is a greenhouse gas that is produced through anaerobic (without oxygen) decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion
Mitigation	An action that will reduce or prevent greenhouse gas emissions, such as electrifying
MT	Metric Ton – Common international measurement for the quantity of greenhouse gas emissions – one metric ton is equal to 2205 pounds or 1.1 short tons
MT CO_2e	Metric tons of carbon dioxide equivalent
Nitrous Oxide (N_2O)	A powerful GHG with a high global warming potential; major sources of nitrous oxide include soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning.
PV	Photovoltaic (Solar energy)
Qualified GHG Reduction Plan	A Plan that accommodates growth in a manner that does not hinder the state's ability to reach further emission reduction goals.
RCP	Representative Concentration Pathway – Greenhouse gas concentration trajectory scenarios adopted by the IPCC.
RTP/SCS	Regional Transportation Plan/Sustainable Communities Strategy – a Plan adopted by SCAG to promote mobility, accessibility, sustainability, and a high-quality of life
SCAG	Southern California Association of Governments – designated Metropolitan Planning Organization (MPO) for the counties of Los Angeles, Riverside, San Bernardino, Ventura, Orange, and Imperial, pursuant to Title 23, United States Code Section 134(d) – the funding entity of this Climate Action Plan
Social Equity	All people having equal access to and influence on the resources and benefits of society
U.S. EPA	United States Environmental Protection Agency - the mission of the U.S. EPA is to protect human health and the environment
VMT	Vehicle Miles Traveled
Weather	The state of the atmosphere over a short period of time (usually an hour or day), describing if it is hot or cold, wet or dry, calm or stormy, clear or cloudy, etc.
ZEV	Zero Emission Vehicle – a vehicle that never emits exhaust gas from the onboard source of power

Carbon-neutrality

Achieving net-zero carbon dioxide (CO_2) emissions by balancing carbon emissions with carbon removal.

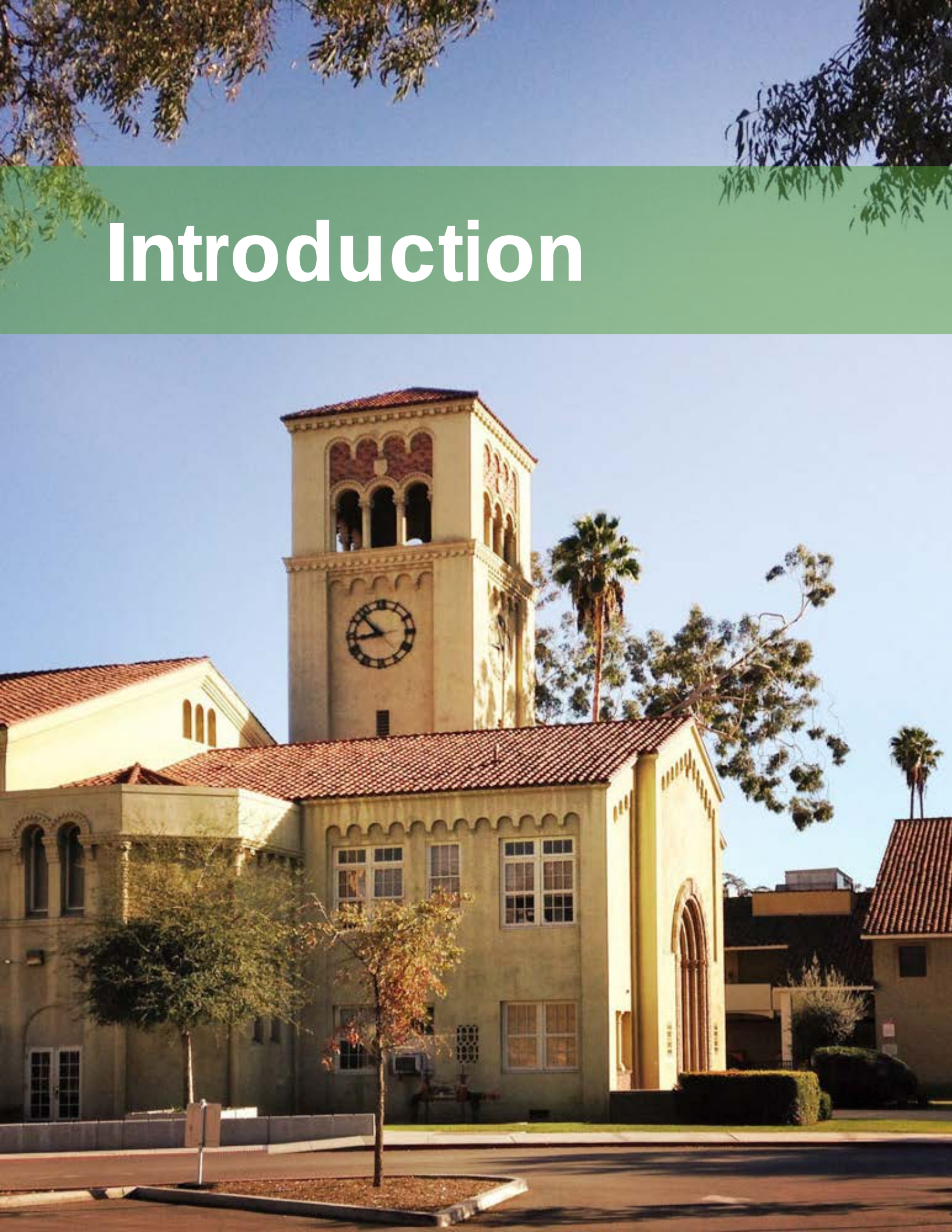
Social Equity

All people having equal access to and influence on the resources and benefits of society.

Qualified GHG Reduction Plan

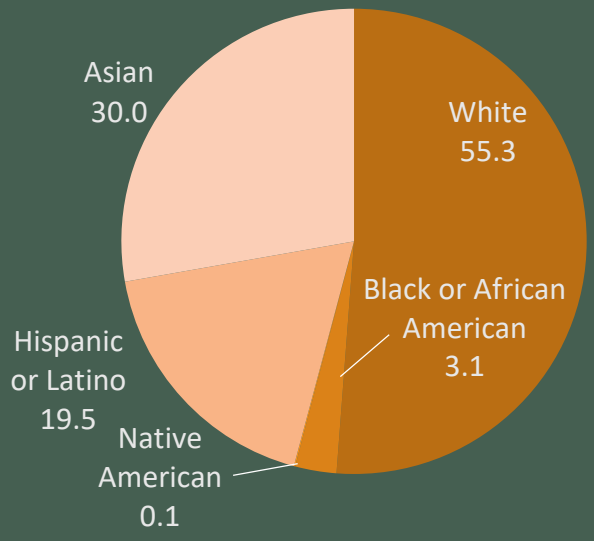
A Plan that accommodates growth in a manner that does not hinder the state's ability to reach.

Introduction



Who are we?

Race and Origin
Percent of Population



3.44 square miles of Flatlands and Hillsides

2019 Population:
25,329

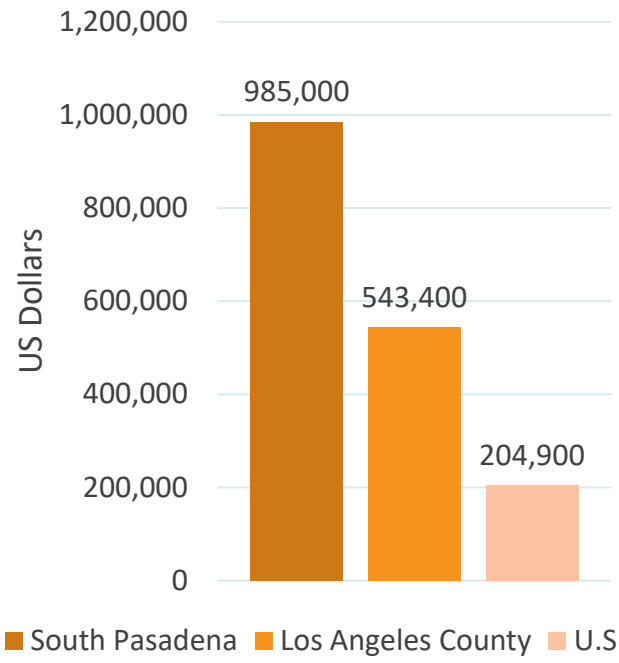
Population per square-mile:
7,524

Tree City USA
21,000
trees

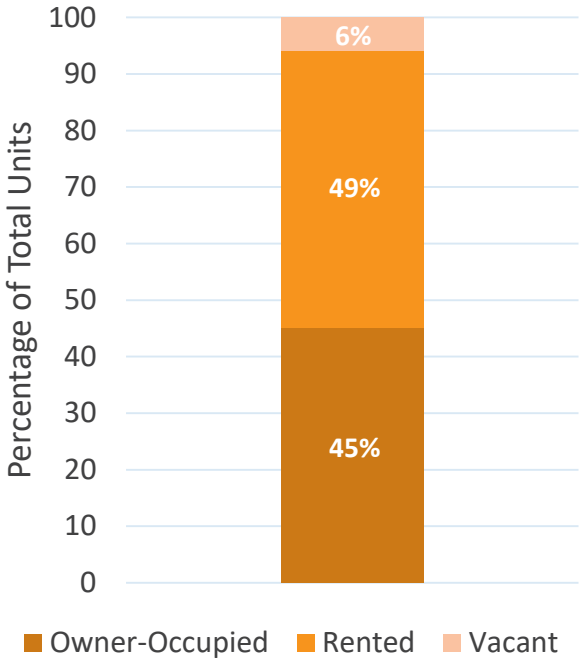
Age of Population

Persons under 5 years	Persons over 65 years
5.3%	13.9%

Median Housing Value



City Housing Statistics



Sources: United States Census Bureau, 2019 and City of South Pasadena *"About Us"* webpage: https://www.southpasadenaca.gov/visitors/about-us

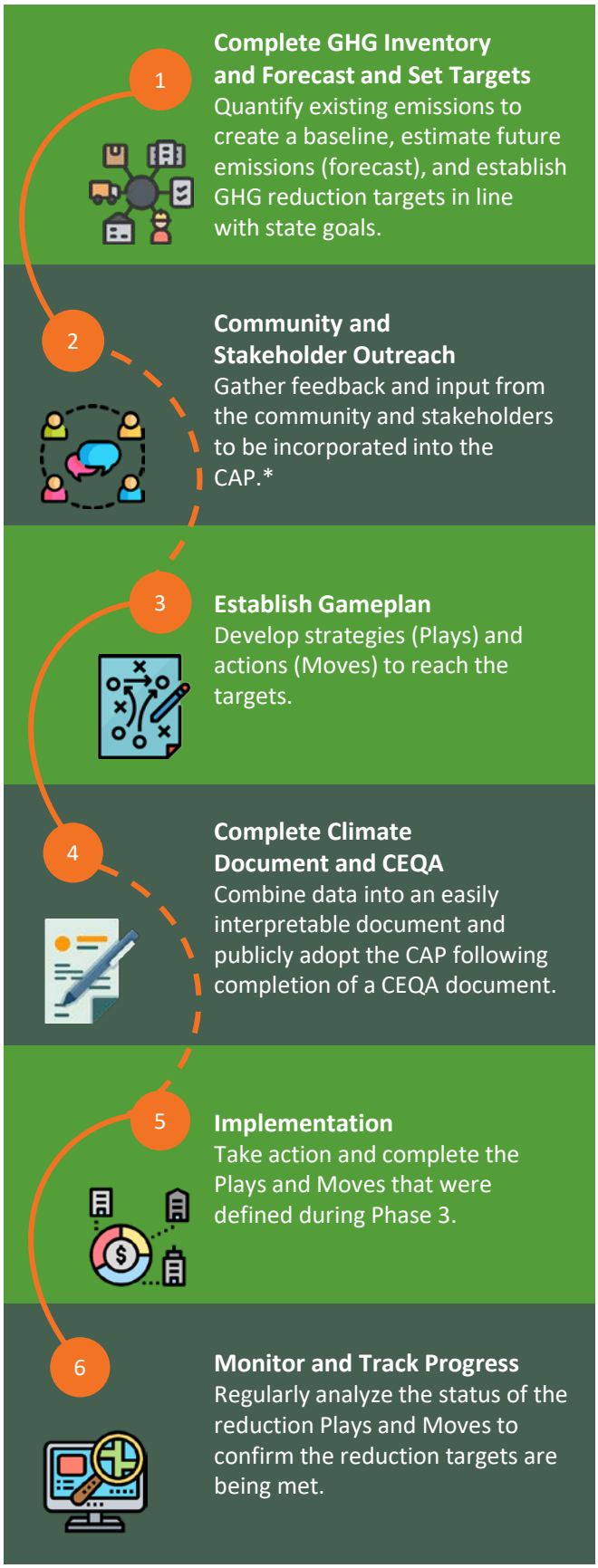
Climate Action Vision

The effects of climate change are already felt on the local level and are projected to worsen over the next century without a concerted global effort to address the sources of greenhouse gas (GHG) emissions. This Climate Action Plan (CAP) details a set of strategies for South Pasadena to reduce its emissions, prepare for and mitigate approaching risks, and chart the course towards a sustainable future. Key components of that future include:

- ✓ **Vibrant Communities** – Healthy neighborhoods and ecosystems with cleaner air, safer streets, increased mobility options, and more adaptive and resilient systems
- ✓ **Engaged Citizens** – Communities that are aware of and interested in the potential environmental, social, and economic impacts of climate change and that seek various solutions surrounding climate change through inspiring educational and outreach programs
- ✓ **Social Equity** – Protecting those most vulnerable against the impacts of climate change and improving the quality of life for all members of the community by working towards a shared and collaborative civic identity

Playing at the Park

Figure 1 Qualified GHG Reduction Plan Elements



* Outreach is ongoing throughout the climate action planning process

- ✓ **Resilient Economy** – Powered by clean and renewable energy sources, making it more resilient to unpredictable climate emergencies, providing more efficient and affordable utilities, creating clean energy jobs, and promoting resource conservation
- ✓ **Environmental Stewardship** – Responsible use and protection of South Pasadena's natural and cultural resources, encouraging active and meaningful enjoyment by present and future generations of residents
- ✓ **Regional Leadership in Sustainability** – Encouraging effective collaboration throughout the community to promote collective change and become an example of successful climate action planning in the Los Angeles region

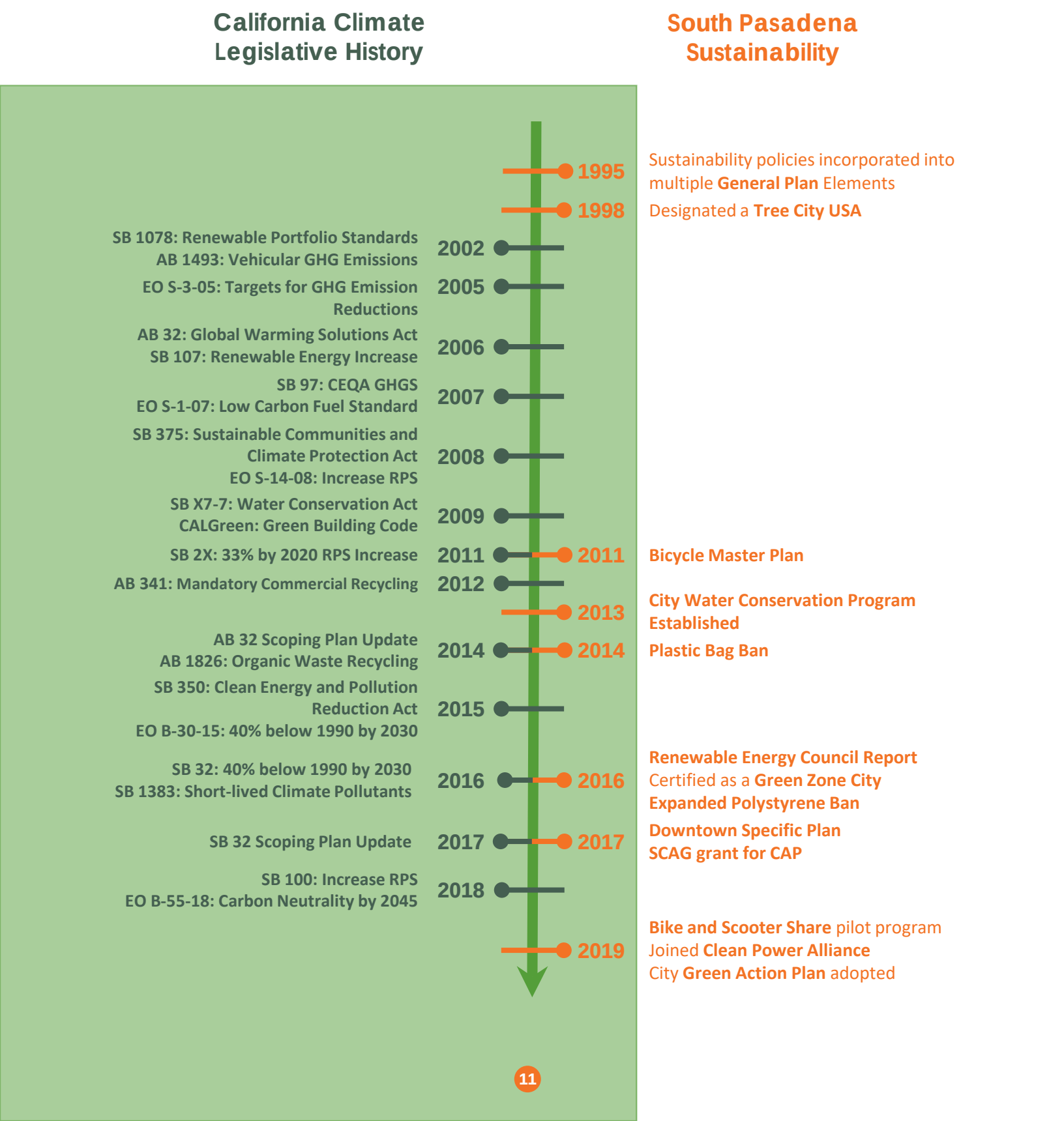
Background

South Pasadena committed to tackling climate change in 2017 by securing grant funding from the Southern California Association of Governments (SCAG) to adopt a CAP. In 2019, the City renewed its commitment to sustainability by unanimously adopting the South Pasadena Green Action Plan (Green Plan).[1] The goals of the Green Plan are to: move towards being a plastic-free city; enhance water conservation efforts; increase organics diversion from landfill; mitigate urban heat island impacts; and prepare for future sustainability initiatives. The Green Plan's short-term initiatives served as a stepping-stone in setting the future targets and initiatives presented in this long-term CAP.

The CAP is a long-range planning document that guides the City towards long-term emissions reductions in accordance with State of California targets. The CAP analyzes emission sources within the City, forecasts future emissions, and establishes emission reduction targets (See *The Playing Field* and the Appendix C). This CAP is the City of South Pasadena's roadmap to achieving the City's 2030 target and state mandated goal of 40% below 1990 levels by 2030 and demonstrates substantial progress towards achieving carbon neutrality by 2045.The CAP also establishes a framework for implementation and monitoring of reduction activities, and further promotes adaptation and preparedness actions. The plan is intended to be a qualified GHG Reduction Plan and meets the requirements of CEQA 15183.5(b), see Figure 1.

1. https://www.southpasadenaca.gov/government/departments/public-works/environmental-programs/sustainable-south-pasadena/south-pasadena-green-action-plan

Figure 2 Leading Climate Action



COVID-19 and Climate Action

The COVID-19 pandemic has disrupted our daily lives and both the local and national economies, bringing the intersection of climate change and public health to the public eye. The pandemic has also shone a light on how disasters disproportionately affect already-vulnerable communities. Disadvantaged communities, already suffering from exposure to higher levels of toxic air pollution, are more vulnerable to respiratory disease and are dying at disproportionately higher rates from the pandemic. Similarly, the economic shutdown has destabilized everyone; but, small business owners and "income-insecure workers" are among those least able to draw on financial reserves and wait for economic recovery. At the same time, global response to the pandemic has shown that an extreme reaction to disasters of this magnitude is both possible and necessary. We can and should strive for a future with cleaner air, safe homes and public spaces, secure jobs, and reliable access to resources. Planning for resilience, particularly at the local level, should include a focus on addressing environmental justice and climate equity. The CAP outlines how South Pasadena can work towards this future.

Purpose

This CAP will guide the City of South Pasadena towards reducing GHG emissions consistent with the targets set out by Assembly Bill (AB) 32 and Senate Bill (SB) 32, as well as fulfill the requirements of the California Environmental Quality Act (CEQA) Guidelines § 15183.5(b). California AB 32 established a statewide target to reduce GHG emissions to 1990 levels by 2020 and SB 32 established a statewide target to reduce GHG emissions to 40 percent below 1990 levels by 2030. Please see Figure 2 and Appendix A, *Regulatory Summary,* for a written description and a timeline of the regulations related to climate action planning.[2]

2. Please see the Regulatory Summary Appendix (Appendix A) for a full summary on the regulatory background that drives the climate action planning process.

The CAP and its accompanying environmental documentation are consistent with the criteria set forth in CEQA Guidelines Section 15183.5(b) as outlined below:

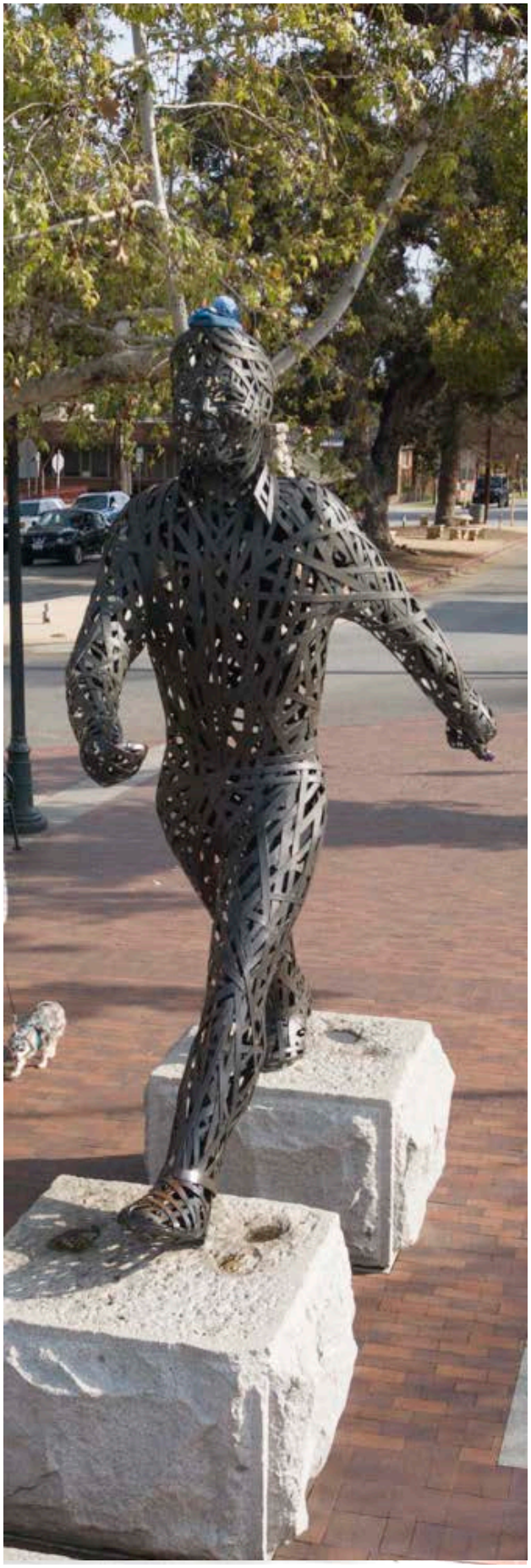
A. Quantify greenhouse gas emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area (See *Playing Field*);
B. Establish a level, based on substantial evidence, below which the contribution to greenhouse gas emissions from activities covered by the plan would not be cumulatively considerable (See *Playing Field*);
C. Identify and analyze the greenhouse gas emissions resulting from specific actions or categories of actions anticipated within the geographic area (See *Playing Field*);
D. Specify measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level (See *Plays and Moves*);
E. Establish a mechanism to monitor the plan's progress toward achieving the level and to require amendment if the plan is not achieving specified levels (See *Implementation*);
F. Be adopted in a public process following environmental review (See Appendix F).

If projects are consistent with the CAP, CEQA analysis can be streamlined by presuming that the project's GHG emissions are not significant.[3]

Greenhouse Gas Emission Background

Most of the energy that affects Earth's climate comes from the sun. When solar radiation reaches the Earth's atmosphere, some of it is reflected back into space and a small portion is absorbed by Earth's surface. As Earth absorbs the solar radiation, its surface gains heat and then re-radiates it back into the atmosphere. Some of this heat gets trapped by gases in the atmosphere, causing Earth to stay warm enough to sustain life.

3. https://opr.ca.gov/docs/OPR_C8_final.pdf



This is known as the "greenhouse effect" and the gases trapping the heat are known as "greenhouse gases"[4] (see Figure 3).

The greenhouse effect is integral to sustaining life on Earth. However, human activities emit GHGs in excess of natural ambient concentrations, thereby contributing to the enhancement of the natural greenhouse effect. This enhanced greenhouse effect contributes to global warming, an accelerated rate of warming of Earth's average surface temperature. More specifically, by burning fossil fuels to power homes, businesses, and automobiles, we increase the amount of GHGs emitted into the atmosphere,[5] which, in turn, leads to increased absorption of infrared radiation by the Earth's atmosphere and increasing temperatures near the surface.

Types of Greenhouse Gases

Greenhouse gases listed by the United Nations Intergovernmental Panel on Climate Change (IPCC) include: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), as well as chlorofluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, which are collectively called fluorinated gases.[6] Ninety-seven percent of the annual GHG emissions generated in the United States consist of CO_2, CH_4, and N_2O,[7] while fluorinated gases[8] result in the remaining three percent of emissions. Because CO_2, CH_4, and N_2O comprise a large majority of GHG emissions at the community level, these are the gases considered in this analysis.

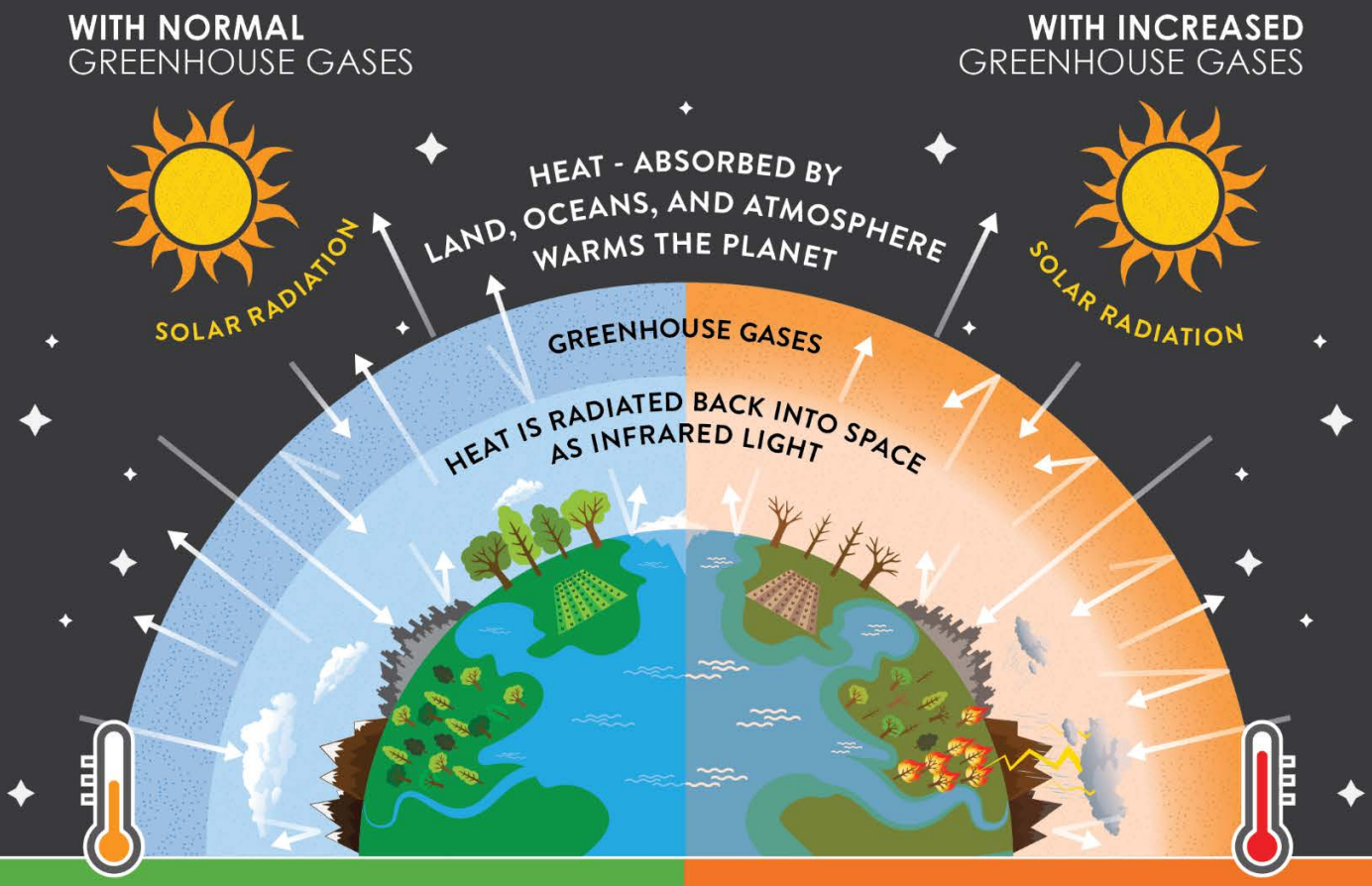
Each of these gases has its own global warming potential (GWP), or extent to which it traps energy in the atmosphere, ranging from a decade to several thousand years. CO_2 is used as the reference point to compare the potential impact of different GHGs, therefore CO_2 has a GWP of 1. Methane has a GWP of 28, meaning that each metric ton (MT) of methane causes 28 times more warming than 1 MT of CO_2. Nitrous oxide has a GWP of 265 or 265 times the GWP of 1 MT of CO_2.[9]

4. https://scied.ucar.edu/longcontent/greenhouse-effect
5. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions
6. https://www.c2es.org/content/main-greenhouse-gases/
7. https://www.wri.org/blog/2020/02/greenhouse-gas-emissions-by-country-sector
8. Fluorinated gases, which includes four main types: hydrofluorocarbons 8. (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6) and nitrogen trifluoride (NF_3), are man-made gases that can stay in the atmosphere for centuries and contribute to the GHG effect.
9. https://www.ipcc.ch/assessment-report/ar5/

Figure 3 Greenhouse Gas Effect

In the last century, human activities such as burning fossil fuels and deforestation have caused a jump in the concentration of greenhouse gases in the atmosphere.

THE RESULT: Extra trapped heat and higher global temperatures.



Some heat continues into space while the rest, trapped by greenhouse gases, help maintain the planet's relatively comfortable temperatures.

LESS GAS =
LESS HEAT TRAPPED IN THE ATMOSPHERE

Retaining more reliable:

- Weather
- Rainfall
- Temperature
- Sea Level

Increased greenhouse gases means less heat escapes to space. Between preindustrial times and now, the earth's average temperature has risen by 1.8°F (1.0°C).

MORE GAS =
MORE HEAT TRAPPED IN THE ATMOSPHERE

More intense:

- Storms
- Drought
- Heat
- Sea Level Rise

When all GHG's are normalized based on their GWP's they are referred to as carbon dioxide equivalents or CO_2e.

Sources of Greenhouse Gas Emissions

The combustion of fossil fuels (such as natural gas and gasoline), the decomposition of waste, and industrial processes are the primary sources of GHG emissions. With the accelerated increase in fossil fuel combustion and deforestation since the Industrial Revolution of the 19th century, concentrations of GHG emissions in the atmosphere have increased exponentially. The United States Environmental Protection Agency (U.S. EPA) tracks the country-wide emissions and publishes an annual report: *Inventory of U.S Greenhouse Gas Emissions and Sinks.* [10]

According to the U.S. EPA, gross GHG emissions nationwide have increased by 1.3 percent since 1990. Annual flux of GHG emissions can be attributed to changes in the economy, the price of fuel, and land-use change. For example, in 2017, nationwide GHG emissions decreased compared to 2016 levels, but rose again in 2018 by 3.1 percent . The fluctuation in CO_2 emissions from fossil fuel combustion was a result of multiple factors: although there continues to be a shift from coal to natural gas and increased use of renewables in the electric power sector, more extreme weather (colder winter, hotter summer) led to increased overall electricity use.

Climate Impacts

Anthropogenic (human) caused climate change is well-understood and widely accepted by the scientific community, with over 97 percent of climate scientists agreeing that the planet is warming and human activities are the root cause.[11] Essentially, climate change is the addition of excess GHGs to the atmosphere which traps energy (heat) and causes changes to temperature, wind patterns, and precipitation. Because of human activities, these GHGs are now higher than they have been in the past 400,000 years, raising carbon dioxide levels from 280 parts per million to 410 parts per million in the last 150 years.[12] Although many changes to climate are governed by natural processes, human activities have contributed an increasing amount of GHGs to the atmosphere at a rate that is unprecedented in Earth's history.

Effects of Climate Change

Globally, climate change is already linked to several changes which will impact biological life forms. Scientists have measured shrinking ice sheets, warming oceans, increasing global temperatures, less snow cover, sea level rise, and species extinction. Consequently, climate change has the potential to result in flooding of low-lying areas (due to sea level rise), reduction of fresh-water supply (due to rainfall and snowfall changes), adverse changes to biological resources and public health (due to increased temperature, less-productive habitats, and expansion of disease vectors), as well as many other adverse environmental consequences. [13]

Globally, a warming trend is abundantly clear, with all the top five hottest years on record happening during the past five years.[14] Additionally, the 20 hottest years on record have all occurred since 1998.[15] Climate change is a global phenomenon that has the potential to impact local health, natural resources, infrastructure, emergency response, tourism, and many other facets of society. The direct impacts projected for the City of South Pasadena include increased temperatures and potential changes in precipitation patterns.

Climate Change in the City of South Pasadena

In the City of South Pasadena, the most pronounced effects of climate change will be increased average temperature, more days of extreme heat, and elevated drought risk. Air quality impacts from fires may also continue to be an issue. The projections in Figures 4 and 5 were taken from Cal-Adapt, an interactive platform that allows users to explore how climate change might affect California at the local level under different emissions scenarios and climate models. See Appendix B for more information on Cal-Adapt.

10. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks
11. https://climate.nasa.gov/scientific-consensus/
12. https://www.ametsoc.org/ams/index.cfm/publications/bulletin-of-the-american-meteorological-society-bams/state-of-the-climate/
13. https://www.ipcc.ch/sr15/chapter/chapter-3/
14. https://climate.nasa.gov/evidence/
15. https://www.ncdc.noaa.gov/cag/

The emissions scenario used in this analysis is Representative Concentration Pathway (RCP) 8.5, also known as the high emissions scenario, which is intended to project business-as-usual continuation of current emissions. A range of climate models exist to cover the variability of physical processes, leading to warm/dry simulations and cool/wet simulations. Best practices for conservative planning indicates that an average of all models gives the most representative value. See Appendix B for further information on RCPs and climate models used.

Average maximum temperatures in the City of South Pasadena are expected to rise between 6.5°F and 11.5°F from 2005 to 2100, depending on the emissions scenario.[16] Figure 4 shows observed and projected annual average maximum temperatures in South Pasadena. South Pasadena is also projected to experience more extreme heat conditions. The annual number of heat waves, defined as four or more days over 100.6°F, is projected to increase from an average of 0.2 between 1975 and 2005 to an average of 4.9 between 2070 and 2099, based on the high emissions scenario. Additionally, the annual number of extreme heat days, with temperatures greater than 100.6°F, is projected to increase from 7 in 2005 to approximately 14 by the end of the century. This combination will result in longer heat waves. From 1950 to 2005, the observed duration of heat waves was on average 2.4 days. By the end of the century the business as usual emissions scenario projects the longest heat wave to last about 11 days.

In addition, the timing of extreme heat days is expected to change. In 1990, the only extreme heat days were in June through September; however, by 2099, the earliest day of extreme heat is expected to occur in mid-April with the latest day of extreme heat occurring in the beginning of November, under the high emissions scenario. This would extend the period of extreme heat days by approximately three months.

The Cal-Adapt projections show little change in total annual precipitation in South Pasadena with no clear or consistent trend during the next century, as illustrated in Figure 5. However, even small changes in precipitation can lead to significant impacts such as altered water availability throughout the year, decreased agricultural output in the region, and altered seasonal patterns which could cause increased droughts and/or flooding.

16. https://cal-adapt.org/tools/annual-averages/

Figure 4 Annual average maximum temperature for South Pasadena (Grid Cell 34.09375, -118.15625) under RCP 8.5 (emissions continue to rise strongly through 2050 and plateau around 2100

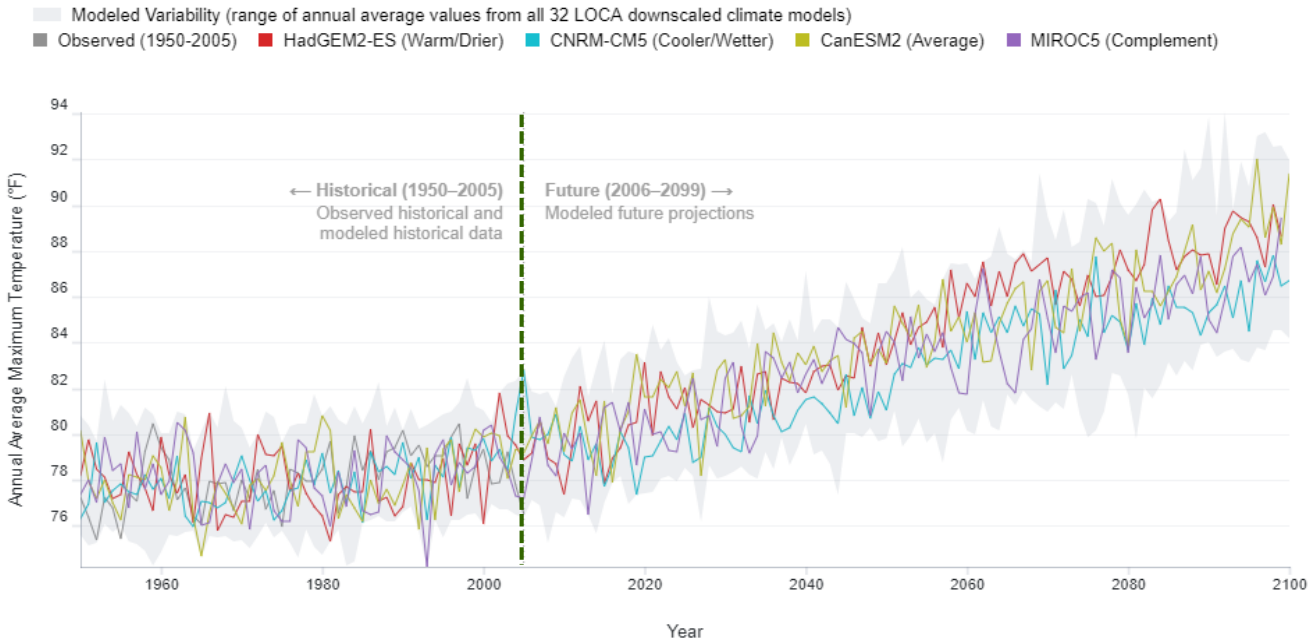
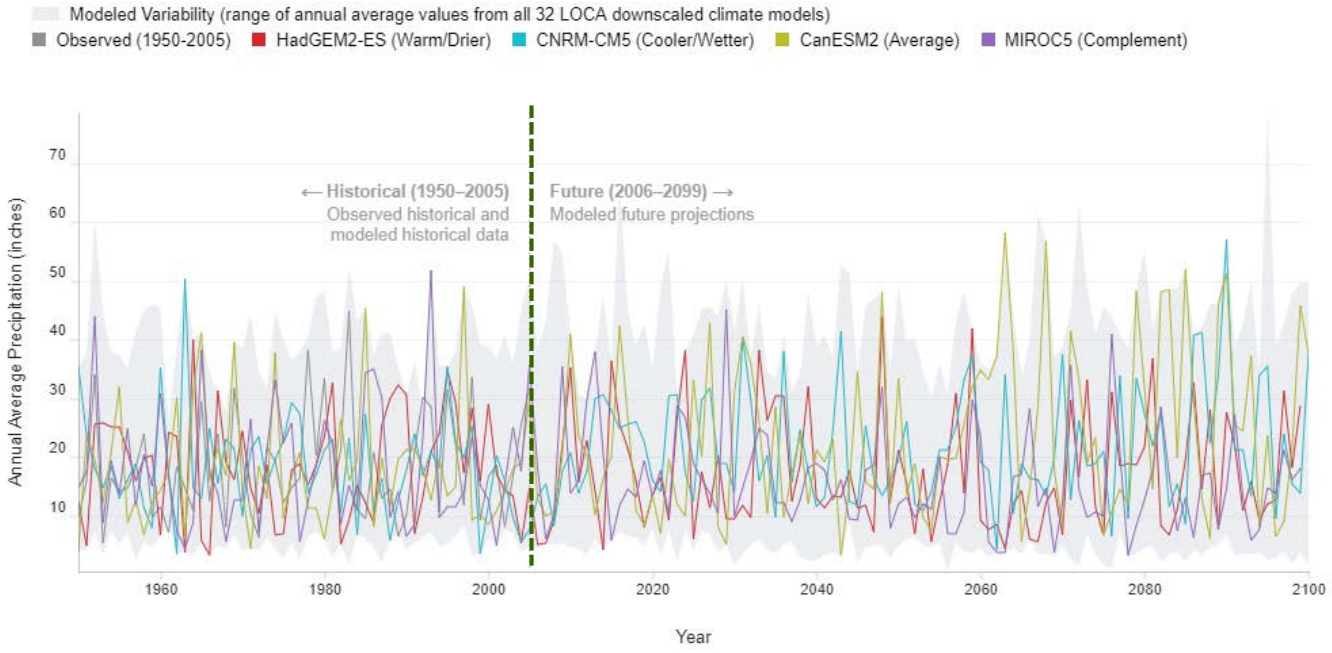


Figure 5 Historical and Projected Annual Average Precipitation in South Pasadena



The entire Los Angeles County region will have to face those kind of precipitation impacts, according to studies from the University of California Los Angeles (UCLA) Institute of the Environment and Sustainability.[17] Regional mountains could lose up to half their snowpack above 6,500 feet by mid-century without the implementation of climate mitigation strategies. Increases in temperature could also worsen local heat island effects in South Pasadena and the surrounding area, meaning that urban areas could experience a compounded level of heating due to built environments absorbing more heat than rural communities.[18] Children, the elderly, asthmatics, and others susceptible to harm from air pollution exposure, are at the greatest risk of the negative impacts associated with climate change.[19]

Social Vulnerability

Those that are most vulnerable will bear the greatest burden associated with the potential impacts of a changing climate. Race, ethnicity, gender identity, sexual orientation, age, social class, physical ability, religious or ethical value systems, national origin, immigration status, linguistic ability, and zip code do not make an individual inherently vulnerable. Instead, vulnerabilities relate to deficiencies in the system rather than a judgement of any particular community member or neighborhood. This document provides a foundation to even the playing field for all members of society and to ultimately reduce potential burdens of climate change on vulnerable populations.

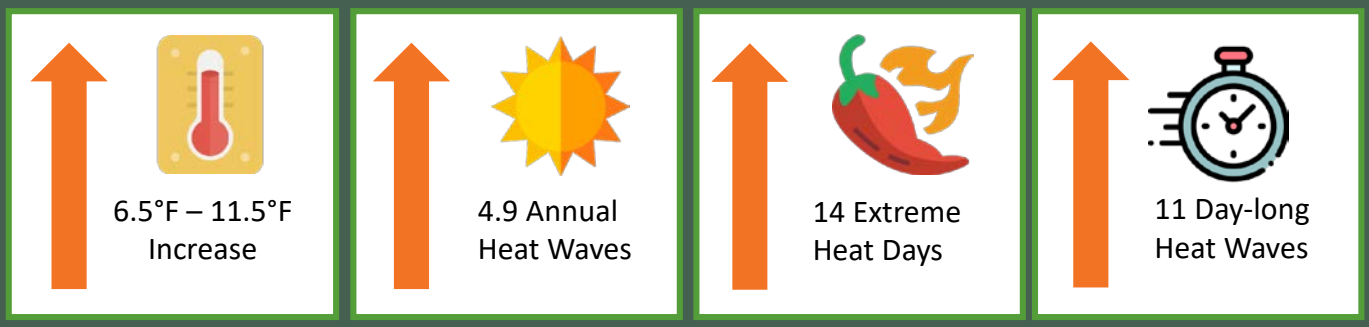
17. https://www.ioes.ucla.edu/project/climate-change-in-the-los-angeles-region/
18. https://www.epa.gov/heatislands/learn-about-heat-islands
19. https://ww2.arb.ca.gov/capp-resource-center/community-assessment/sensitive-receptor-assessment

Potential Impacts to the Community

The City of South Pasadena may experience a variety of impacts due to climate change including an increase in average temperature and changes in precipitation, as outlined above under *Climate Change in the City of South Pasadena*. Increased temperatures have the potential to affect the City in a variety of ways, especially through decreased public health. Public health may be negatively impacted by a changing climate as a result of changing environmental conditions including extreme weather events, changes in temperature and rainfall that decrease water supply, worsening air quality, and increases in allergens and air pollutants.

This could lead to hazardous conditions such as heat stroke and respiratory ailments for community

Figure 6 Impacts of Climate Change in the City of South Pasadena (~2100)



members. Potential impacts to public health include cardiovascular disease, exacerbation of asthma, increased risk of skin cancer and cataracts, and heat-related illnesses such as heat stroke, heat exhaustion, and kidney stones.[20] Those in the community without health insurance (about 5.9 percent of the population under 65) and those living under the poverty line (approximately 8.7 percent of the population) are particularly vulnerable. [21]

With anticipated increases in temperature, those without health insurance and/or those that are economically disadvantaged may find it more difficult to afford the additional costs of cooling their homes. Consequently, many low-income households, especially those of seniors and the disabled may become physically vulnerable to the effects of extreme heat events.

It is imperative that the City of South Pasadena take action now to mitigate and prepare for these climate threats and hazards. The measures included in this Climate Action Plan set a path to achieving GHG reduction goals that will contribute to long-term stability. These Plays and Moves will build and decarbonize the local economy in a cost-effective manner that prioritizes benefits to the community. This Plan includes actions in which every part of the community – residents, property owners, businesses, and City government – can participate to improve quality of life. The City of South Pasadena will strive to set an example at the municipal level by doing its part to achieve climate goals and fostering a safe, healthy, vibrant, and resilient community for all South Pasadenans.

Let's be bold! We have the momentum; we can do it! The kids are counting on us!

- City of South Pasadena Resident

20. https://resources.ca.gov/CNRALegacyFiles/docs/climate/01APG_Planning_for_Adaptive_Communities.pdf
21. https://www.census.gov/quickfacts/southpasadenacitycalifornia

11
Total Outreach Events

94+
Community Event Attendees

75
Comments Received and Survey Responses

236+
Views on Virtual Events

Summary of Outreach Events

Date	Topic	Audience
10/30/19	CAP Intro and Inventory	Staff
11/14/19	CAP Intro and Inventory	Community
1/15/20	CAP Intro and Inventory	City Council
3/12/20	GHG Reduction Strategies	Staff
5/26/20	GHG Reduction Strategies	NREC
5/28/20	GHG Reduction Strategies	Community
8/25/20	Draft CAP Review	NREC
9/10/20	Draft CAP Review	Community
10/7/20	Draft CAP Review	City Council
TBD	Final CAP Review	NREC
TBD	Final CAP Adoption	City Council

Natural Resources and Environmental Commission (NREC)

Developing the Plan

Purposeful and transparent stakeholder group and community participation in the climate action planning process ensured that this CAP is representative of the needs and desires of all members of the South Pasadena community. The CAP was developed through an integrated partnership between City staff from all departments, the Natural Resources and Environmental Commission (NREC), and the community. The NREC is an advisory group to the City Council in all matters pertaining to energy, science and technology, and natural resources and the environment and played an integral role in the development of the CAP. In addition, community members were provided with numerous opportunities to provide direct feedback on all aspects of the CAP via surveys, the comment box on the CAP website, in-person/virtually at community events, and via direct email to City staff.

Over the course of the 20-month (April 2019 – December 2020) CAP development process, eleven outreach events were held including three community meetings, three NREC presentations, two staff meetings, and three City Council presentations. A series of in-person community workshops and focus group meetings were scheduled for Spring through Winter of 2020; however, due to the COVID-19 pandemic, the events beginning in May 2020 were shifted to a virtual format. This virtual format provided opportunities for additional

community members to participate, either by tuning in to the virtual event or watching it while it streamed live online. In addition, these events were recorded and posted on the CAP website allowing community members who were unable to participate at the time of the event to view the important presentations at their convenience. The virtual events were participated by and viewed by hundreds of community members during the duration of the CAP preparation.

During the first set of outreach events, where the CAP process was introduced and the GHG inventory was reviewed, feedback was provided by stakeholders and community members regarding which strategies they'd like included in the Final CAP. This feedback was incorporated into the development phase of the Plays and Moves, which were reviewed during the second set of outreach events in Spring of 2020. Upon completion of the Spring 2020 outreach events, a survey was released to gain feedback on the emission reduction strategies (Plays and Moves). In total, 58 insightful responses were received on the survey and six Moves were added based on the feedback provided. Please see the Moves marked with an asterisk in the *Plays and Moves* Section for a complete summary of the additions that were made based on the community feedback received.

A public-facing Climate Action Plan website was linked to the City's website to share information and be an avenue to accept public comments and feedback. These comments were reviewed as they came in and re-reviewed with the survey results to see if any additional Plays or Moves were necessary based on feedback provided. In addition to the outreach avenues detailed above, feedback was solicited and CAP updates were communicated to the community via press releases, City Hall Scoop blog articles, the Neighborhood Pulse monthly newsletters, the Environmental Programs listserv1, City social media pages, the City website, Council and Commission meetings, and local organizations. The feedback received from the community and stakeholders shaped the Final CAP and helped establish an implementable and shared path forward to reach the City's climate action goals.

What we heard from the Community:

"**Education is paramount** - getting this information to the high school, middle school, and elementary school in an engaging format is essential to informing **ALL South Pasadena residents**!"

"I'd love to see **community solar** and a neighborhood **micro electric grid** for City offices and **in public spaces** like the library/senior center complex and for the schools."

"**Our tree canopy** is one of the few things that **distinguishes us** from nearby cities. It's our treasure and **we should do everything to protect it and expand it**."

"Having our residents **use 100% renewable energy**, whether or not they can install photovoltaic (PV) solar panels on their structures, is **one of the most efficient ways of reducing City GHGs**."

Comments included in the CAP were received during the survey and via the City's CAP Website comment box! Thank you for providing your feedback, we appreciate it!

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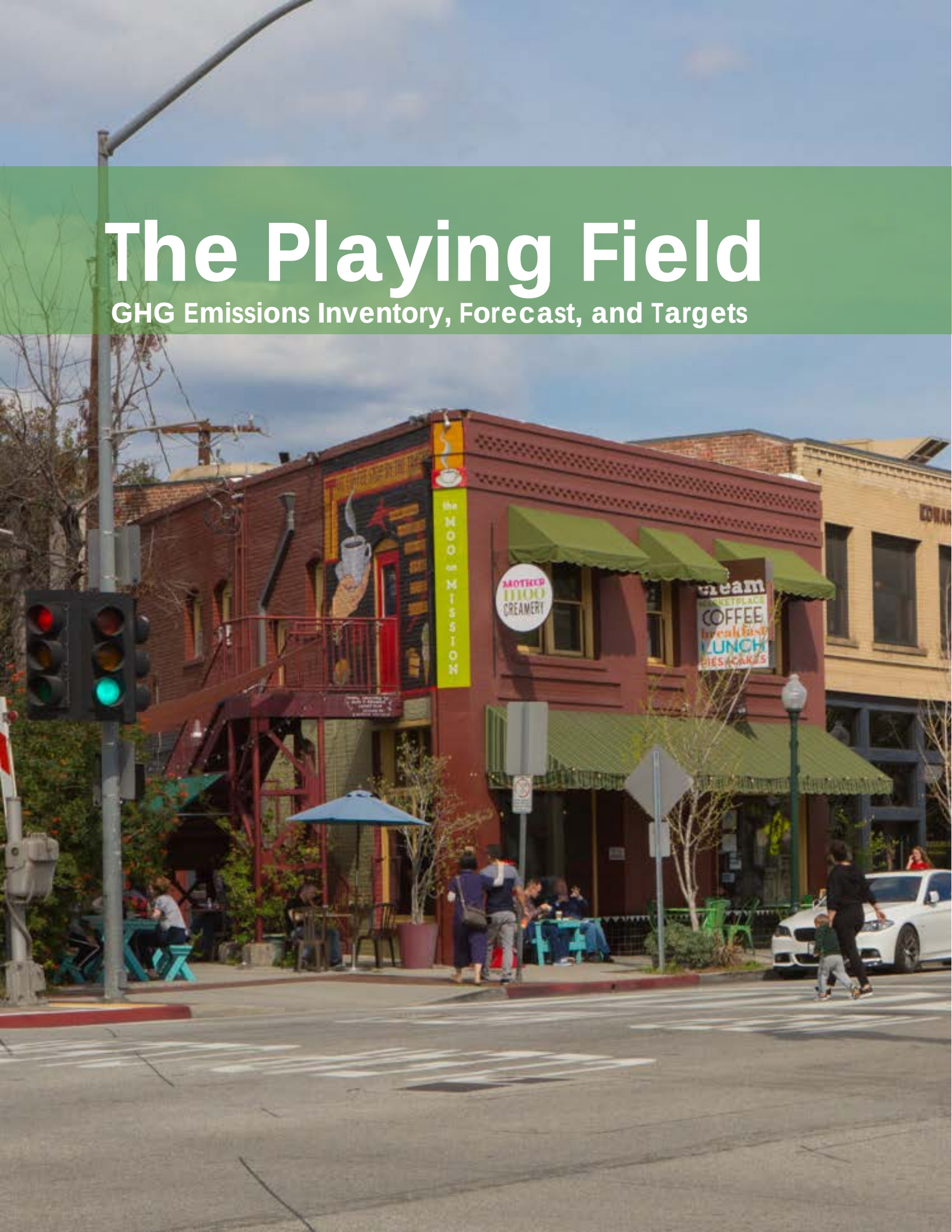
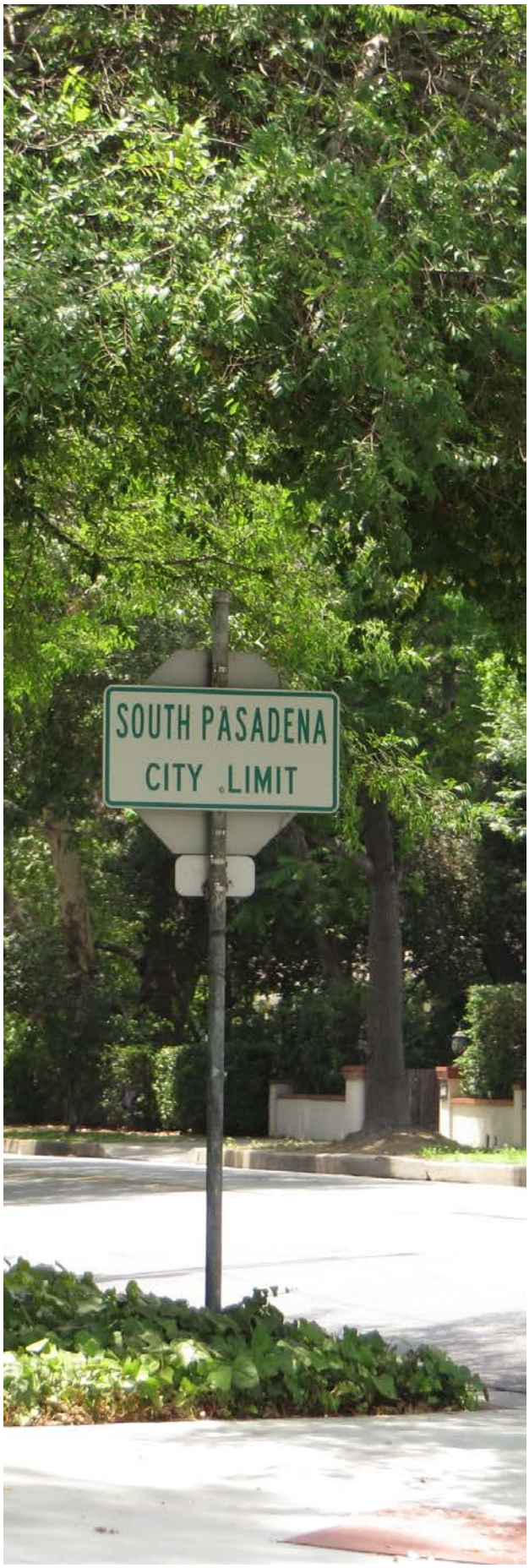
The Playing Field

GHG Emissions Inventory, Forecast, and Targets





Baseline GHG Emissions

This Climate Action Plan includes a 2016 baseline inventory of GHG emissions from municipal operations and community-wide activities within the City. It is important to note that the municipal operations inventory is a subset of the community inventory, meaning that the municipal emissions are included within the community-wide inventory. To allow for comparison among GHG emissions sources, all emissions are translated to the equivalent of one metric ton of carbon dioxide, or MT CO_2e. One MT CO_2e is the equivalent of using 113 gallons of gasoline or driving 2,492 miles in a standard combustion vehicle.[22]

Inventory

Methodology

Emissions estimates were calculated using the best available methodologies from the International Council for Local Environmental Initiatives (ICLEI). Specifically , the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions Version 1.2 (Community) is used to calculate community-wide emissions and the Local Government Operations Protocol Version 1.1 (LGOP) is used to calculate municipal emissions. See Appendix C for more information.

1 MT CO_2e = 2,492 miles traveled in a standard combustion vehicle, which is the approximate distance from South Pasadena City Hall to Pittsburg Pennsylvania!

2016 Municipal Baseline Emissions

In 2016, the City of South Pasadena's GHG emissions associated with municipal operations totaled 2,755 MT CO_2e. As shown in Table 1 and Figure 7, emissions from the City's energy use were the largest sector (1,613 MT CO_2e, or 59 percent). The second largest source of emissions (584 MT CO_2e, or 21 percent) was waste generated by municipal employees and facilities.

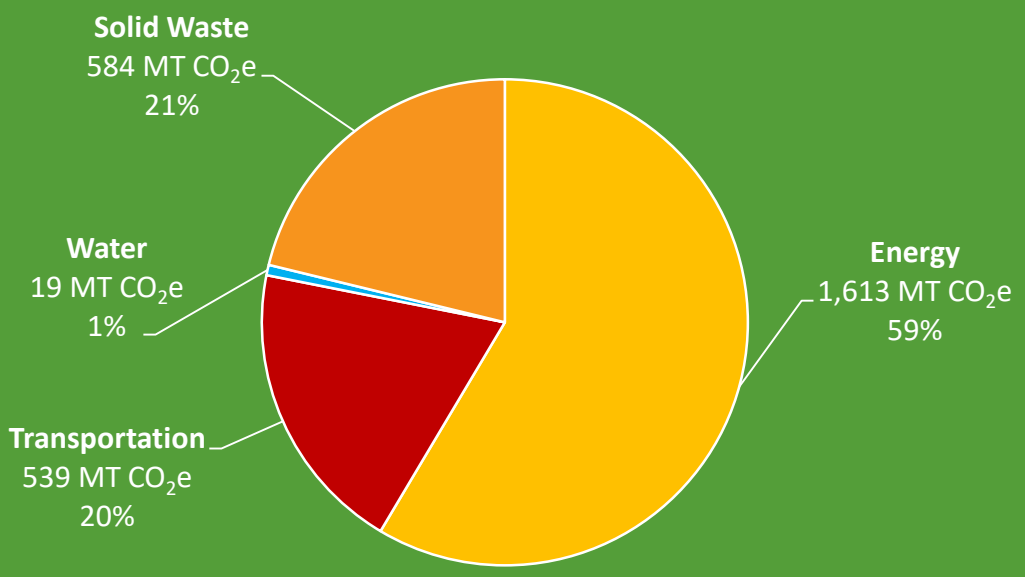
22. https://developer.epa.gov/greenhouse-gas-equivalencies-calculator-widget/

Table 1 2016 Municipal Emissions Summary by Sector

Sector	GHG Emissions ($MT CO_2e$)	Percentage of Total Emissions
Energy	**1,613**	**59**
Electricity	1,504	55
Natural Gas	109	4
Transportation	**539**	**19**
Vehicle Fleet	173	6
Employee Commute	366	13
Water and Wastewater	**19**	**1**
Solid Waste	**584**	**21**
Total	**2,755**	**100 %**

Notes:
MT: Metric tons
1. Emissions have been rounded and therefore sums may not match.
Source: Emissions were calculated following ICLEI LGOP (May 2010) and using data provided and approved by the City.

Figure 7 2016 Municipal Emissions Summary by Sector



Transportation associated with the City fleet and employee commuting generated emissions equivalent to 539 MT CO_2e, or 19 percent. The remaining municipal emissions (19 MT CO_2e) were from water use and wastewater generation by the City's operations.

2016 Community-wide Baseline Emissions

In 2016, the South Pasadena community emitted approximately 125,269 MT CO_2e. As shown in Table 2 and Figure 8, the transportation sector was the largest source of emissions, generating approximately 67,228 MT CO_2e, or 54 percent of total 2016 emissions. Electricity and natural gas consumption within the residential and commercial sectors were the second largest source of 2016 emissions, generating 49,301 MT CO_2e, or 39 percent of the total. Waste generation, including processing and the decomposition of waste, resulted in six percent (7,712 MT CO_2e) of the City's emissions, while water use and wastewater generation resulted in the remaining one percent (1,026 MT CO_2e).

Emissions Forecast

Emissions forecasts (what we predict GHG emissions to be in the future) are generated from the 2016 baseline inventory to help identify actions that must be taken now in order to meet future targets. This CAP identifies provisional GHG emissions reduction targets for the years 2020 (AB 32 target year), 2030 (SB 32 target year), 2040 (City of South Pasadena's General Plan horizon year), and 2045 (EO B-55-18 target year).

A business-as-usual scenario provides a forecast of how GHG emissions would change in the years 2020, 2030, 2040, and 2045 if consumption trends continue as they did in 2016 and growth were to occur as projected in the City's General Plan. South Pasadena's business-as-usual GHG emissions are projected to increase to 126,337 MT CO_2e in 2020, 128,792 MT CO_2e in 2030, 131,675 MT CO_2e in 2040, and 133,121 MT CO_2e in 2045 (see Table 3).

However, since 2016, several state regulations (i.e., SB 1, SB 100, AB 1493) have been enacted that will reduce future local emissions. These regulations have been incorporated into an adjusted forecast, which provides a more accurate picture of future emissions growth and the emission reduction the City and community will be responsible for after state regulations have been implemented (see Table 3).

Emissions Targets

After analyzing the City's baseline inventory and forecast scenarios, emission targets were set to create quantitative goals that will further the City's ability to measure emission reduction progress from the baseline scenarios. The 2016 baseline emissions were reduced by 40 percent to establish a 2030 target of 75,161 MT CO_2e for the City. In accordance with the new California Air Resource Board (CARB) methodology and the statewide goal established in SB 32, this absolute emissions[23] target was then translated into a 2030 per capita emission target of 2.9 MT CO_2e per year by dividing the 2030 absolute target by South Pasadena's projected population in 2030.

The following GHG reduction targets were established by the City of South Pasadena to remain consistent with the state's 2030 (SB 32) goal and be in line with the reduction trajectory to achieve the state's long-term 2045 goal:

- Reduce GHG emissions to 2.9 MT CO_2e per capita by 2030 (the SB 32 target year)
- Reduce GHG emissions to 0.0 MT CO_2e per capita by 2045 (the EO B-55-18 target year)

As shown in Table 4 and Figure 9, South Pasadena would require implementing local reduction measures to meet the state targets established for 2030 and 2045 even after accounting for reductions that will result from state regulations. Table 4 shows that South Pasadena would be required to reduce 18,578 MT CO_2e by 2030, 53,874 MT CO_2e by 2040, and 73,969 MT CO_2e by 2045 to meet the state goals. Table 4 also shows the remaining per capita reductions needed to meet the goal (MT CO_2e per capita).

These reductions will be achieved through implementation of local Plays (strategies) and Moves (actions) developed from best practices of other similar and neighboring jurisdictions, as well

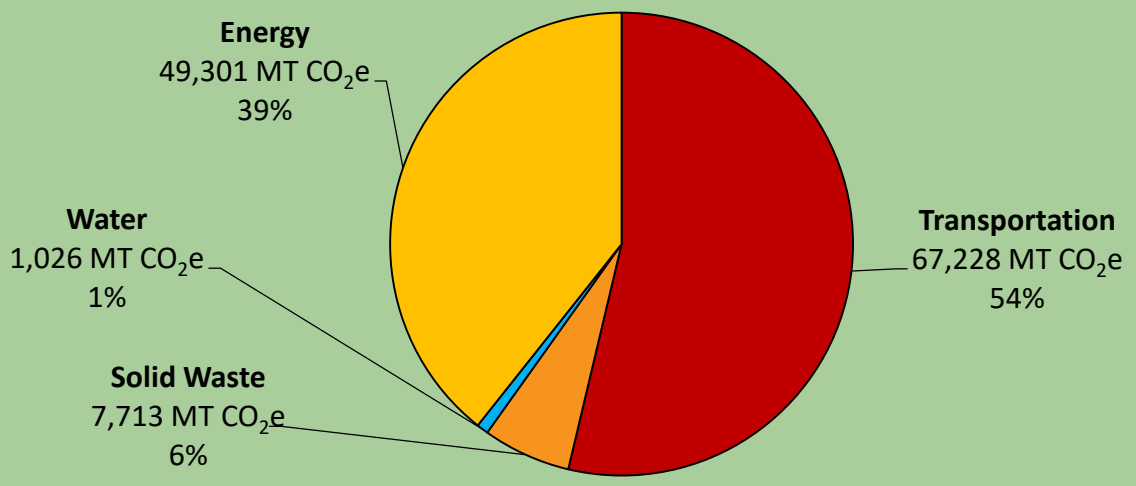
23. Absolute emissions refer to the total quantity of GHG emissions being emitted.

Table 2 2016 Community-wide Emissions Summary by Sector

Sector	GHG Emissions ($MT CO_2e$)	Percentage of Total Emissions
Energy	**49,301**	**39**
Electricity	23,987	19
Natural Gas	24,287	19
Electricity Transmission and Distribution Losses	1,027	1
Transportation	**67,228**	**54**
On-road Transportation	65,351	52
Off-road Equipment	829	1
Transit[2]	1,048	1
Water and Wastewater	**1,026**	**1**
Water transport, distribution and treatment	700	1
Wastewater collection and treatment	326	<1
Solid Waste	**7,713**	**6**
Waste Sent to Landfills	7,509	6
Process Emissions	203	<1
Combustion Emissions	1	<1
Total	**125,269**	**100%**

Notes:
MT: Metric tons
1. Emissions have been rounded and therefore sums may not match.
2. Transit in South Pasadena is provided by Los Angeles Metro.
Source: Emissions were calculated following ICLEI U.S. Community Protocol and using data provided and approved by the City.

Figure 8 2016 Community-wide Emissions Summary by Sector



as those recommended by state organizations and agencies. The Plays and Moves were vetted by City staff and the community and are quantified to identify their overall contribution to meeting the City's 2020, 2030, 2040, and 2045 GHG reduction targets, as outlined in the *Game Plan.* See Appendix C for more information on the forecast and targets.

Table 3 Business-as-Usual and Adjusted Forecast for City of South Pasadena

Emission Forecast	2020 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Business-as-Usual Forecast	126,337	128,792	131,675	133,121
Emission Reductions from State Measures	9,638	35,052	52,747	59,152
Adjusted Forecast	**116,699**	**93,740**	**78,927**	**73,969**

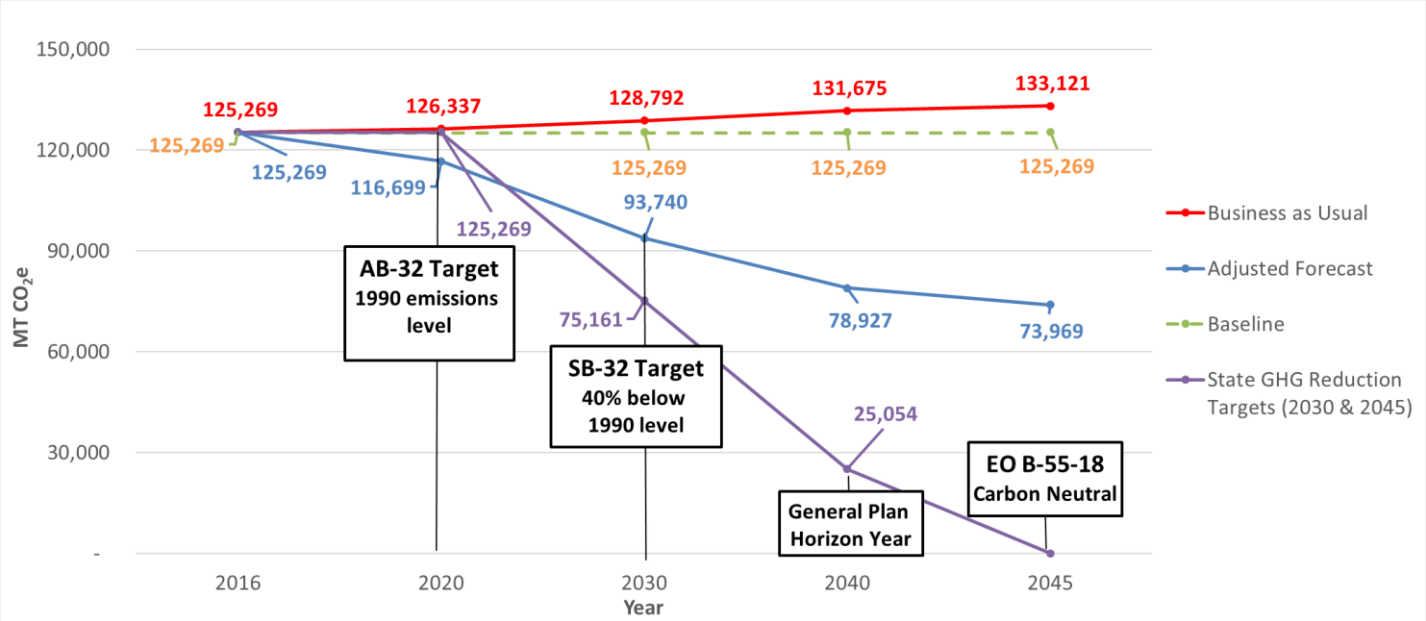
Notes: Emissions have been rounded to the nearest whole number and therefore sums may not match.

Table 4 Community Emissions, Targets, and Reductions Needed to Meet Targets

Emission Forecast	2020 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Adjusted Forecast	116,699	93,740	78,927	73,969
Provisional Emissions Target	125,268	75,161	25,054	0
Remaining Reductions Needed to Meet Target	**-8,570**	**18,578**	**53,874**	**73,969**
Population[1]	26,198	26,649	27,100	27,327
Per Capita Adjusted Forecast (MT CO_2e per capita)	4.5	3.5	2.9	2.7
Per Capita Targets (MT CO_2e per capita)	4.8	2.9	1.0	0.0
Remaining Per Capita Reductions Needed to Meet Target (MT CO_2e per capita)	**-0.4**	**0.6**	**1.9**	**2.7**

1. Population from SCAG 2016 RTP/SCS Demographic and Growth Forecast.
http://scagrtpscs.net/Documents/2016/final/f2016RTPSCS_DemographicsGrowthForecast.pdf
Note: Emissions have been rounded to the nearest whole number and therefore sums may not match.

Figure 9 Community Emissions, Targets, and Reductions Needed to Meet Targets



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Gameplan

Greenhouse Gas Emission Reduction Plays and Moves

Reducing Emissions in South Pasadena

At its core, the CAP aims to reduce GHG emissions in the City of South Pasadena through equitable, achievable, and implementable actions that benefit all South Pasadenans. The City of South Pasadena has actively worked to reduce GHG emissions and increase the resilience of the City for decades. However, there has not been a mechanism to quantify the reductions achieved to-date. Nonetheless, these efforts should be recognized as the foundation of mitigating the impacts of climate change in the City. This CAP further encourages sustainability and implementation of the Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) strategies. Since, the City is nearly built-out, the majority of sustainable development includes rethinking how the system works and revamping existing infrastructure.

South Pasadena Historical Museum

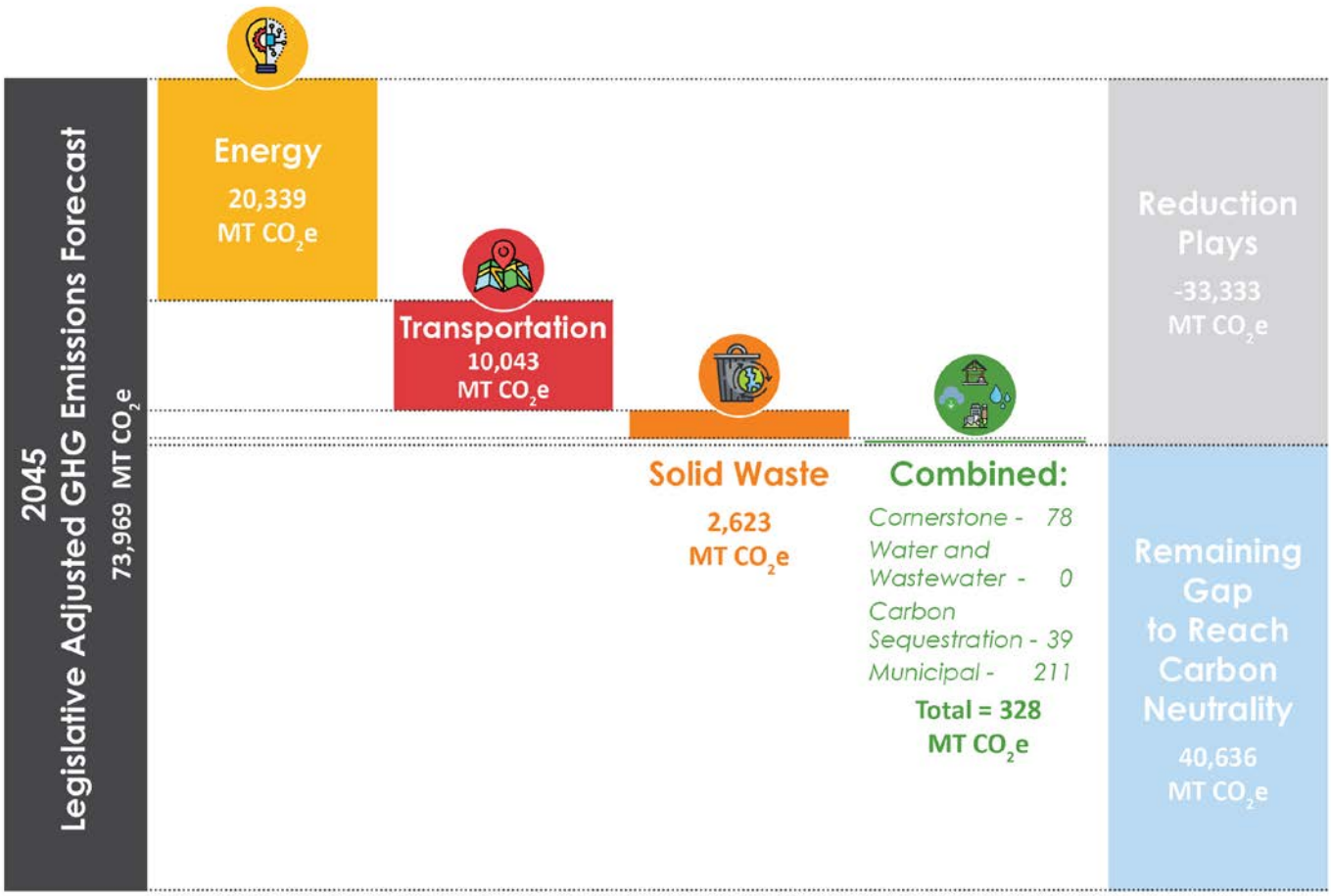
As mentioned in the *Introduction*, the Plays and Moves outlined in this CAP were created through a collaborative process with City staff, the NREC, and the community. The Moves marked with an asterisk were added based on community feedback received. The City is actively engaged in creating unique solutions and working with other jurisdictions and local partners to solve problems that may arise, as demonstrated by the reduction Plays and supporting Moves, which are summarized in Table 5.

Table 5 Emission Reduction Plays and Moves Summary

Sector	Play		GHG Emissions Reduction Contribution
Cornerstone	C.1	Engage South Pasadena youth in climate change action and provide education on ways to live a sustainable lifestyle.	2030: 25 MT CO_2e 2045: 78 MT CO_2e
Energy	E.1	Maximize the usage of renewable power within the community, by continuing to achieve an opt-out rate lower than 4% for the Clean Power Alliance.	2030: 13,408 MT CO_2e 2045: 0 MT CO_2e
	E.2	Require electrification of 100% of newly constructed buildings.	2030: 240 MT CO_2e 2045: 984 MT CO_2e
	E.3	Electrify 5% of existing buildings by 2030 and 80% by 2045.	2030: 1,184 MT CO_2e 2045: 19,355 MT CO_2e
	E.4	Develop and promote reduced reliance on natural gas through increased clean energy systems that build off of renewable energy development, production, and storage.	Supportive of 2030 and 2045 Goals
Transportation	T.1	Increase use of zero-emission vehicle and equipment 13% by 2030 and 25% by 2045.	2030: 3,774 MT CO_2e 2045: 6,629 MT CO_2e
	T.2	Implement programs for public and shared transit that decrease passenger car vehicle miles traveled 2% by 2030 and 4% by 2045.	2030: 807 MT CO_2e 2045: 1,399 MT CO_2e
	T.3	Develop and implement an Active Transportation Plan to shift 3% of passenger car vehicle miles traveled to active transportation by 2030, and 6% by 2045.	2030: 1,186 MT CO_2e 2045: 2,015 MT CO_2e
Water and Wastewater	W.1	Reduce per capita water consumption by 10% by 2030 and 35% by 2045.	2030: 414 MT CO_2e 2045: 0 MT CO_2e
Solid Waste	SW.1	Implement and enforce SB 1383 organics and recycling requirements to reduce landfilled organics waste emissions 50% by 2022 and 75% by 2025.	2030: 1,702 MT CO_2e 2045: 1,764 MT CO_2e
	SW.2	Reduce residential and commercial waste sent to landfills by 50% by 2030 and 100% by 2045.	2030: 415 MT CO_2e 2045: 859 MT CO_2e
Carbon Sequestration	CS.1	Increase carbon sequestration through increased tree planting and green space.	2030: 19 MT CO_2e 2045: 39 MT CO_2e
Municipal	M.1	Reduce carbon intensity of City operations.	2030: 188 MT CO_2e 2045: 188 MT CO_2e
	M.2	Electrify the municipal vehicle fleet and mobile equipment.	2030: 23 MT CO_2e 2045: 23 MT CO_2e
	M.3	Increase City's renewable energy production and energy resilience.	Supportive of 2030 and 2045 Goals
Total			**2030: 23,386 MT CO_2e** **2045: 33,333 MT CO_2e**

Note: South Pasadena would be required to reduce 18,578 MT CO_2e by 2030, 53,874 MT CO_2e by 2040, and 73,969 MT CO_2e by 2045 to meet the City's targets and state goals.

Figure 10 Path to Carbon Neutrality



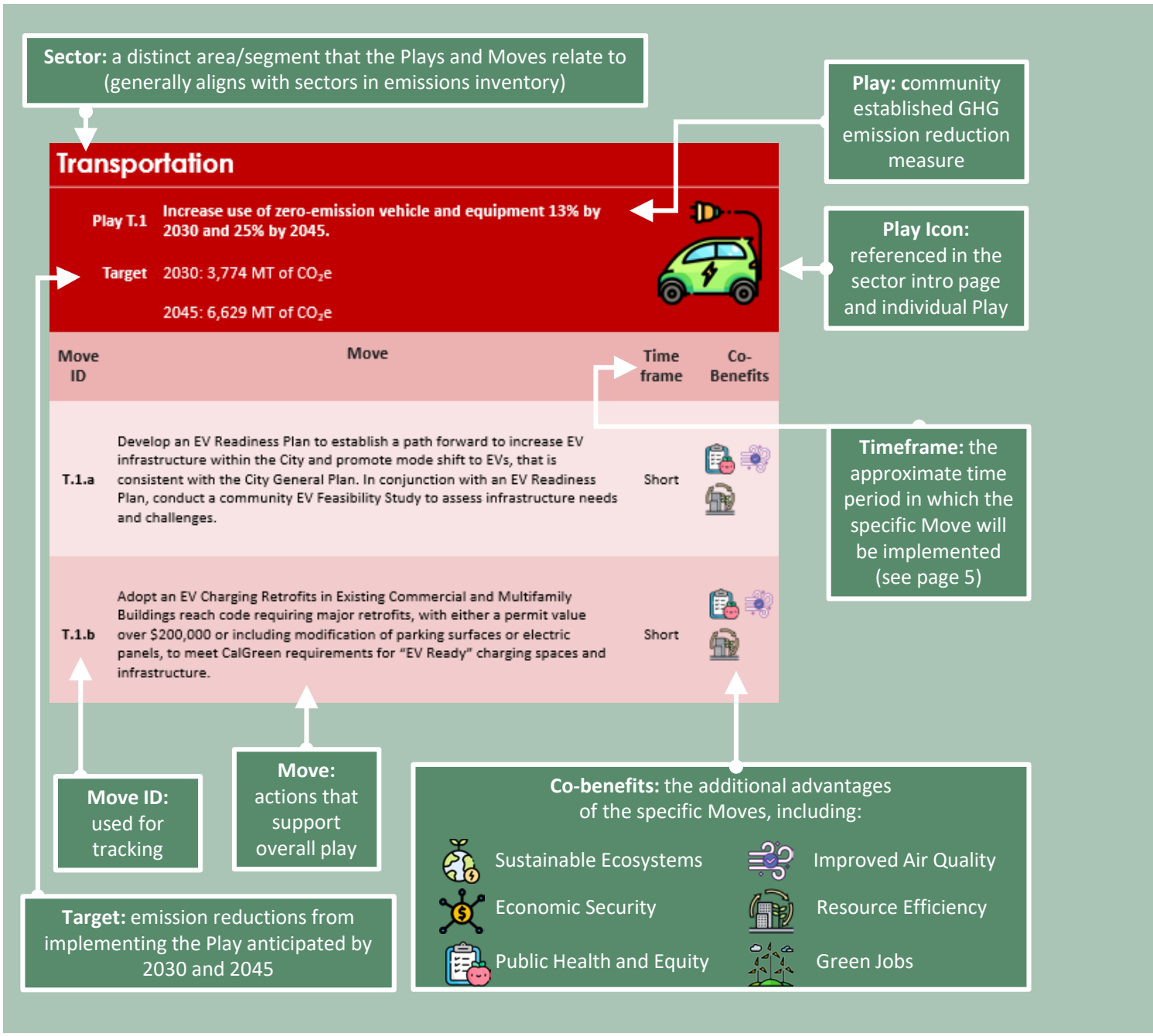
Meeting the State's Goals

The Plays and Moves outlined in this section were established and refined to meet the City's GHG emission reduction target for 2030 and provide substantial progress towards meeting the longer-term target of carbon neutrality by 2045, which align with the state's goals and is the City's fair share towards achieving the state's overall climate goals (see Appendix D for more information on the emission reductions anticipated to be achieved from each Play). As shown in Figure 10, the Plays and Moves established in this Plan help the City of South Pasadena meet the 2030 target and put the City on the trajectory towards meeting the 2045 target of carbon neutrality.

Specifically, Figure 10 shows the adjusted emissions forecast on the left with the emission reductions required to meet the 2030 and 2045 goal on the right. As demonstrated, while the Plays and Moves help reach the 2030 targets, more work is needed to reach the longer-term 2045 emission reduction target. It is anticipated that the CAP will be updated on a regular (triennial basis) as outlined in *Keeping Score.* Future iterations of the CAP will outline additional ways to meet the longer-term 2045 emission reduction target as new technologies and solutions become available.

Making meaningful progress towards reducing the City's GHG emissions starts with the leadership of City government, through strong actions like providing permit incentives and developing equitable outreach programs that spur change in the community. There is a wealth of opportunities for South Pasadena to take action, to improve the community while also reducing its GHG emissions. It is important that these opportunities are taken advantage of, so real momentum can be built upon and we can meet California's 2030 GHG emission reduction goal. See the following pages for more information on the specific Plays and Moves included in this Climate Action Plan.

Reading the Gameplan



"Supportive" Plays and Moves

Do not directly result in quantitative greenhouse gas emission reductions, although they support the overall goals of the Climate Action Plan.

Table 6 Co-Benefit Summary

Icon	Co-Benefit	Description
	Sustainable Ecosystems	Promotes the ability of non-human aspects of South Pasadena and the world to thrive
	Economic Security	Contributes to the stability of financial resources for the City of South Pasadena and/or residents/business owners in the City
	Public Health and Equity	Supports the health and wellbeing of all members of the South Pasadena community, while also promoting equity
	Improved Air Quality	Reduces the presence of harmful substances in the local atmosphere
	Resource Efficiency	Improves the effective use of resources while minimizing waste
	Green Jobs	Creates or advances employment opportunities in sectors contributing to sustaining or improving environmental quality

Implementation Timeframes

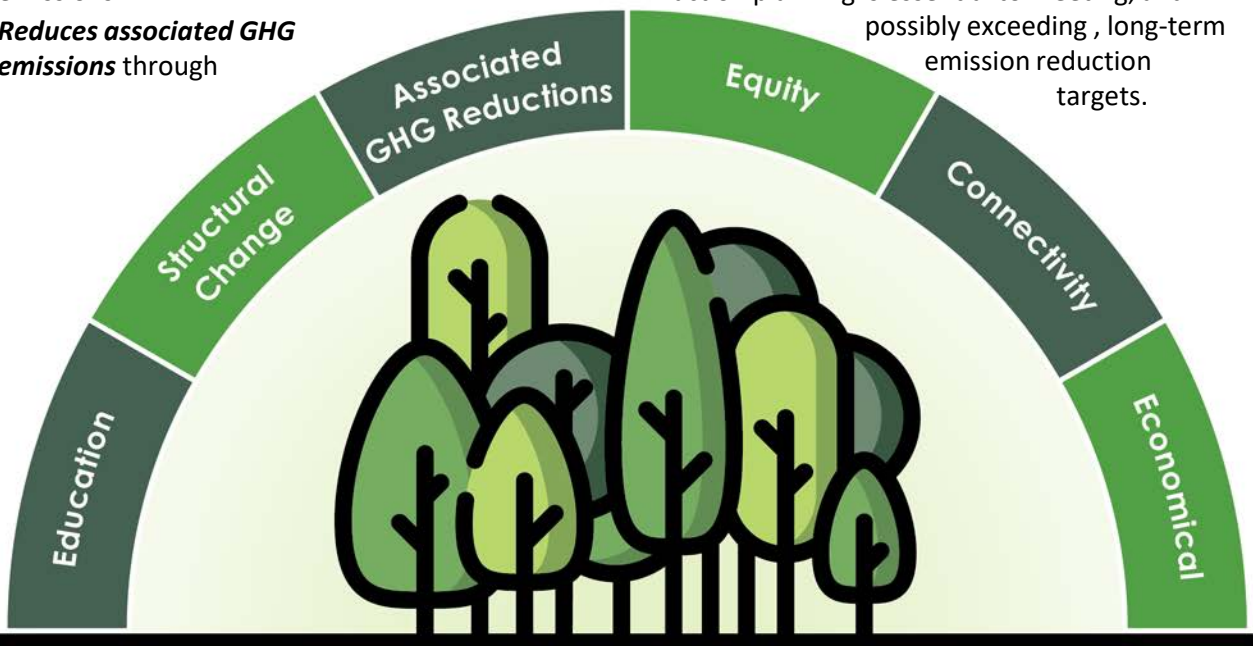
Cornerstones of Climate Action Planning

The City of South Pasadena acknowledges that long-term sustainable change must occur to reduce our GHG emissions and limit our impact on climate change. This change will come from a collective commitment to reduce emissions through implementation of effective and equitable emission reduction strategies, such as the Plays and Moves outlined in this CAP. High-quality climate action planning is built on six essential components that result in implementable and effective GHG emission reduction strategies.

These six essential components, ***education, structural change, associated GHG reductions, equity, connectivity, and economical design***, are the cornerstones that lay the foundation for transformational change and are essential to creating Plays that will engage the community and fulfill the emissions reductions goals laid out in the Plan. As an example, the Cornerstone Measure (C.1) embodies and illustrates the components of a well-designed strategy that can be implemented over the long-term. Specifically, C.1:

- ✓ Provides ***education*** to students, staff, and the community as part of the foundation to engage, inform, and empower all community members regarding decarbonization.
- ✓ Supports ***structural change*** by establishing a specific program to increase tree planting in South Pasadena, which will in-turn increase carbon sequestration and reduce GHG emissions.
- ✓ ***Reduces associated GHG emissions*** through carbon sequestration, which is a key component to climate action planning as all sources of emissions will not be able to be reduced entirely and some sequestration will be required to reach the City's long-term targets.
- ✓ Demonstrates ***equitability*** by working to identify cost-effective plants/trees that can be planted in the ground or remain potted for students living in rental/multi-family homes. It is essential that climate action planning consists of inclusive participation in decision making and equal benefits and impacts for the community.
- ✓ ***Connects*** the South Pasadena Unified School District with important tools to educate students, staff, and the community on ways to reduce GHG emissions. Connecting with various entities is an important part of this CAP because it helps establish sustainable progress by teaming with and empowering organizations and community groups that are uniquely skilled and positioned to implement emission reductions Plays and Moves.
- ✓ Outlines feasible and ***economical*** carbon reduction pathways and solutions, such as identifying grant opportunities and working with local nurseries to provide students with cost-effective California native plants/trees.

Implementing emission reduction Plays and Moves, such as C.1 and the others outlined in this CAP, that embody the cornerstones of high-quality climate action planning is essential to meeting, and possibly exceeding , long-term emission reduction targets.



Cornerstone

C.1		**Engage South Pasadena youth in climate change action and provide education on ways to live a sustainable lifestyle.**

Cornerstone

Play C.1 **Engage South Pasadena youth in climate change action and provide education on ways to live a sustainable lifestyle.**

Target 2030: 25 MT of CO_2e

2045: 78 MT of CO_2e

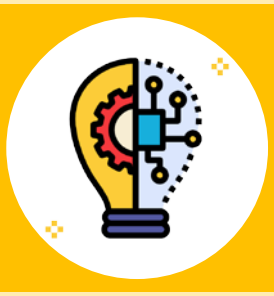
Move ID	Move	Time frame	Co-Benefits
C.1.a	Support South Pasadena Unified School District by providing students with information on climate change and the beneficial role of trees.	Short	
C.1.b	Utilize South Pasadena's historic neighborhoods to demonstrate to students the importance of mature urban trees in providing shade and reducing the urban heat island effect.	Short	
C.1.c	Identify grant funding opportunities and engage with local nurseries to identify appropriate and cost-effective California native plants/trees that can be both planted in the ground or remain potted for students living in rental/multi-family homes.	Short	

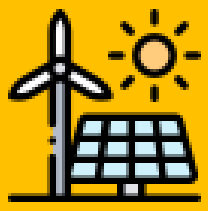
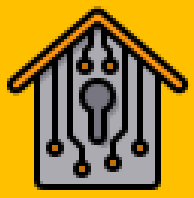
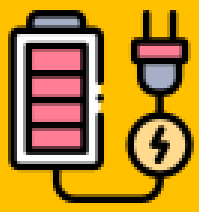
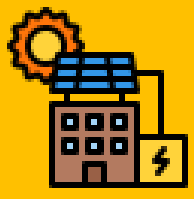
Sustainable Ecosystems | **Economic Security** | **Public Health** | **Improved Air Quality** | **Resource Efficiency** | **Green Jobs**

Short- Now – 3 years | **Mid-** 3 years – 5 years | **Long-term** 5 years – 10+ years

***Move added based on community feedback**

Energy



E.1		**Maximize the usage of renewable power within the community, by continuing to achieve an opt-out rate lower than 4% for the the Clean Power Alliance.**
E.2		**Require electrification of 100% of newly constructed buildings.**
E.3		**Electrify 5% of existing buildings by 2030 and 80% by 2045.**
E.4		**Develop and promote reduced reliance on natural gas through increased clean energy systems that build off of renewable energy development, production, and storage.**

Energy

Play E.1 **Maximize the usage of renewable power within the community, by continuing to achieve an opt-out rate lower than 4% for the Clean Power Alliance.**

Target 2030: 13,408 MT of CO_2e

2045: 0 MT of CO_2e

Move ID	Move	Time frame	Co-Benefits
E.1.a	Monitor progress and perform public outreach and education campaigns highlighting the benefits of 100% renewable energy, including: ✓ Monitoring opt-out rates on an annual basis ✓ Tabling at community events ✓ Establishing an informational resource page on the City website ✓ Regular social media posts ✓ Energy bill inserts	Short	

Play E.2 **Require electrification of 100% of newly constructed buildings.**

Target 2030: 240 MT of CO_2e

2045: 984 MT of CO_2e

Move ID	Move	Time frame	Co-Benefits
E.2.a	Develop a webpage and materials for display at City Hall promoting the benefits of electrification and resources that can assist with the fuel-switching process.	Short	
E.2.b	Provide financial and technical resources, including hosting workforce development trainings for installers and building owners/operators to discuss benefits and technical requirements of electrification.	Short	
E.2.c	Perform regular internal trainings with planners and building officials on current state decarbonization goals and incentives available for electric homes.	Short	

Sustainable Ecosystems | Economic Security | Public Health | Improved Air Quality | Resource Efficiency | Green Jobs

Short- (Now – 3 years) | Mid- (3 years – 5 years) | Long-term (5 years – 10+ years)

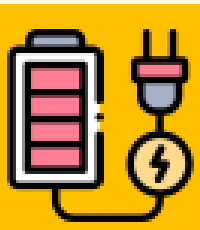
***Move added based on community feedback**

Move ID	Move	Time frame	Co-Benefits
E.2.d*	Provide education around cooking with electric appliances, including demonstrations from chefs and/or local restaurants, as available.	Short	
E.2.e	Adopt an Electrification Readiness reach code for all new buildings and accessory dwelling units which bans the piping of natural gas. In doing so the City will: ✓ Engage with stakeholders, both internal stakeholders, such as City staff and officials, and external stakeholders, such as local developers regarding the purpose and impact of the reach code ✓ Conduct a cost effectiveness study ✓ Develop and draft an ordinance ✓ Conduct public hearings, public notices, and formally adopt the ordinance ✓ Submit the adopted ordinance to the California Energy Commission (CEC)	Mid	
E.2.f	Adopt an ordinance that allows granting of minor allowances for certain site development standards when there is no practical ways to design a project to be all electric.	Mid	

Play E.3 **Electrify 5% of existing buildings by 2030 and 80% by 2045.**

Target 2030: 1,184 MT of CO_2e

2045: 19,355 MT of CO_2e



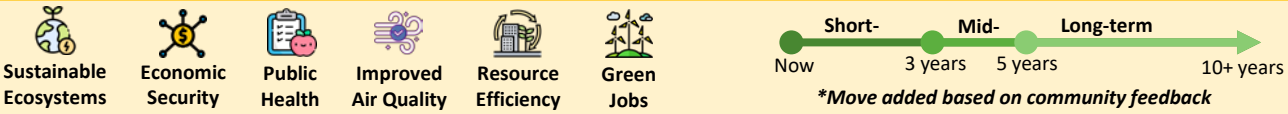
Move ID	Move	Time frame	Co-Benefits
E.3.a	Develop an existing building electrification permit tracking program to track annual progress in achieving the targeted electrification goal.	Short	
E.3.b	Keep an updated list of rebates and incentives available to residents who would like to convert their buildings to electric power.	Short	

Sustainable Ecosystems | Economic Security | Public Health | Improved Air Quality | Resource Efficiency | Green Jobs

Now — Short- (3 years) — Mid- (5 years) — Long-term (10+ years)

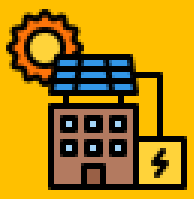
***Move added based on community feedback**

Move ID	Move	Time frame	Co-Benefits
E.3.c	Provide education on the potential energy savings and benefits of electric heat pumps for water heating and space heating when permits for replacement are obtained.	Short	
E.3.d	Work with Southern California Edison (SCE) and/or the Clean Power Alliance to provide rebates for residential replacement of natural gas-powered air and water heating appliances with electric-powered.	Short	
E.3.e	Promote water heater, space heating, and appliance (electric stoves/dryers) replacement programs and incentives (residential) at time of construction permit.	Mid	
E.3.f	Perform an existing buildings analysis in order to understand the potential for electrification retrofitting in South Pasadena and establish a roadmap for eliminating natural gas from existing buildings.	Mid	
E.3.g	Establish a comprehensive, coordinated education campaign focused towards property owners, landlords, property management companies, and occupants for reducing the use of natural gas in homes and businesses. Establish a shared understanding of existing incentives for electric appliances and upgrades, and how to access them, including SCE incentive programs and rebates.	Mid	
E.3.h	Perform a cost-effectiveness study for electrification retrofitting, including requirements for newly permitted HVAC/hot water heaters and other appliances to be electric.	Mid	
E.3.i	Develop a best practices model based on the progress electrifying existing buildings in South Pasadena and outside of South Pasadena to significantly increase electrification post-2030.	Long	



**Move added based on community feedback*

Play E.4	**Develop and promote reduced reliance on natural gas through increased clean energy systems that build off of renewable energy development, production, and storage.**
Target	Supportive of 2030 Goals
	Supportive of 2045 Goals

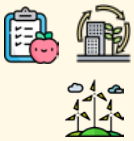


Move ID	Move	Time frame	Co-Benefits
E.4.a	Conduct a Feasibility Study to assess cost and applicable locations for installation of battery back-up systems or generators throughout the City in support of the General Plan.	Short	
E.4.b	Promote installation of storage technology in concert with renewable energy infrastructure through educational programs, outreach, and information provided via City platforms.	Short	
E.4.c	Conduct "micro-grid" Feasibility/Pilot Study in support of the General Plan.	Short	
E.4.d	In support of the General Plan, develop and implement a Solar Action Plan with a goal of meeting 50% of South Pasadena's power demand through solar by 2040.	Short	
E.4.e	In support of the 2018-2019 City Strategic Plan, develop a strategy and implementation schedule for the Renewable Energy Plan, after feasibility study.	Short	
E.4.f	Adopt a PV (Solar) Ordinance requiring newly constructed and majorly renovated multi-family and commercial buildings to install PV systems with an annual output greater or equal to 25% of buildings electricity demand. Ensure consistency of ordinance with the City General Plan.	Mid	

Sustainable Ecosystems | Economic Security | Public Health | Improved Air Quality | Resource Efficiency | Green Jobs

Short- (Now – 3 years) | Mid- (3 years – 5 years) | Long-term (5 years – 10+ years)

***Move added based on community feedback**

Move ID	Move	Time frame	Co-Benefits
E.4.g	Require all new structures or major retrofits to be pre-wired for solar panels, consistent with the General Plan.	Mid	
E.4.h	Work with various City departments to establish and streamline battery storage requirements to allow for easier implementation of these technologies throughout the City.	Mid	
E.4.i*	Work with home and business owners, including those in the historic districts, to identify and promote renewable energy demonstration projects to showcase the benefits.	Mid	
E.4.j*	Work with SCE and the CPA to develop a program and timeline for increasing resilience to power losses, including Public Safety Power Shutoffs (PSPS), and climate-driven extreme weather events for low-income, medically dependent, and elderly populations through installation of renewable energy and onsite energy storage with islanding capabilities, following appropriate project-level environmental review.	Mid	

Transportation

T.1		**Increase use of zero-emission vehicle and equipment 13% by 2030 and 25% by 2045.**
T.2		**Implement programs for public and shared transit that decrease passenger car vehicle miles traveled 2% by 2030 and 4% by 2045.**
T.3		**Develop and implement an Active Transportation Plan to shift 3% of passenger car vehicle miles traveled to active transportation by 2030, and 6% by 2045.**

Transportation

Play T.1 **Increase use of zero-emission vehicle and equipment 13% by 2030 and 25% by 2045.**

Target 2030: 3,774 MT of CO_2e

2045: 6,629 MT of CO_2e

Move ID	Move	Time frame	Co-Benefits
T.1.a	Develop an EV Readiness Plan to establish a path forward to increase EV infrastructure within the City and promote mode shift to EVs, that is consistent with the City General Plan. In conjunction with an EV Readiness Plan, conduct a community EV Feasibility Study to assess infrastructure needs and challenges.	Short	
T.1.b	Adopt an EV Charging Retrofits in Existing Commercial and Multifamily Buildings reach code requiring major retrofits, with either a permit value over $200,000 or including modification of parking surfaces or electric panels, to meet CalGreen requirements for "EV Ready" charging spaces and infrastructure.	Short	
T.1.c	Streamline permit processes (city, county, state, utility) for electric vehicle charging infrastructure and alternative fuel stations.	Short	
T.1.d	Enhance promotion of public and private conversion to zero-emission vehicles through implementation of the City General Plan; including use of City events, social media, and the City website to educate on benefits of zero-emission vehicles and available incentives.	Short	
T.1.e	Establish an ordinance that restricts use of gas-powered lawn equipment, including leaf blowers, and provide information on the City website outlining available incentives.	Short	

Sustainable Ecosystems | **Economic Security** | **Public Health** | **Improved Air Quality** | **Resource Efficiency** | **Green Jobs**

Now — **Short-** 3 years — **Mid-** 5 years — **Long-term** 10+ years

***Move added based on community feedback**

Move ID	Move	Time frame	Co-Benefits
T.1.f	Adopt an EV Readiness Reach Code requiring new commercial construction to provide the minimum number of EV capable spaces to meet Tier 2 requirements (20% of total). In doing so the City will: ✓ Engage with stakeholders, both internal stakeholders, such as local government staff and officials, and external stakeholders, such as local developers regarding the purpose and impact of the reach code ✓ Conduct a cost effectiveness study ✓ Develop and draft an ordinance ✓ Conduct public hearings, public notices, and formally adopt the ordinance ✓ Submit the adopted ordinance to the California Energy Commission (CEC)	Short	
T.1.g	Earmark and identify additional funding for implementation of the EV Readiness Plan to include public charging infrastructure in key locations.	Short / Mid	

Play T.2 **Implement programs for public and shared transit that decrease passenger car vehicle miles traveled 2% by 2030 and 4% by 2045.**

Target 2030: 807 MT of CO_2e

2045: 1,399 MT of CO_2e

Move ID	Move	Time frame	Co-Benefits
T.2.a	Conduct a Feasibility and Community Interest Study on the four transit improvement options of the City's General Plan.	Short	
T.2.b	Pursue a community car, bike, or e-scooter "micro-transit" share pilot consistent with the City General Plan.	Short	

Sustainable Ecosystems | Economic Security | Public Health | Improved Air Quality | Resource Efficiency | Green Jobs

Short- (Now – 3 years) | Mid- (3 years – 5 years) | Long-term (5 years – 10+ years)

**Move added based on community feedback*

Move ID	Move	Time frame	Co-Benefits
T.2.c	Conduct local transportation surveys to better understand the community's needs and motivation for traveling by car versus other alternatives such as bus or Metro Gold Line light rail. Use survey results to inform transit expansion and improvement projects.	Short / Mid	
T.2.d	Adopt a Transportation Demand Management (TDM) Plan for the City that includes a transit system focus. Provide incentives for implementation of TDM measures at local businesses and new developments.	Mid	
T.2.e	Facilitate transportation equity through targeted provision of programs that encourage minority, low-income, disabled, and senior populations to take transit, walk, bike, use rideshare or car share.	Mid	

Play T.3 **Develop and implement an Active Transportation Plan to shift 3% of passenger car vehicle miles traveled to active transportation by 2030, and 6% by 2045.**

Target 2030: 1,186 MT of CO_2e

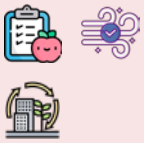
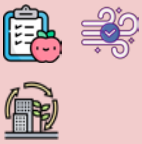
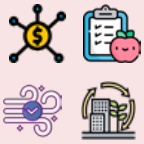
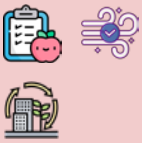
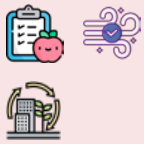
2045: 2,015 MT of CO_2e

Move ID	Move	Time frame	Co-Benefits
T.3.a	Develop and adopt an Active Transportation Plan consistent with Southern California Association of Governments (SCAG) 2016 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) that will identify funding strategies and policies for development of pedestrian, bicycle, and other alternative modes of transportation projects. Establish citywide events, outreach, educational programs, and platforms to promote active transportation in the community in support of the General Plan.	Short	
T.3.b	Conduct a Street/Intersection Study to identify streets and intersections that can be improved for pedestrians and bicyclists through traffic calming measures and/or where multi-use pathway opportunities exist to increase active transportation.	Short	

Sustainable Ecosystems | Economic Security | Public Health | Improved Air Quality | Resource Efficiency | Green Jobs

Short- (Now) | Mid- (3 years) | Long-term (5 years, 10+ years)

**Move added based on community feedback*

Move ID	Move	Time frame	Co-Benefits
T.3.c	Annually review and update the City's Bicycle and Pedestrian Network Map and post throughout City.	Short	
T.3.d*	Work with the Community Service Department or South Pasadena Police Department to develop programs and classes to teach and promote bicycle riding education and safety to residents of all ages and skill levels.	Short	
T.3.e	Conduct a nexus study and develop an ordinance requiring payment of fees from development projects to implement safe active transportation routes and infrastructure citywide.	Mid	
T.3.f	Amend zoning code to require installation of bike stalls or lockers at new developments, "mobility hubs", and during change of use of existing buildings, consistent with the General Plan.	Mid	
T.3.g	Adopt a Trip Reduction Ordinance that incudes requirements in the Zoning Code to require end-of-trip facilities for cyclists (e.g., showers, bike repair kiosks, and lockers) in new, non-residential building projects of a specified size.	Mid	

Water

W.1		**Reduce per capita water consumption by 10% by 2030 and 35% by 2045.**

Water

Play W.1 **Reduce per capita water consumption by 10% by 2030 and 35% by 2045.**

Target 2030: 414 MT of CO_2e

2045: 0 MT of CO_2e

Move ID	Move	Time frame	Co-Benefits
W.1.a	Continue to enforce the Model Water Efficient Landscapes Ordinance.	Short	
W.1.b	Work with the Los Angeles County Sanitation District (LACSD) to bring recycled water lines and infrastructure to the City.	Short	
W.1.c	In conjunction with the Downtown Specific Plan Action and City General Plan Action, adopt an ordinance restricting the use of potable water for non-potable uses and requiring greywater capture for land uses that are excess water users (e.g. golf courses, car washes, large fields, etc.).	Short	
W.1.d	Implement Plays 1 through 4 under Goal II of the Green Action Plan on the provided implementation timeline, aiming to provide education and promotion of greywater systems. (See the City's Green Action Plan for more information).	Short	
W.1.e	In conjunction with Move II.1.1 of the City Green Action Plan, develop a Recycled Water Use Master Plan that identifies access to recycled water and quantity of recycled water available to the City, as well as establishes an implementation plan. The implementation plan shall identify land use types (i.e., landscaping, gold courses, fields) and specific projects that will switch from potable to recycled water use allowing for a goal of 20% of City's potable water use to be replaced with recycled water.	Short	
W.1.f	Implement 100% renewable power for all pumping and treatment of water.	Short	

Sustainable Ecosystems | Economic Security | Public Health | Improved Air Quality | Resource Efficiency | Green Jobs

Short- (Now – 3 years) | Mid- (3 years – 5 years) | Long-term (5 years – 10+ years)

***Move added based on community feedback**

Solid Waste

SW.1		**Implement and enforce SB 1383 organics and recycling requirements to reduce landfilled organics waste emissions 50% by 2022 and 75% by 2025.**
SW.2		**Reduce residential and commercial waste sent to landfills by 50% by 2030 and 100% by 2045.**

Solid Waste

Play SW.1 **Implement and enforce SB 1383 organics and recycling requirements to reduce landfilled organics waste emissions 50% by 2022 and 75% by 2025.**

Target 2030: 1,702 MT of CO_2e

2045: 1,764 MT of CO_2e

Move ID	Move	Time frame	Co-Benefits
SW.1.a	Adopt procurement policies to comply with SB 1383 requirements for jurisdictions to purchase recovered organic waste products.	Short	
SW.1.b	Adopt an ordinance requiring compliance with SB 1383. Ensure ordinances established through the City General Plan Action and the Zero Waste Plan are consistent with SB 1383 requirements; and revise ordinances if necessary.	Short	
SW.1.c	Adopt an Edible Food Recovery Ordinance for edible food generators, food recovery services, or organization that are required to comply with SB 1383.	Short	
SW.1.d	Partner with the City's waste hauler, to provide organic waste collection and recycling services to all commercial and residential generators of organic waste.	Short	
SW.1.e	Adopt an ordinance requiring all residential and commercial customers to subscribe to an organic waste collection program and/or report self-hauling or backhauling of organics.	Short	
SW.1.f	Conduct a Feasibility Study and prepare an action plan to ensure edible food reuse infrastructure is sufficient to accept capacity needed to recover 20% of edible food disposed or identify proposed new or expanded food recovery capacity.	Short	
SW.1.g	Establish an education and outreach program for school children and adults around food waste prevention, nutrition education, and the importance of edible food recovery. Support City Green Action Plan Play III identified educational goals (Move III.1.3., Move III.1.4., Move III1.6., Move III.2.1, Move III. 3.3, and Move III.4.2) through an established educational program.	Mid	

Sustainable Ecosystems | **Economic Security** | **Public Health** | **Improved Air Quality** | **Resource Efficiency** | **Green Jobs**

Short- Now | **Mid-** 3 years | **Long-term** 5 years – 10+ years

***Move added based on community feedback**

Move ID	Move	Time frame	Co-Benefits
SW.1.h	Establish an edible food recovery program supporting the City General Plan and the City Green Action Plan Move III.1.2 to minimize food waste.	Short / Mid	
SW.1.i	Adopt an ordinance or enforceable mechanism to regulate haulers collecting organic waste, including collection program requirements and identification of organic waste receiving facilities.	Short / Mid	
SW.1.j	Partner with City waste services to: ✓ Ensure organic waste collection from mixed waste containers are transported to a high diversion organic waste processing facility. ✓ Provide quarterly route reviews to identify prohibited contaminants potentially found in containers that are collected along route. ✓ Clearly label all new containers indicating which materials are accepted in each container, and by January 1, 2025, place or replace labels on all containers.	Mid	

Play SW.2 **Reduce residential and commercial waste sent to landfills by 50% by 2030 and 100% by 2045.**

Target 2030: 415 MT of CO_2e

2045: 859 MT of CO_2e

Move ID	Move	Time frame	Co-Benefits
SW.2.a	Develop and implement a Zero Waste Plan, consistent with the General Plan Action, in order to reach South Pasadena's goal of zero waste by 2040.	Short	
SW.2.b*	Provide ongoing education to residents, business owners, and South Pasadena School District regarding waste reduction, composting, and recycling.	Short	

Sustainable Ecosystems | Economic Security | Public Health | Improved Air Quality | Resource Efficiency | Green Jobs

Short- (Now – 3 years) | Mid- (3 years – 5 years) | Long-term (5 years – 10+ years)

Move added based on community feedback

Move ID	Move	Time frame	Co-Benefits
SW.2.c	Increase reuse, recycling, and composting at temporary public events by mandating the installation of public recycling and composting containers and collection service; and encouraging reusable food ware, when relevant, according to the California State Retail Food Code.	Short	
SW.2.d	Develop a waste department or working group to enhance recycling and composting outreach and provide technical assistance or information in support of City Green Action Plan Move III. Additionally, implement and share a Recycle and Reuse Directory through City platforms, in support of Green Action Plan Move I.2.5.	Short	
SW.2.e	Adopt an ordinance requiring compliance with Sections 4.410.2, 5.410.1, 4.408.1, and 5.408.1 of the California Green Building Standards Code related to construction of buildings with adequate space for recycling containers and construction and demolition (C&D) recycling.	Short	
SW.2.f	Implement the City General Plan, requiring construction sites to separate waste for proper diversion and reuse or recycling.	Short	
SW.2.g	Develop and implement a Waste Stream Education Program targeting property managers of multi-family residences and the commercial sector, in support of Goal III of the City Green Action Plan.	Short	
SW.2.h	Develop policies to mandate/encourage reduction of waste and reuse in the food industry (e.g. facilities serving prepared food and prepackaged food; home meal delivery services), hospitality industry, and other commercial industries. Efforts may include developing ordinances for food service ware and a ban on single-use individual toiletry bottles in hotels/motels, grant/discount programs for switching to reusables, fast food champion pilot project, and working with home meal delivery services (e.g., Blue Apron), etc. to explore opportunities to reduce single-use packaging and encourage reuse.	Short	
SW.2.i	Encourage reusable foodware; or if reusable foodware is not a feasible option, explore opportunities to mandate/encourage a switch to more environmentally friendly alternatives for various products in the commercial industry, when relevant.	Short	

Carbon Sequestration

CS.1		**Increase carbon sequestration through increased tree planting and green space.**

Carbon Sequestration

Play CS.1 **Increase carbon sequestration through increased tree planting and green space.**

Target 2030: 19 MT CO_2e

2045: 39 MT CO_2e

Move ID	Move	Time frame	Co-Benefits
CS.1.a	Identify and map public spaces that can be converted to green space, including public parking that can be converted to parklets, freeway airspace that can be made into green space, vertical walls that can be planted with vines, and rooftops of public buildings that can be developed into gardens.	Short	
CS.1.b	Adopt a Greenscaping Ordinance that has a street tree requirement for all zoning districts, has a shade tree requirement for new development, requires greening of parking lots, and increases permeable surfaces in new development.	Short	
CS.1.c	Prepare and adopt an Urban Forest Management Plan for the City that includes an inventory of existing trees, identifies future tree planting opportunities, and a climate-ready tree palette, as well as ongoing operations and maintenance needs.	Short / Mid	
CS.1.d	Adopt a standard policy and set of practices for expanding urban tree canopy and placing vegetative barriers between busy roadways and developments to reduce exposure to air pollutants from traffic.	Short / Mid	

Sustainable Ecosystems | Economic Security | Public Health | Improved Air Quality | Resource Efficiency | Green Jobs

Short- (Now – 3 years) | Mid- (3 years – 5 years) | Long-term (5 years – 10+ years)

***Move added based on community feedback**

Municipal

M.1		**Reduce carbon intensity of City operations.**
M.2		**Electrify the municipal vehicle fleet and mobile equipment.**
M.3		**Increase City's renewable energy production and energy resilience.**

Municipal

Play M.1 **Reduce carbon intensity of City operations.**

Target 2030: 188 MT of CO_2e

2045: 188 MT of CO_2e

Move ID	Move	Time frame	Co-Benefits
M.1.a	As recommended in the 2016 Renewable Energy Council Report, complete energy audits for all City facilities and implement all feasible recommendations for fuel switching and efficiency upgrades.	Short	
M.1.b	As recommended in the 2016 Renewable Energy Council Report, purchase renewable natural gas (RNG) for applicable City fleet vehicles.	Short	
M.1.c	As recommended in the 2016 Renewable Energy Council Report, install PV solar systems at the City Hall and at Wilson Reservoir.	Mid	
M.1.d	Adopt retrofitting policy for City owned buildings such that energy efficient and electrification retrofits are incorporated into City buildings as they become available.	Mid	
M.1.e	Develop a policy for the City which would require all new building RFP's to include life cycle costing over 30 years and tie this directly to energy consumption and building electrification. This would include the buildings operational and maintenance costs and ensure that the City has the most cost effective (and sustainable) building possible.	Mid / Long	
M.1.f	As recommended in the 2016 Renewable Energy Council Report, invest all savings from City energy efficiency projects into a new revolving green fund that can be used to fund additional energy efficiency and GHG reduction projects.	Long	

Sustainable Ecosystems | Economic Security | Public Health | Improved Air Quality | Resource Efficiency | Green Jobs

Short- (Now – 3 years) | Mid- (3 years – 5 years) | Long-term (5 years – 10+ years)

***Move added based on community feedback**

Play M.2 **Electrify the municipal vehicle fleet and mobile equipment.**

Target 2030: 23 MT of CO_2e

2045: 23 MT of CO_2e

Move ID	Move	Time frame	Co-Benefits
M.2.a	Develop a suite of transportation demand management tools to incentivize alternative transportation methods for employees, including telecommute options.	Short	
M.2.b	Provide bicycles and bicycle storage for employees to use during work hours for short business or personal trips.	Short	
M.2.c	Develop and adopt a policy to apply lifecycle assessment to all new vehicle and equipment purchases.	Mid	
M.2.d	Implement the City Fleet Alternative Fuel Conversion Policy developed under the City General Plan, electrifying the City vehicle fleet and using it to encourage residents to convert as well.	Mid	
M.2.e	Install EV charging stations at municipal buildings.	Mid	

Sustainable Ecosystems **Economic Security** **Public Health** **Improved Air Quality** **Resource Efficiency** **Green Jobs**

Short- Now — **Mid-** 3 years — **Long-term** 5 years — 10+ years

Move added based on community feedback

Play M.3	**Increase City's renewable energy production and energy resilience.**
Target	Supportive of 2030 Goals
	Supportive of 2045 Goals

Move ID	Move	Time frame	Co-Benefits
M.3.a	Conduct a Feasibility Study to determine which City buildings would serve as ideal resilience centers including solar and battery installations.	Short	
M.3.b	Convert all streetlights to light emitting diode (LED) bulbs.	Short	
M.3.c	Work with the CPA to identify and develop local solar projects to connect to the grid.	Mid	
M.3.d	Install solar arrays at facilities that currently do not have solar arrays and work with emergency services to add solar and battery storage at priority locations. Review options for potential to combine multiple buildings into micro-grid systems.	Mid	
M.3.e*	Explore opportunities and partnerships to develop renewable-powered fuel cell micro-grids to provide back-up or primary power for critical facilities such as hospitals and schools as a clean alternative to diesel generators.	Long	

Sustainable Ecosystems | **Economic Security** | **Public Health** | **Improved Air Quality** | **Resource Efficiency** | **Green Jobs**

Short- Now – 3 years | **Mid-** 3 years – 5 years | **Long-term** 5 years – 10+ years

Move added based on community feedback

Adaptation

Even if all GHG emission generating sources stopped producing and emitting GHG emissions today, the current concentration of emissions in the atmosphere would continue to impact the climate and City of South Pasadena. Specifically, as mentioned in the *Introduction*, the City of South Pasadena is likely to increasingly experience extreme heat events, reductions in fresh-water supply, and increased average temperatures.[24] These impacts will have heterogeneous effects on the City's residents, business owners, and visitors; infrastructure; environment; and economy and, therefore, adaptive measures must be taken to increase the City's resilience. This section connects the Plays and Moves presented in this CAP to measures to further adapt and increase the City's resilience to climate change.

Junior High School Bell Tower

Increased Average Temperatures and Extreme Heat

As previously mentioned, the City of South Pasadena is expected to see increasing trends in extreme-heat days. This increase in extreme heat days coupled with more heat waves will result in longer heat waves.[25] Extreme

24. https://www.ipcc.ch/sr15/chapter/chapter-3/
25. https://cal-adapt.org/tools/annual-averages/

heat events will have greater effects on populations such as the homeless, aging adults, outdoor workers, people with chronic illnesses, and pregnant women. Homeless people may not have access to indoor spaces or even shade to escape these temperatures. Whereas, aging adult populations and those who are chronically ill have a reduced ability to adapt to temperature changes and are therefore more susceptible to heat strokes and other serious heat-induced illnesses. To help increase the City's resilience to these events, there are long-term preventative strategies such as strategic planting of trees and vegetation cover, improvements in the built environment, and rebate and home-cooling programs, which are included in the various Plays and Moves. For example, trees provide shade and reduce temperatures through evapotranspiration. These benefits from strategically planted trees and vegetation can help reduce peak summer temperatures by 2-9°F.[26] Increased tree cover and vegetation will help mitigate the effects of urban heat islands, which include areas in South Pasadena that experience compounded heating due to built environments absorbing more heat than rural communities.[27]

Reductions in Fresh Water

As weather patterns continue to change, more precipitation is likely to occur as rain which will affect regional snowpack and therefore South Pasadena's water resources. Changes in precipitation coupled with increased temperatures can cause periods of abnormally dry weather, further affecting water-supply. While many of these issues occur at a greater regional and even global scale, the City and community can take steps to conserve water at a local level. Planting drought-tolerant landscaping can lessen the demand for irrigation and help decrease stormwater runoff. At home, residents can install high-efficiency toilets and showerheads, only run full loads of laundry and dishes, and take shorter showers; these small changes can save hundreds of gallons of water a month. The community must be educated on these practices to reap the water saving benefits and the City government will play a role in this education.

Air Pollution

The City's urban environment and location decreases the direct risk of wildfire. However, the wildland interface in the hillside area, specifically the section of the City located south of Monterey Road and west of Meridian Avenue, is at risk to wildfire.[28] South Pasadena has robust fire-readiness efforts detailed in the General Plan Safety Element. Nonetheless, if a wildfire were to occur in this area, the air quality would significantly decrease and greatly affect human health, especially the respiratory systems of young children, older adults, homeless communities, and those with chronic illnesses. The combustion of fossil fuels, especially within the transportation sector, also leads to decreased local air quality and health consequences for local communities.

If temperatures continue to rise as predicted in the Cal-Adapt scenarios, there will be more days with weather conducive to ozone formation, leading to reduced air quality and increased health problems. To help improve local air quality, community members can opt to bike, take public transit, or carpool instead of taking their personal vehicle.[29] All of the City's Moves detailed under Transportation, Play T.1, aim to increase the use of zero-emission vehicles and equipment which will help increase local air quality. The transportation section incentivizes the transition to electric vehicles by increasing charging stations, conducting an EV feasibility study, exploring ordinances on gas-powered lawn equipment, and developing an Active Transportation Plan, to name a few, which will all lead to increased air quality.

26. https://www.osti.gov/biblio/10180633
27. https://www.epa.gov/heatislands/learn-about-heat-islands
28. https://www.southpasadenaca.gov/home/showdocument?id=18657
29. https://ww2.arb.ca.gov/our-work/topics/simple-solutions-improve-air-quality

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Keeping Score

Implementation and the Next Steps

Implementation

This Climate Action Plan is the City of South Pasadena's roadmap to achieving the City's 2030 target and state mandated goal of 40% below 1990 levels by 2030, with the ultimate goal of achieving carbon neutrality by 2045. While substantial evidence suggests that the Plays and Moves outlined in this CAP will achieve the 2030 targets, uncertainty increases over time (see Appendix D for a discussion on the substantial evidence used to quantify the emission reductions attributable to each Play). The adoption rates of each Play and Move, costs of technology, legislative environment, and benefits assumed in this report will continue to evolve over time. Therefore, this CAP should be viewed as a strategic framework that will be reevaluated on a tri-annual basis. This section outlines how the City will implement the actions included in the CAP, monitor progress, and prepare updates over time.

The Team

Achieving long-term emission reduction goals will require participation from everyone. The City can update building codes, provide electric vehicle charging infrastructure and designate bike lanes, but it is up to the broader community to embrace these new services and technologies and gain the benefits outlined in this Plan. Making meaningful progress towards reducing our GHG emissions starts with City leadership, through policies, education, ordinances, and investments that act as catalysts for change throughout the wider community. Community partners like the Clean Power Alliance, Los Angeles Metro, and utility providers, then support these policies with incentives and programs. Businesses can then leverage these policies to provide new services and adopt more sustainable practices. Finally, residents and visitors that have been provided with the incentives and education, can actively work together to reduce our impacts and decrease GHG emissions. As policies and programs are developed and infrastructure is constructed, City staff will continue to engage the community, provide informative progress updates, and create ongoing opportunities to solicit community feedback. The City looks forward to working together to reduce our long-term impact from GHG emissions through new/updated programs and opportunities that will help meet the GHG emissions reduction goals. Thanks for being part of our team!

Figure 11 CAPDash – Implementation and Monitoring Tool

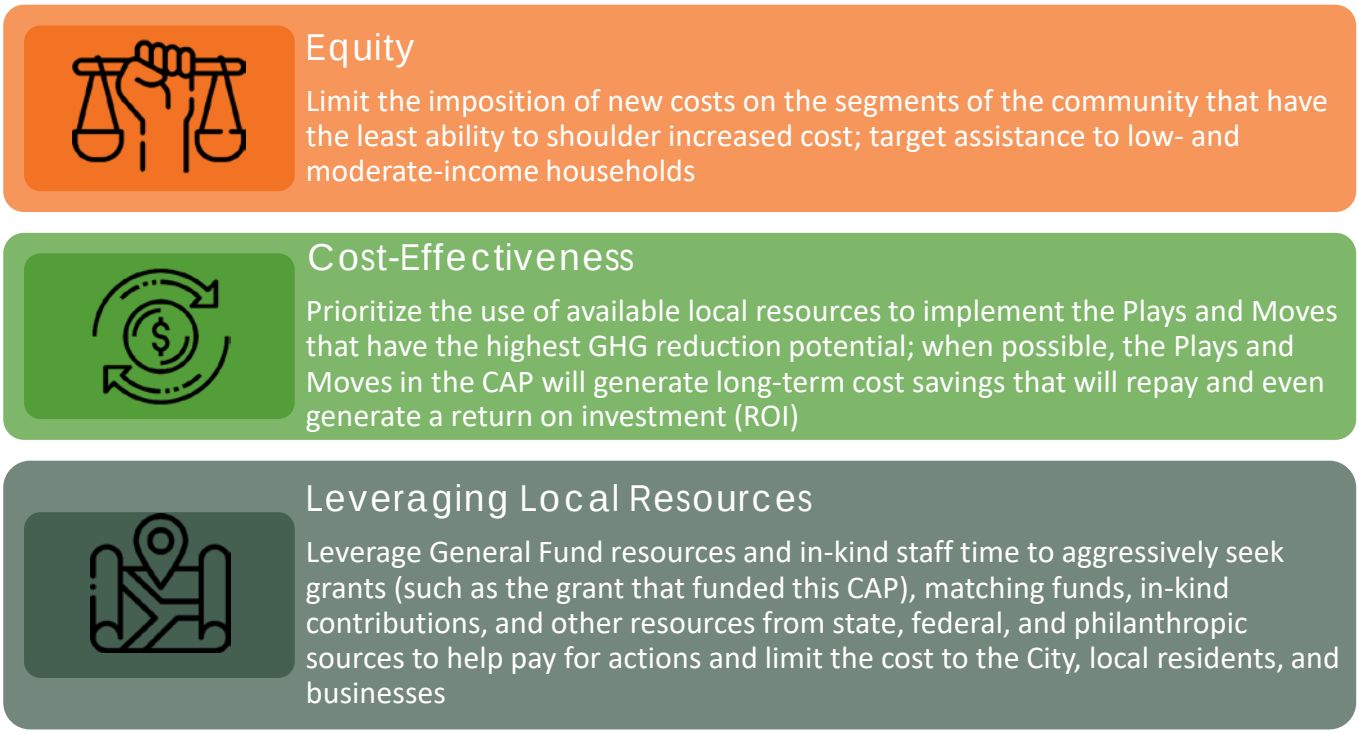
CAPDash

CAPDash is a customizable, web-based dashboard developed by Rincon Consultants, Inc. that allows the City of South Pasadena to track the annual emission reductions achieved through implementation of each Play and meet the requirements of CEQA Section 15183.5(b) (see Figure 11). The City will conduct annual implementation monitoring of the GHG emissions reduction measures and report out on this progress to City Council every third year beginning in 2023. The process for monitoring and quantifying measure implementation status relies on key target metrics identified for each of the Plays and Moves. By committing to annual monitoring of CAP implementation progress and adjusting where necessary, South Pasadena will rise to meet the local and global imperative of reducing greenhouse gas emissions. In the process of meeting that challenge, we will benefit from the supplemental health, economic, resilience, and other co-benefits of the GHG emissions reduction measures. This gameplan marks another major milestone in the City's commitment to a sustainable future.

Funding Strategy

This Plan focuses first and foremost on Plays and Moves that are either no or low-cost to the community. The single largest GHG emissions reduction will come from a communitywide switch to the Clean Power Alliance's carbon-free power portfolio at very low cost to the community, which occurred in 2019. Not only will this single Play reduce GHG emissions, but it will also provide the foundation for the City's long-term GHG emissions reduction plan. Other Plays and Moves, such as electrification of existing buildings may not yet be feasible for everyone. However, more and more resources are becoming available and being provided

Figure 12 Funding Strategy Principles



by the state, local government, and utilities to help fund this transition. The City will seek grants, matching funds, in-kind contributions, and other resources to help pay for Plays and Moves and limit the cost of implementation to the City and our collective community.

Full implementation of the City's CAP will require investments on the part of the City, local households and property owners, and commercial businesses. In most cases, the expenditures will not only help to reduce GHG emissions but will also bring other valuable co-benefits as described in the *Plays and Moves*. The CAP will be implemented over time. Funding sources for some actions can be identified at the outset, while the best means to fund other actions will be determined at the time the City is ready to implement them, depending on the resources available. Three primary principles can help the City determine the best approach to funding various Plays and Moves, including: equity, cost-effectiveness, and ability to leverage local resources, as outlined in Figure 12. An overview of funding sources can be found in Table 7 and a detailed Funding Strategy is provided in Appendix E.

Going the Distance

If the City has not made sufficient progress on GHG emissions reduction goals by the next triennial review, a CAP update may be required to establish new or more robust emission reduction goals to increase emissions reductions and maintain status as a CEQA-qualified GHG emissions reduction plan. The CAP update could require additional implementation of the existing actions and/or additional actions such as shifting incentive and educational programs to mandatory requirements. A complete CAP update for post-2030 emissions reductions targets will be required, and City staff shall begin this effort by 2029, during the third triennial review.

Table 7 Funding Matrix

Move	Cost	City Lead	Potential Funding Source
Play C.1 Engage South Pasadena youth in climate action and provide education on ways to live a sustainable lifestyle			
C.1.a Support South Pasadena Unified School District by providing students with information on climate change and the beneficial role of trees.	$	Public Works, Community Services	U.S. EPA - Environmental Education Grants
C.1.b Utilize South Pasadena's historic neighborhoods to demonstrate to students the importance of mature urban trees in providing shade and reducing the urban heat island effect.	$	Public Works, Community Services	U.S. EPA - Environmental Education Grants
C.1.c Identify grant funding opportunities and engage with local nurseries to identify appropriate and cost-effective California native plants/trees that can be both planted in the ground or remain potted for students living in rental/multi-family homes.	$	Public Works, Community Services	General Fund
Play E.1 Maximize the usage of renewable power within the community, by continuing to achieve an opt-out rate lower than 4% for the Clean Power Alliance.			
E.1.a Monitor progress and perform public outreach and education campaigns highlighting the benefits of 100% renewable energy, including: ✓ Monitoring opt-out rates on an annual basis ✓ Tabling at community events ✓ Establishing an informational resource page on the City website ✓ Regular social media posts ✓ Energy bill inserts	$	Public Works	General Fund
Play E.2 Require electrification of 100% of newly constructed buildings.			
E.2.a Develop a webpage and materials for display at City Hall promoting the benefits of electrification and resources that can assist with the fuel-switching process.	$	Public Works, Building and Planning	General Fund
E.2.b Provide financial and technical resources, including hosting workforce development trainings for installers and building owners/operators to discuss benefits and technical requirements of electrification.	$	Building and Planning	Foothill Workforce Development Board – job training
E.2.c Perform regular internal trainings with planners and building officials on current state decarbonization goals and incentives available for electric homes.	$	Building and Planning	General Fund

$ <$10,000 **Low Cost** | $$ $10,000 to $50,000 **Medium Cost** | $$$ ≥$50,000 **High Cost**

Public Works | Finance | Management Services | Community Services | Building and Planning

Move	Cost	City Lead	Potential Funding Source
E.2.d Provide education around cooking with electric appliances, including demonstrations from chefs and/or local restaurants, as available.	$		General Fund
E.2.e Adopt an Electrification Readiness reach code for all new buildings and accessory dwelling units which bans the piping of natural gas. In doing so the City will: ✓ Engage with stakeholders, both internal stakeholders, such as City staff and officials, and external stakeholders, such as local developers regarding the purpose and impact of the reach code ✓ Conduct a cost effectiveness study ✓ Develop and draft an ordinance ✓ Conduct public hearings, public notices, and formally adopt the ordinance ✓ Submit the adopted ordinance to the California Energy Commission (CEC)	$ - $$		General Fund
E.2.f Adopt an ordinance that allows granting of minor allowances for certain site development standards when there is no practical ways to design a project to be all electric	$ - $$		General Fund
Play E.3 Electrify 5% of existing buildings by 2030 and 80% by 2045.			
E.3.a Develop an existing building electrification permit tracking program to track annual progress in achieving the targeted electrification goal.	$		General Fund
E.3.b Keep an updated list of rebates and incentives available to residents who would like to convert their buildings to electric power.	$		General Fund
E.3.c Provide education on the potential energy savings and benefits of electric heat pumps for water heating and space heating when permits for replacement are obtained.	$		General Fund
E.3.d Work with Southern California Edison (SCE) and/or the Clean Power Alliance to provide rebates for residential replacement of natural gas-powered air and water heating appliances with electric-powered.	$		1. General Fund 2. SCE 3. Clean Power Alliance for rebate funding
E.3.e Promote water heater, space heating, and appliance (electric stoves/dryers) replacement programs and incentives (residential) at time of construction permit.	$		General Fund
E.3.f Perform an existing buildings analysis in order to understand the potential for electrification retrofitting in South Pasadena and establish a roadmap for eliminating natural gas from existing buildings.	$$ - $$$		California Energy Commission – Energy Partnership Program

Move	Cost	City Lead	Potential Funding Source
E.3.g Establish a comprehensive, coordinated education campaign focused towards property owners, landlords, property management companies, and occupants for reducing the use of natural gas in homes and businesses. Establish a shared understanding of existing incentives for electric appliances and upgrades, and how to access them, including SCE incentive programs and rebates.	$$		1. SCE/CPA or SCG – rebates, incentives, and financing programs 2. U.S. EPA - Environmental Education Grants
E.3.h Perform a cost-effectiveness study for electrification retrofitting, including requirements for newly permitted HVAC/hot water heaters and other appliances to be electric.	$		California Energy Commission
E.3.i Develop a best practices model based on the progress electrifying existing buildings in South Pasadena and outside of South Pasadena to significantly increase electrification post-2030.	$		General Fund
Play E.4 Develop and promote reduced reliance on natural gas through increased clean energy systems that build off of renewable energy development, production, and storage.			
E.4.a Conduct a Feasibility Study to assess cost and applicable locations for installation of battery back-up systems or generators throughout the City in support of the General Plan.	$$		California Energy Commission (CEC) - Energy Partnership Program
E.4.b Promote installation of storage technology in concert with renewable energy infrastructure through educational programs, outreach, and information provided via City platforms.	$		General Fund
E.4.c Conduct "micro-grid" Feasibility/Pilot Study in support of the General Plan.	$$		California Energy Commission (CEC) - Energy Partnership Program
E.4.d In support of the General Plan, develop and implement a Solar Action Plan with a goal of meeting 50% of South Pasadena's power demand through solar by 2040.	$$ - $$$		Private Solar Dealers/Installers
E.4.e In support of the 2018-2019 City Strategic Plan, develop a strategy and implementation schedule for the Renewable Energy Plan, after feasibility study.	$$		General Fund
E.4.f Adopt a PV (Solar) Ordinance requiring newly constructed and majorly renovated multi-family and commercial buildings to install PV systems with an annual output greater or equal to 25% of buildings electricity demand. Ensure consistency of ordinance with the City General Plan.	$ - $$		General Fund
E.4.g Require all new structures or major retrofits to be pre-wired for solar panels, consistent with the General Plan.	$		General Fund

$ <$10,000 **Low Cost** | $$ $10,000 to $50,000 **Medium Cost** | $$$ ≥$50,000 **High Cost** | Public Works | Finance | Management Services | Community Services | Building and Planning

Move	Cost	City Lead	Potential Funding Source
E.4.h Work with various City departments to establish and streamline battery storage requirements to allow for easier implementation of these technologies throughout the City.	$	Public Works, Building and Planning	General Fund
E.4.i Work with home and business owners, including those in the historic districts, to identify and promote renewable energy demonstration projects to showcase the benefits.	$	Public Works, Building and Planning	General Fund
E.4.j Work with SCE and the CPA to develop a program and timeline for increasing resilience to power losses, including Public Safety Power Shutoffs (PSPS), and climate-driven extreme weather events for low-income, medically dependent, and elderly populations through installation of renewable energy and onsite energy storage with islanding capabilities, following appropriate project-level environmental review.	$ $ $	Public Works	1. SCE 2. CPA
Play T.1 Increase use of zero-emission vehicle and equipment 13% by 2030 and 25% by 2045.			
T.1.a Develop an EV Readiness Plan to establish a path forward to increase EV infrastructure within the City and promote mode shift to EVs, that is consistent with the City General Plan. In conjunction with an EV Readiness Plan, conduct a community EV Feasibility Study to assess infrastructure needs and challenges.	$ $	Public Works	1. Moving California, California Climate Investments - Sustainable Transportation Equity Project (STEP) 2. CARB- Clean Vehicle Rebate Program
T.1.b Adopt an EV Charging Retrofits in Existing Commercial and Multifamily Buildings reach code requiring major retrofits, with either a permit value over $200,000 or including modification of parking surfaces or electric panels, to meet CalGreen requirements for “EV Ready” charging spaces and infrastructure.	$ - $ $	Public Works, Building and Planning	1. Moving California, California Climate Investments - STEP 2. CAL eVIP - Southern California Incentive Project (SCIP)
T.1.c Streamline permit processes (city, county, state, utility) for electric vehicle charging infrastructure and alternative fuel stations.	$	Building and Planning	General Fund
T.1.d Enhance promotion of public and private conversion to zero-emission vehicles through implementation of the City General Plan; including use of City events, social media, and the City website to educate on benefits of zero-emission vehicles and available incentives.	$	Public Works	General Fund
T.1.e Establish an ordinance that restricts use of gas-powered lawn equipment, including leaf blowers, and provide information on the City website outlining available incentives.	$ - $ $	Public Works	General Fund

$ <$10,000 **Low Cost** | $ $ $10,000 to $50,000 **Medium Cost** | $ $ $ ≥$50,000 **High Cost** | Public Works | Finance | Management Services | Community Services | Building and Planning

Move	Cost	City Lead	Potential Funding Source
T.1.f Adopt an EV Readiness Reach Code requiring new commercial construction to provide the minimum number of EV capable spaces to meet Tier 2 requirements (20% of total). In doing so the City will: ✓ Engage with stakeholders, both internal stakeholders, such as local government staff and officials, and external stakeholders, such as local developers regarding the purpose and impact of the reach code ✓ Conduct a cost effectiveness study ✓ Develop and draft an ordinance ✓ Conduct public hearings, public notices, and formally adopt the ordinance ✓ Submit the adopted ordinance to the California Energy Commission (CEC)	$ - $$	Public Works, Management Services	1. General Fund 2. AB 2766 funds
T.1.g Earmark and identify additional funding for implementation of the EV Readiness Plan to include public charging infrastructure in key locations.	$	Public Works	1. General Fund 2. AB 2766 – local subventions 3. Funding from EV charging station companies
Play T.2 Implement programs for public and shared transit that decrease passenger car VMT 3% by 2030 and 6% by 2045.			
T.2.a Conduct a Feasibility and Community Interest Study on the four transit improvement options of the City's General Plan.	$$	Management Services	1. SCAG - Sustainable Communities Program 2. AB 2766 - Local Subventions 3. LA County Measures A, C, R, M - Local Return Program
T.2.b Pursue a community car, bike, or e-scooter "micro-transit" share pilot consistent with the City General Plan.	$	Management Services	AB2766 - Local Subventions
T.2.c Conduct local transportation surveys to better understand the community's needs and motivation for travelling by car versus other alternatives such as bus or Metro Gold Line light rail. Use survey results to inform transit expansion and improvement projects.	$ - $$	Public Works, Management Services	General Fund
T.2.d Adopt a Transportation Demand Management (TDM) Plan for the City that includes a transit system focus. Provide incentives for implementation of TDM measures at local businesses and new developments.	$$ - $$$	Management Services	LA County Measures A, C, R, M – Local Return Program

$ <$10,000 **Low Cost** | $$ $10,000 to $50,000 **Medium Cost** | $$$ ≥$50,000 **High Cost** | Public Works | Finance | Management Services | Community Services | Building and Planning

Move	Cost	City Lead	Potential Funding Source
T.2.e Facilitate transportation equity through targeted provision of programs that encourage minority, low-income, disabled, and senior populations to take transit, walk, bike, use rideshare or car share.	$	Public Works, Management Services	LA County Measures A, C, R, M – Local Return Program
Play T.3 Develop and implement an Active Transportation Plan to shift 3% of passenger car VMT to active transportation by 2030, and 5% by 2045.			
Play T.3.a Develop and adopt an Active Transportation Plan consistent with SCAG 2016 RTP/SCS that will identify funding strategies and policies for development of pedestrian, bicycle, and other alternative modes of transportation projects. Establish citywide events, outreach, educational programs, and platforms to promote active transportation in the community in support of the General Plan.	$ $ $	Public Works, Management Services	1. California Transportation Commission (CTC) - Active Transportation Program (ATP) 2. LA Metro - TDA Article 3
Play T.3.b Conduct a Street/Intersection Study to identify streets and intersections that can be improved for pedestrians and bicyclists through traffic calming measures and/or where multi-use pathway opportunities exist to increase active transportation.	$ - $ $	Public Works	1. California Transportation Commission (CTC) - Local Partnership Program (LPP) 2. Mitigation fees paid by new development projects that contribute to VMT - Local VMT-based transportation impact fee or local/regional VMT bank/exchange program 3. LA Metro - TDA Article 3
Play T.3.c Annually review and update the City's Bicycle and Pedestrian Network Map and post throughout City.	$	Management Services	General Fund
Play T.3.d Work with the Community Service Department or South Pasadena Police Department to develop programs and classes to teach and promote bicycle riding education and safety to residents of all ages and skill levels.	$	Public Works	General Fund
Play T.3.e Conduct a nexus study and develop an ordinance requiring payment of fees from development projects to implement safe active transportation routes and infrastructure citywide.	$ - $ $	Public Works	Mitigation fees paid by new development projects
Play T.3.f Amend zoning code to require installation of bike stalls or lockers at new developments, "mobility hubs", and during change of use of existing buildings, consistent with the General Plan.	$	Public Works, Management Services	General Fund, combine with Play T.3.g

$ <$10,000 **Low Cost** | $ $ $10,000 to $50,000 **Medium Cost** | $ $ $ ≥$50,000 **High Cost** | Public Works | Finance | Management Services | Community Services | Building and Planning

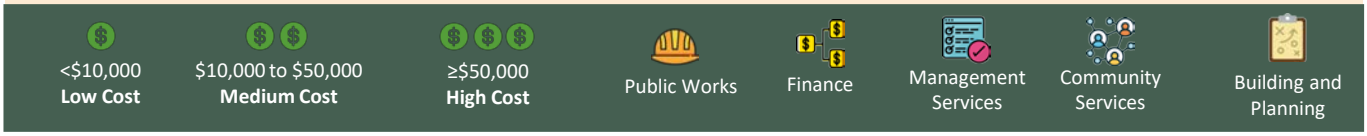
Move	Cost	City Lead	Potential Funding Source
Play T.3.g Adopt a Trip Reduction Ordinance that incudes requirements in the Zoning Code to require end-of-trip facilities for cyclists (e.g., showers, bike repair kiosks, and lockers) in new, non-residential building projects of a specified size.	$ - $$		General Fund
Play W.1 Reduce per capita water consumption by 10% by 2030 and 35% by 2045.			
W.1.a Continue to enforce the Model Water Efficient Landscapes Ordinance.	$		General Fund
W.1.b Work with the Los Angeles County Sanitation District (LACSD) to bring recycled water lines and infrastructure to the City.	$$$		1. User Fees 2. Water Resources Control Board- Water Recycling Funding Program - Construction Grant
W.1.c In conjunction with the Downtown Specific Plan Action and City General Plan Action, adopt an ordinance restricting the use of potable water for non-potable uses and requiring greywater capture for land uses that are excess water users (e.g. golf courses, car washes, large fields, etc.).	$ - $$		Water Conservation Funds
W.1.d Implement Plays 1 through 4 under Goal II of the Green Action Plan on the provided implementation timeline, aiming to provide education and promotion of greywater systems. (See the City's Green Action Plan for more information).	$		Water Conservation Funds
W.1.e In conjunction with Move II.1.1 of the City Green Action Plan, develop a Recycled Water Use Master Plan that identifies access to recycled water and quantity of recycled water available to the City, as well as establishes an implementation plan. The implementation plan shall identify land use types (i.e., landscaping, gold courses, fields) and specific projects that will switch from potable to recycled water use allowing for a goal of 20% of City's potable water use to be replaced with recycled water.	$$$		Water Resources Control Board - Water Recycling Funding Program - Planning Grant
W.1.f Implement 100% renewable power for all pumping and treatment of water.	$		General Fund
Play SW.1 Implement and enforce SB 1383 organics and recycling requirements to reduce landfilled organics waste emissions 50% by 2022 and 75% by 2025.			
SW.1.a Adopt procurement policies to comply with SB 1383 requirements for jurisdictions to purchase recovered organic waste products.	$		General Fund

$ <$10,000 **Low Cost**
$$ $10,000 to $50,000 **Medium Cost**
$$$ ≥$50,000 **High Cost**
Public Works
Finance
Management Services
Community Services
Building and Planning

Move	Cost	City Lead	Potential Funding Source
SW.1.b Adopt an ordinance requiring compliance with SB 1383. Ensure ordinances established through the City General Plan Action and the Zero Waste Plan are consistent with SB 1383 requirements; and revise ordinances if necessary.	$ - $$		User fees for solid waste services
SW.1.c Adopt an Edible Food Recovery Ordinance for edible food generators, food recovery services, or organization that are required to comply with SB 1383.	$ - $$		User fees for solid waste services
SW.1.d Partner with the City's waste hauler, to provide organic waste collection and recycling services to all commercial and residential generators of organic waste.	$		User fees for solid waste services
SW.1.e Adopt an ordinance requiring all residential and commercial customers to subscribe to an organic waste collection program and/or report self-hauling or backhauling of organics.	$ - $$		User fees for solid waste services
SW.1.f Conduct a Feasibility Study and prepare an action plan to ensure edible food reuse infrastructure is sufficient to accept capacity needed to recover 20% of edible food disposed or identify proposed new or expanded food recovery capacity.	$ - $$		CalRecycle - Food Waste Prevention and Rescue Grant Program
SW.1.g Establish an education and outreach program for school children and adults around food waste prevention, nutrition education, and the importance of edible food recovery. Support City Green Action Plan Play III identified educational goals (Move III.1.3., Move III.1.4., Move III1.6., Move III.2.1, Move III. 3.3, and Move III.4.2) through an established educational program.	$		U.S. EPA - Environmental Education Grants
SW.1.h Establish an edible food recovery program supporting the City General Plan and the City Green Action Plan Move III.1.2 to minimize food waste.	$		CalRecycle - Food Waste Prevention and Rescue Grant Program
SW.1.i Adopt an ordinance or enforceable mechanism to regulate haulers collecting organic waste, including collection program requirements and identification of organic waste receiving facilities.	$ - $$		General Fund, possibly incorporate costs into franchise agreement.
SW.1.j Partner with City waste services to: ✓ Ensure organic waste collection from mixed waste containers are transported to a high diversion organic waste processing facility. ✓ Provide quarterly route reviews to identify prohibited contaminants potentially found in containers that are collected along route. ✓ Clearly label all new containers indicating which materials are accepted in each container, and by January 1, 2025, place or replace labels on all containers.	$		User fees for solid waste services; incorporate into agreement with Athens Services

$ <$10,000 **Low Cost** | $$ $10,000 to $50,000 **Medium Cost** | $$$ ≥$50,000 **High Cost** | Public Works | Finance | Management Services | Community Services | Building and Planning

Move	Cost	City Lead	Potential Funding Source
Play SW.2 Reduce residential and commercial waste sent to landfills by 50% by 2030 and 100% by 2045.			
SW.2.a Develop and implement a Zero Waste Plan, consistent with General Plan Action A.3.17a, in order to reach South Pasadena's goal of zero waste by 2040.	$ - $$	Public Works	User fees
SW.2.b Provide ongoing education to residents, business owners, and South Pasadena School District regarding waste reduction, composting, and recycling.	$	Public Works	U.S. EPA - Environmental Education Grants
SW.2.c Increase reuse, recycling, and composting at temporary public events by mandating the installation of public recycling and composting containers and collection service; and encouraging reusable food ware, when relevant, according to the California State Retail Food Code.	$	Public Works	CalRecycle - Beverage Container Recycling Grants
SW.2.d Develop a waste department or working group to enhance recycling and composting outreach and provide technical assistance or information in support of City Green Action Plan Move III. Additionally, implement and share a Recycle and Reuse Directory through City platforms, in support of Green Action Plan Move I.2.5.	$ - $$	Public Works	General Fund
SW.2.e Adopt an ordinance requiring compliance with Sections 4.410.2, 5.410.1, 4.408.1, and 5.408.1 of the California Green Building Standards Code related to construction of buildings with adequate space for recycling containers and construction and demolition (C&D) recycling.	$ - $$	Building and Planning	General Fund, planning and building permit fees.
SW.2.f Implement the City General Plan, requiring construction sites to separate waste for proper diversion and reuse or recycling.	$	Public Works, Building and Planning	General Fund, planning and building permit fees.
SW.2.g Develop and implement a Waste Stream Education Program targeting property managers of multi-family residences and the commercial sector, in support of Goal III of the City Green Action Plan.	$	Public Works	General Fund
SW.2.h Develop policies to mandate/encourage reduction of waste and reuse in the food industry (e.g. facilities serving prepared food and prepackaged food; home meal delivery services), hospitality industry, and other commercial industries. Efforts may include developing ordinances for food service ware and a ban on single-use individual toiletry bottles in hotels/motels, grant/discount programs for switching to reusables, fast food champion pilot project, and working with home meal delivery services (e.g., Blue Apron), etc. to explore opportunities to reduce single-use packaging and encourage reuse.	$ - $$	Public Works	General Fund, affected businesses
SW.2.i Encourage reusable foodware; or if reusable foodware is not a feasible option, explore opportunities to mandate/encourage a switch to more environmentally friendly alternatives for various products in the commercial industry, when relevant.	$	Public Works	General Fund



Move	Cost	City Lead	Potential Funding Source
Play CS.1 Reduce residential and commercial waste sent to landfills by 50% by 2030 and 100% by 2045.			
CS.1.a Identify and map public spaces that can be converted to green space, including public parking that can be converted to parklets, freeway airspace that can be made into green space, vertical walls that can be planted with vines, and rooftops of public buildings that can be developed into gardens.	$	Public Works	CalFire - Urban and Community Forestry
CS.1.b Adopt a Greenscaping Ordinance that has a street tree requirement for all zoning districts, has a shade tree requirement for new development, requires greening of parking lots, and increases permeable surfaces in new development.	$ - $$	Public Works, Management Services	General Fund
CS.1.c Prepare and adopt an Urban Forest Management Plan for the City that includes an inventory of existing trees, identifies future tree planting opportunities, and a climate-ready tree palette, as well as ongoing operations and maintenance needs.	$$$	Public Works	CalFire - Urban and Community Forestry
CS.1.d Adopt a standard policy and set of practices for expanding urban tree canopy and placing vegetative barriers between busy roadways and developments to reduce exposure to air pollutants from traffic.	$	Public Works	General Fund
Play M.1 Reduce carbon intensity of City operations.			
M.1.a As recommended in the 2016 Renewable Energy Council Report, complete energy audits for all City facilities and implement all feasible recommendations for fuel switching and efficiency upgrades.	$$$	Public Works	California Energy Commission Energy Partnership Program
M.1.b As recommended in the 2016 Renewable Energy Council Report, purchase renewable natural gas (RNG) for applicable City fleet vehicles.	$	Public Works	General Fund
M.1.c As recommended in the 2016 Renewable Energy Council Report, install PV solar systems at the City Hall and at Wilson Reservoir.	$$$	Public Works	General Fund
M.1.d Adopt retrofitting policy for City owned buildings such that energy efficient and electrification retrofits are incorporated into City buildings as they become available.	$	Public Works	General Fund
M.1.e Develop a policy for the City which would require all new building RFP's to include life cycle costing over 30 years and tie this directly to energy consumption and building electrification. This would include the buildings operational and maintenance costs and ensure that the City has the most cost effective (and sustainable) building possible.	$	Public Works	General Fund
M.1.f As recommended in the 2016 Renewable Energy Council Report, invest all savings from City energy efficiency projects into a new revolving green fund that can be used to fund additional energy efficiency and GHG reduction projects.	$	Finance	General Fund

$ <$10,000 **Low Cost** | $$ $10,000 to $50,000 **Medium Cost** | $$$ ≥$50,000 **High Cost** | Public Works | Finance | Management Services | Community Services | Building and Planning

Move	Cost	City Lead	Potential Funding Source
Play M.2 Electrify the municipal vehicle fleet and mobile equipment.			
M.2.a Develop a suite of transportation demand management tools to incentivize alternative transportation methods for employees, including telecommute options.	$		General Fund
M.2.b Provide bicycles and bicycle storage for employees to use during work hours for short business or personal trips.	$		General Fund
M.2.c Develop and adopt a policy to apply lifecycle assessment to all new vehicle and equipment purchases.	$		General Fund
M.2.d Implement the City Fleet Alternative Fuel Conversion Policy developed under the City General Plan, electrifying the City vehicle fleet and using it to encourage residents to convert as well.	$		Southern California Air Quality Management District (SCAQMD) - Carl Moyer Program
M.2.e Install EV charging stations at municipal buildings.	$ $		1. Moving California, California Climate Investments, CARB - STEP 2. CAL eVIP, CA Energy Commission - Southern California Incentive Project (SCIP)
Play M.3 Increase City's renewable energy production and energy resilience.			
M.3.a Conduct a Feasibility Study to determine which City buildings would serve as ideal resilience centers including solar and battery installations.	$		General Fund
M.3.b Convert all streetlights to light emitting diode (LED) bulbs.	$ $ $		General Fund
M.3.c Work with the CPA to identify and develop local solar projects to connect to the grid.	$		General Fund, possibly incorporate costs into Lighting and Landscaping Assessment District
M.3.d Install solar arrays at facilities that currently do not have solar arrays and work with emergency services to add solar and battery storage at priority locations. Review options for potential to combine multiple buildings into micro-grid systems.	$ $ $		General Fund
M.3.e Explore opportunities and partnerships to develop renewable-powered fuel cell micro-grids to provide back-up or primary power for critical facilities such as hospitals and schools as a clean alternative to diesel generators.	$		General Fund

$ <$10,000 **Low Cost** | $ $ $10,000 to $50,000 **Medium Cost** | $ $ $ ≥$50,000 **High Cost** | Public Works | Finance | Management Services | Community Services | Building and Planning

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Appendix A:
Regulatory Summary

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Regulatory Summary

As the impacts of climate change are being recognized, many strategies that address climate change have emerged at all levels of government. This section provides an overview of the regulatory context at the international, state, and local levels relative to the City of South Pasadena's actions toward reducing greenhouse gas (GHG) emissions.

International Climate Action Guidance

1992 United Nations Framework Convention on Climate Change

The primary international regulatory framework for GHG reduction is the United Nations Framework Convention on Climate Change Paris Agreement (UNFCCC). The UNFCCC is an international treaty adopted in 1992 with the objective of stabilizing atmospheric GHG concentrations to prevent disruptive anthropogenic climate change. The framework established non-binding limits on global GHG emissions and specified a process for negotiating future international climate-related agreements.[1]

1997 Kyoto Protocol

The Kyoto Protocol is an international treaty that was adopted in 1997 to extend and operationalize the UNFCCC. The protocol commits industrialized nations to reduce GHG emissions per county-specific targets, recognizing that they hold responsibility for existing atmospheric GHG levels. The Kyoto Protocol involves two commitment periods during which emissions reductions are to occur, the first of which took place between 2008-2012 and the second of which has not entered into force. [2]

2015 The Paris Agreement

The Paris Agreement is the first-ever universal, legally binding global climate agreement that was adopted in 2015 and has been ratified by 189 countries worldwide.[3] The Paris Agreement establishes a roadmap to keep the world under 2° C of warming with a goal of limiting an increase of temperature to 1.5° C. The agreement does not dictate one specific reduction target, instead relying on individual countries to set nationally determined contributions (NDCs) or reductions based on GDP and other factors. According to the International Panel on Climate Change (IPCC) limiting global warming to 1.5° C will require global emissions to reduce through 2030 and hit carbon neutrality by mid-century.[4]

1 United Nations Framework Convention on Climate Change (UNFCCC). United Nations Framework Convention on Climate Change. https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf
2 UNFCCC. What is the Kyoto Protocol? https://unfccc.int/kyoto_protocol
3 UNFCCC. Paris Agreement - Status of Ratification. https://unfccc.int/process/the-paris-agreement/status-of-ratification
4 IPCC. Global Warming of 1.5 C. https://www.ipcc.ch/sr15/

California Regulations and State GHG Targets

California remains a global leader in the effort to reduce GHG emissions and combat climate change through its mitigation and adaptation strategies. With the passage of Assembly Bill (AB) 32 in 2006, California became the first state in the United States to mandate GHG emission reductions across its entire economy. To support AB 32, California has enacted legislation, regulations, and executive orders (EO) that put it on course to achieve robust emission reductions and address the impacts of a changing climate. The following is a summary of executive and legislative actions most relevant to the CAP.

2002 Senate Bill 1078

In 2002, SB 1078, established the California Renewables Portfolio Standards (RPS) Program and was accelerated in 2006 by SB 107, requiring that 20 percent of retail electricity sales be composed of renewable energy sources by 2010. EO S-14-08 was signed in 2008 to further streamline California's renewable energy project approval process and increase the state's RPS to the most aggressive in the nation at 33 percent renewable power by 2020.

2002 Assembly Bill 1493

In 2002, AB 1493, also known as the Pavley Regulations, directed the California Air Resources Board (CARB) to establish regulations to reduce GHG emissions from passenger vehicles to the maximum and most cost-effective extent feasible. CARB approved the first set of regulations to reduce GHG emissions from passenger vehicles in 2004, with the regulations initially taking effect with the 2009 model year.

2005 Executive Order S-3-05

Executive Order (EO) S-3-05 was signed in 2005, establishing statewide GHG emissions reduction targets for the years 2020 and 2050. The EO calls for the reduction of GHG emissions in California to 2000 levels by 2010, 1990 levels by 2020, and 80 percent below 1990 levels by 2050. The 2050 emission reductions target would put the state's emissions in line with the worldwide reductions needed to reach long-term climate stabilization as concluded by the IPCC *2007 Fourth Assessment Report*.

2006 Assembly Bill 32

California's major initiative for reducing GHG emissions is outlined in AB 32, the "California Global Warming Solutions Act of 2006," which was signed into law in 2006. AB 32 codifies the statewide goal of reducing GHG emissions to 1990 levels by 2020 and requires CARB to prepare a Scoping Plan that outlines the main state strategies for reducing GHG emissions to meet the 2020 deadline. In addition, AB 32 requires CARB to adopt regulations to require reporting and verification of statewide GHG emissions.

Based on this guidance, CARB approved a 1990 statewide GHG baseline and 2020 emissions limit of 427 million metric tons of CO_2 equivalent (MMT CO_2e). The Scoping Plan was approved by CARB on December 11, 2008 and included measures to address GHG emission reduction strategies related to energy efficiency, water use, and recycling and solid waste, among other measures. Many of the GHG reduction measures included in the Scoping Plan (e.g., Low Carbon Fuel Standard, Advanced

Clean Car standards,[5] and Cap-and-Trade) have been adopted since approval of the Scoping Plan.

In May 2014, CARB approved the first update to the AB 32 Scoping Plan. The 2014 Scoping Plan update defined CARB's climate change priorities for the next five years and set the groundwork to reach post-2020 statewide goals. The update highlighted California's progress toward meeting the "near-term" 2020 GHG emission reduction goals defined in the original Scoping Plan. It also evaluated how to align the state's longer-term GHG reduction strategies with other state policy priorities, including those for water, waste, natural resources, clean energy, transportation, and land use (CARB 2014).

2007 Executive Order S-1-07

Also known as the Low Carbon Fuel Standard, EO S-1-07, issued in 2007, established a statewide goal that requires transportation fuel providers to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020. EO S-1-07 was readopted and amended in 2015 to require a 20 percent reduction in carbon intensity by 2030, the most stringent requirement in the nation. The new requirement aligns with California's overall 2030 target of reducing climate changing emissions 40 percent below 1990 levels by 2030, which was set by Senate Bill 32 and signed by the governor in 2016.

2007 Senate Bill 97

Signed in August 2007, SB 97 acknowledges that climate change is an environmental issue that requires analysis in California Environmental Quality Act (CEQA) documents. In March 2010, the California Natural Resources Agency adopted amendments to the State CEQA Guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions. The adopted guidelines give lead agencies the discretion to set quantitative or qualitative thresholds for the assessment and mitigation of GHG and climate change impacts.

2008 Senate Bill 375

SB 375, signed in August 2008, enhances the state's ability to reach AB 32 goals by directing CARB to develop regional GHG emission reduction targets to be achieved from passenger vehicles by 2020 and 2035. In addition, SB 375 directs each of the state's 18 major Metropolitan Planning Organizations (MPOs), including the Southern California Association of Governments (SCAG) in Los Angeles, to prepare a "sustainable communities strategy" (SCS) that contains a growth strategy to meet these emission targets for inclusion in the MPO's Regional Transportation Plan (RTP).

On March 22, 2018, CARB adopted updated regional targets for reducing GHG emissions from 2005 levels by 2020 and 2035. The SCAG, of which South Pasadena is a member, was assigned targets of an 8% reduction in GHGs from transportation sources by 2020 and a 19% reduction in GHGs from transportation sources by 2035. In the SCAG region, SB 375 also provides the option for the coordinated development of subregional plans by the subregional Councils of Governments and the County Transportation Commissions to meet SB 375 requirements.

5 On September 19, 2019 the National Highway Traffic Safety Agency (NHTSA) and the US Environmental Protection Agency (EPA) issued a final action entitled the One National Program on Federal Preemption of State Fuel Economy Standards Rule. This action finalizes Part I of the Safer, Affordable, Fuel-Efficient (SAFE) Vehicles Rule. This rule states that federal law preempts State and local tailpipe greenhouse gas (GHG) emissions standards as well as zero emission vehicle (ZEV) mandates. The SAFE Rule withdraws the Clean Air Act waiver it granted to California in January 2013 as it relates to California's GHG and zero emission vehicle programs.

2009 California Green Building Code

The California Green Building Standards Code (CALGreen) is Part 11 of the California Building Standards Code or Title 24 and is the first statewide "green" building code in the nation. The purpose of CALGreen is to improve public health, safety, and general welfare by enhancing the design and construction of buildings. Enhancements include reduced negative impact designs, positive environmental impact designs, and encouragement of sustainable construction practices. The first CALGreen Code was adopted in 2009 and has been updated in 2013, 2016, and 2019. The CALGreen Code will have subsequent, and continually more stringent, updates every three years.

2009 Senate Bill X7-7

In 2009, SB X7-7, also known as the Water Conservation Act, was signed, requiring all water suppliers to increase water use efficiency. This legislation sets an overall goal of reducing per capita urban water use by 20 percent by2020.

2011 Senate Bill 2X

In 2011, SB 2X was signed, requiring California energy providers to buy (or generate) 33 percent of their electricity from renewable energy sources by 2020.

2012 Assembly Bill 341

AB 341 directed the California Department of Resources Recycling and Recovery (CalRecycle) to develop and adopt regulations for mandatory commercial recycling. As of July 2012, businesses are required to recycle, and jurisdictions must implement a program that includes education, outreach, and monitoring. AB 341 also set a statewide goal of 75 percent waste diversion by the year 2020.

2014 Assembly Bill 32 Scoping Plan Update

In 2014, CARB approved the first update to the Scoping Plan. This update defines CARB's climate change priorities and sets the groundwork to reach the post-2020 targets set forth in EO S-3-05. The update highlights California's progress toward meeting the near-term 2020 GHG emissions reduction target, defined in the original Scoping Plan. It also evaluates how to align California's longer-term GHG reduction strategies with other statewide policy priorities, such as water, waste, natural resources, clean energy, transportation, and land use.

2014 Assembly Bill 1826

AB 1826 was signed in 2014 to increase the recycling of organic material. GHG emissions produced by the decomposition of these materials in landfills were identified as a significant source of emissions contributing to climate change. Therefore, reducing organic waste and increasing composting and mulching are goals set out by the AB 32 Scoping Plan. AB 1826 specifically requires jurisdictions to establish organic waste recycling programs by 2016, and phases in mandatory commercial organic waste recycling over time.

2015 Senate Bill 350

SB 350, the Clean Energy and Pollution Reduction Act of 2015, has two objectives: to increase the procurement of electricity from renewable sources from 33 percent to 50 percent by 2030 and to double the energy efficiency of electricity and natural gas end users through energy efficiency and conservation.

2015 Executive Order B-30-15

In 2015, EO B-30-15 was signed, establishing an interim GHG emissions reduction target to reduce emissions to 40 percent below 1990 levels by 2030. The EO also calls for another update to the CARB Scoping Plan.

2016 Senate Bill 32

On September 8, 2016, the governor signed SB 32 into law, extending AB 32 by requiring the state to further reduce GHGs to 40 percent below 1990 levels by 2030 (the other provisions of AB 32 remain unchanged). The bill charges CARB to adopt the regulation so that the maximum technologically feasible emissions reductions are achieved in the most cost-effective way.

2016 Senate Bill 1383

Adopted in September 2016, SB 1383 requires CARB to approve and begin implementing a comprehensive strategy to reduce emissions of short-lived climate pollutants. The bill requires the strategy to achieve the following reduction targets by 2030:

- Methane – 40 percent below 2013 levels
- Hydrofluorocarbons – 40 percent below 2013 levels
- Anthropogenic black carbon – 50 percent below 2013 levels

SB 1383 also requires the CalRecycle, in consultation with the CARB, to adopt regulations that achieve specified targets for reducing organic waste in landfills. The bill further requires 20% of edible food disposed of at the time to be recovered by 2025.

2017 Scoping Plan Update

On December 14, 2017, CARB adopted the 2017 Scoping Plan, which provides a framework for achieving the 2030 goal set by SB 32. The 2017 Scoping Plan relies on the continuation and expansion of existing policies and regulations, such as the Cap-and-Trade Program, as well as implementation of recently adopted policies, such as SB 350 and SB 1383 .

The 2017 Scoping Plan also puts an increased emphasis on innovation, adoption of existing technology, and strategic investment to support its strategies. As with the 2014 Scoping Plan Update, the 2017 Scoping Plan does not provide project-level thresholds for land use development. Instead, it recommends that local governments adopt policies and locally appropriate quantitative thresholds consistent with statewide per capita goals of six metric tons (MT) CO_2e by 2030 and two MT CO_2e by 2050 (CARB 2017). As stated in the 2017 Scoping Plan, these goals may be appropriate for plan-level analyses (city, county, subregional, or regional level), but not for specific individual projects because they include all emissions sectors in the state (CARB 2017).

2018 Senate Bill 100

Adopted on September 10, 2018, SB 100 supports the reduction of GHG emissions from the electricity sector by accelerating the State's Renewables Portfolio Standard Program, which was last updated by SB 350 in 2015. SB 100 requires electricity providers to increase procurement from eligible renewable energy resources to 33 percent of total retail sales by 2020, 60 percent by 2030, and 100 percent by 2045.

2018 Executive Order B-55-18

Also, on September 10, 2018, the governor issued Executive Order B-55-18, which established a new statewide goal of achieving carbon neutrality by 2045 and maintaining net negative emissions thereafter. This goal is in addition to the existing statewide GHG reduction targets established by SB 375, SB 32, SB 1383, and SB 100.

City of South Pasadena Sustainability Plans and Regulations

The City of South Pasadena has established actions related to increasing sustainability and reducing GHG emissions and the potential impacts of climate change. These actions are outlined in in the City's Green Action Plan, Draft 2020 General Plan, and Draft Downtown Specific Plan.

2019 South Pasadena Green Action Plan

In November 2019, the City of South Pasadena adopted the South Pasadena Green Action Plan (Green Plan), which includes five main goals: work towards making South Pasadena a plastic-free City; enhance water conservation projects and programs; increase organics diversion from landfills; mitigate impacts of the urban heat island effect; and prepare for the consideration of future sustainability initiatives. The Green Plan was a collaborative effort that encompassed the values, ideas, and efforts from all City Department Staff, City Council, the City's Natural Resources and Environmental Commission, and the passionate residents of South Pasadena. This short-term plan aimed to implement essential and attainable sustainability initiatives that would set the foundation of the City's first Climate Action Plan.

2020 General Plan Update

The City's General Plan is currently being updated and a draft version was released to the public in November 2019. The General Plan is a blueprint for how the City should develop over time, and consists of several mandated topics called "Elements." In general, these Elements include broad policies that identify the overall pattern of future development, determining when, where, and what type of new growth and investment may occur. The "Our Natural Community" Element of the Draft General Plan includes p which promote alternative transportation and use of energy-efficient vehicles, and works to minimize the adverse impacts of growth and development on air quality and climate.

2020 Downtown Specific Plan Update

The 2020 Downtown Specific Plan Draft was also released in November 2019 and has policies related to energy efficiency and climate resilience. The primary goals of the Downtown Specific Plan are to leverage public transit and multimodality, focusing on responsible infill development, and preserving and rehabilitating historic buildings.

Appendix B:
Technical Appendix – Cal-Adapt

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Cal-Adapt Resource Guide

Cal-Adapt[1] is an interactive platform that allows users to explore how climate change might affect California at the local level. The site was developed by the University of California, Berkeley's Geospatial Innovation Facility (GIF) with funding and advisory oversight by the California Energy Commission's Public Interest Energy Research (PIER) Program. The data used within the Cal-Adapt visualization tools have been gathered from California's scientific community, and represent peer-reviewed, high-quality scientific information.[2]

The site includes the following climate change projections:

- Annual Averages (temperature and precipitation)
- Extreme Precipitation Events
- Extreme Heat Days & Warm Nights
- Cooling Degree Days & Heating Degree Days
- Snowpack
- Sea Level Rise
- Wildfire
- Streamflow
- Extended Drought

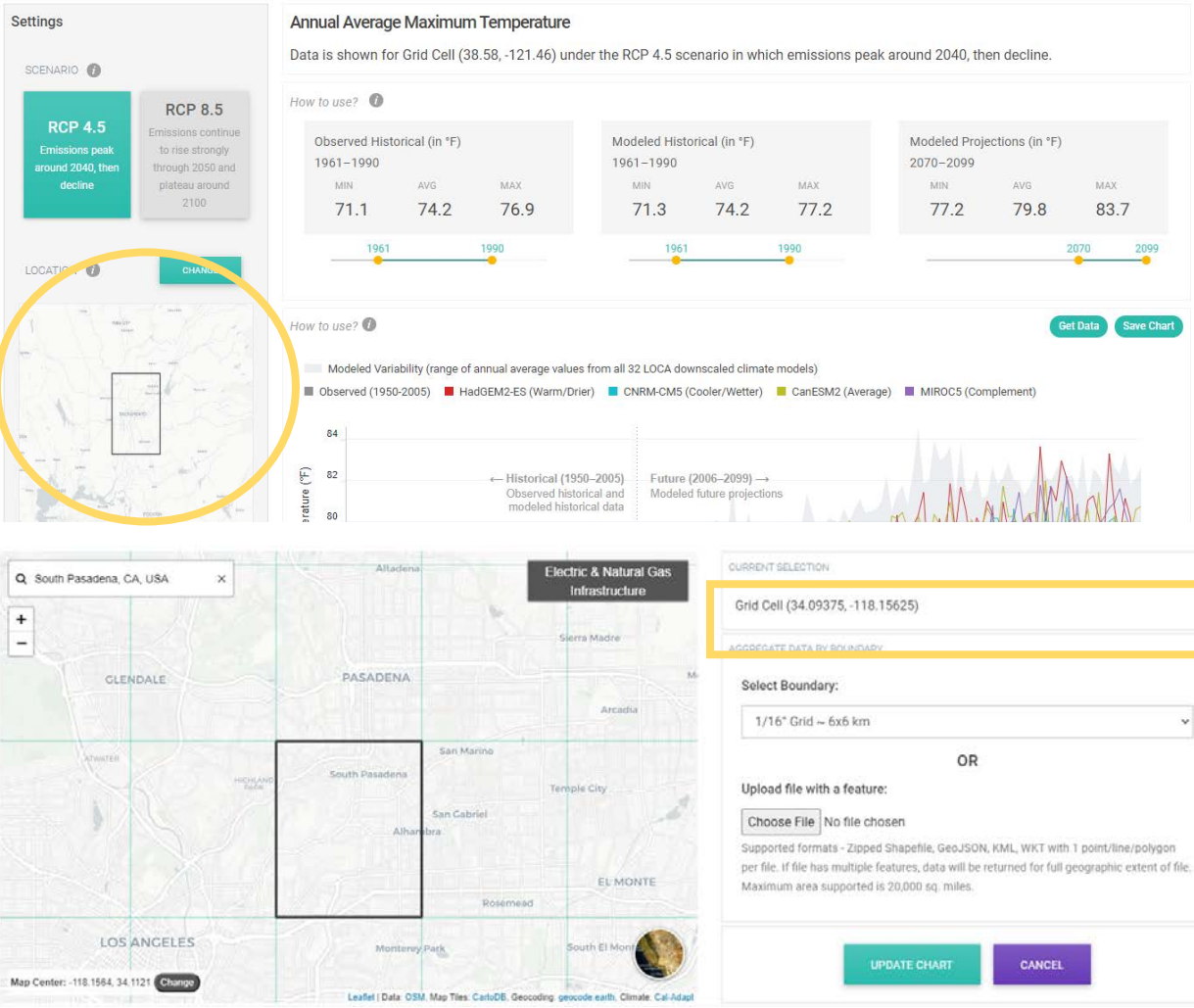
These localized climate change projections are available on the Cal-Adapt landing page or via the *Tools* tab. Another way to download data is through the *Data* tab. The *Data* tab allows you to download data from individual publishers and spatial data. This technical appendix describes downloading data from the landing page, or Tools *tab*, as it is more interactive and provides visualizations of the data.

[1] Cal-Adapt https://cal-adapt.org/
[2] Cal-Adapt https://cal-adapt.org/about/

Best Practices

Location

When choosing a location, Cal-Adapt will prompt you to select a 6x6 kilometer grid cell or a county, among other options. The grid cell used for South Pasadena is shown below (Grid Cell 34.09375, -118.15625).

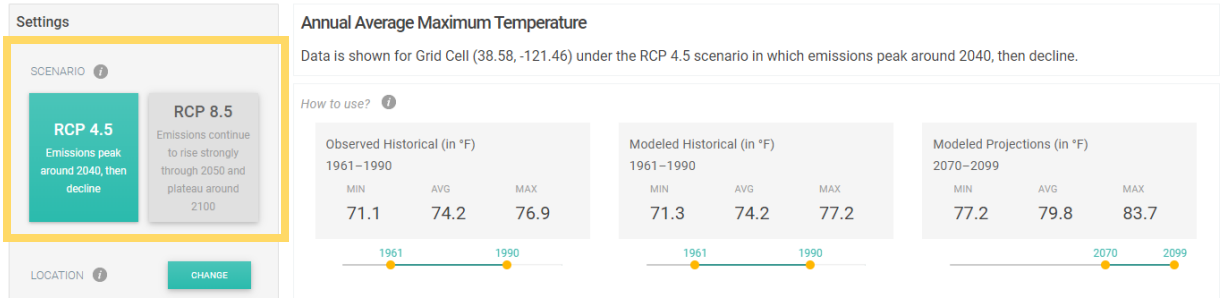


Representative Concentration Pathways (RCP)

These are scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases (GHGs). Each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing, which is the difference between sunlight absorbed by the Earth and energy radiated back to space.

The California Adaptation Planning Guide[3] recommends always using the high emissions scenario (RCP 8.5).[4] The stabilizing scenario (RCP 4.5)[5] may also be used to provide a wider range of possible futures.

[3] https://resources.ca.gov/CNRALegacyFiles/docs/climate/01APG_Planning_for_Adaptive_Communities.pdf
[4] Emissions continue to rise through the end of the century before leveling off
[5] Emissions rise through 2050 before leveling off

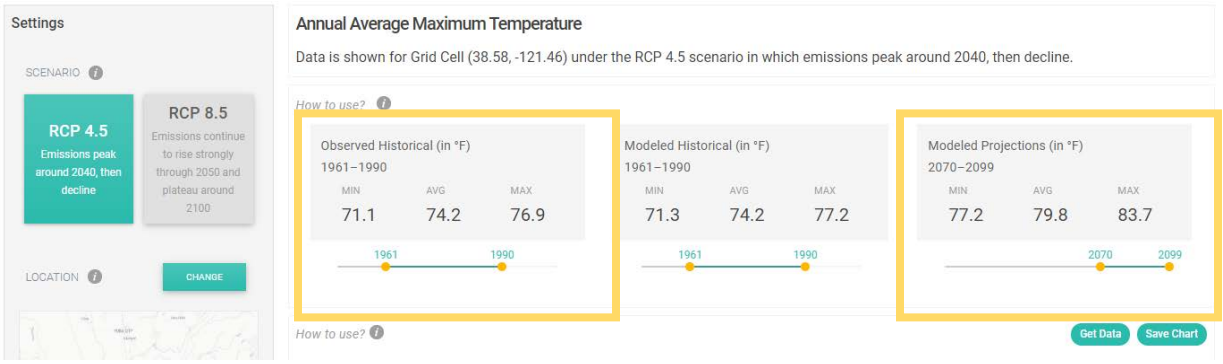


Past and Future Year Horizons

To gain an understanding of how climate change may impact a location, we need to know the historical and projected conditions. Below are the past and future year horizons used for the *Climate Change in the City of South Pasadena* subsection of the South Pasadena CAP.

- Historical/Current: 1990 and 2005
- Long-term: 2099

It is important to consider a long-term benchmark year when working with climate change projections as it allows us to understand the potential impacts over a specific period of time.



Climate Models

Cal-Adapt allows you to choose whether to use the minimum, average, or maximum estimates (shown below). These are calculated over all models shown in the chart provided by Cal-Adapt. For a representative value of all models combined, rather than selecting the lowest or highest predicting model, it's best to use the average value. The four models used in this assessment are:

- HadGEM2-ES: a warm/drier simulation
- CNRM-CM5: a cooler/wetter simulation
- CanESM2: an average simulation
- MIROC5: a complement simulation (most unlike the other three models).

These models were selected by California's Climate Action Team Research Working Group as the priority models for research contributing to California's Fourth Climate Change Assessment. To determine projected timing of extreme heat days, Rincon used the range all four priority models. This allows for conservative planning, recommended by the California Adaptation Planning Guide.

Resources

Cal-Adapt https://cal-adapt.org/

California Adaptation Planning Guide
https://resources.ca.gov/CNRALegacyFiles/docs/climate/01APG_Planning_for_Adaptive_Communities.pdf

Appendix C:
Technical Appendix – Inventory, Forecast, and Targets

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City of South Pasadena Climate Action Plan

GHG Emissions: Municipal Inventory, Community Inventory, Forecast and Target Setting Methodology

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1 Introduction

California considers greenhouse gas (GHG) emissions and the impacts of climate change to be a serious threat to the public health, environment, economic well-being, and natural resources of the state, and has taken an aggressive stance to mitigate the impact on climate change at the state-level through the adoption of legislation and policies. Many cities have developed local climate action plans and aligned goals to correspond with state emissions reduction goals. The two major state GHG-related goals are established by Assembly Bill (AB) 32 and Senate Bill (SB) 32. AB 32 required state agencies reduce state GHG emissions to 1990 levels by 2020 whereas SB 32 requires a 40 percent reduction below 1990 levels by 2030. The goals set by AB 32 were achieved by the state in 2016[1] and many jurisdictions are completing GHG inventories to quantify progress toward their own 2020 goals as well as develop targets to align with the requirements of SB 32. A long-term goal of carbon neutrality by 2045 for the state was established, but not codified, through Executive Order (EO) B-55-18. While it is not required for jurisdictions to meet this target, many are establishing or exceeding this goal to show alignment with the aggressive decarbonization goals of the state.

This technical appendix provides the detailed methodology used for the City of South Pasadena 2016 Municipal and Community GHG inventory, Community GHG Emissions Forecast, and the setting of emission reduction targets. Emissions are forecasted for the years 2020, 2030, 2040 (the General Plan horizon year), and 2045 to align with state and City targets.

Estimating GHG emissions enables local governments to establish an emissions baseline, track emissions trends, identify the greatest sources of GHG emissions within their jurisdictions, and set targets for future reductions. This inventory is intended to inform completion of a qualified GHG reduction plan for the City of South Pasadena and is compliant with the Local Governments for Sustainability (ICLEI) *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions*[2] (*U.S. Community Protocol*) as well as California Environmental Quality Act (CEQA) Guidelines Section 15183.5(b) for the requirements of a 'qualified' GHG emissions reduction plan. Methodology for some sections has been updated slightly to conform with the industry standard for California cities as recommended in the Association for Environmental Professionals (AEP) *California Supplement to the United States Community-Wide GHG Emissions Protocol* (California Supplement). Emissions inventories are an iterative process and each year must be viewed in the context of other inventories and relative trends of each sector to maintain consistency with the emissions inventory methods and factors.

Emissions contained within this inventory include activities under the jurisdictional control or significant influence of the City of South Pasadena, as recommended by AEP in preparing Community Protocol and CEQA-compliant inventories.[3] The municipal operations inventory is a subset of the community-wide inventory, meaning the municipal emissions are included within the community-wide inventory.

[1] California Air Resources Board. California Greenhouse Gas Emissions Inventory. Accessed at: https://ww3.arb.ca.gov/cc/inventory/inventory.htm. Accessed on: July 2019

[2] ICLEI. 2013. U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1

[3] Association of Environmental Professionals. 2013. The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Protocol.

1.1 Greenhouse Gases

The 2016 City of South Pasadena Community Inventory was developed using the Community Protocol[4] and California Supplement.[5] Emissions from nitrous oxide (N_2O), methane (CH_4), and carbon dioxide (CO_2) are included in this assessment. Each GHG has a different capability of trapping heat in the atmosphere, known as its global warming potential (GWP), which is normalized relative to CO_2 and expressed as carbon dioxide equivalent, or CO_2e. The CO_2e values for these gases are derived from the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) GWP values for consistency with the yearly California Air Resources Board (CARB) GHG inventory, as shown in Table 1.[6],

Table 1 Global Warming Potentials of Greenhouse Gases

Greenhouse Gas	Molecular Formula	Global Warming Potential (CO_2e)
Carbon Dioxide	CO_2	1
Methane	CH_4	25
Nitrous Oxide	N_2O	298

Notes: MT CO_2e = metric tons of carbon dioxide equivalent

1.2 Excluded GHG Emissions and Emission Sources

The following GHG emissions and emission sources are excluded from the 2016 inventory and emissions forecast.

Consumption-Based GHG Emissions

GHG emissions from consumption of goods and services (such as food, clothing, electronic equipment, etc.) by residents of a city are excluded from the inventory and forecast of City of South Pasadena emissions. Currently there exists no widely accepted standard methodology for reporting consumption-based inventories.

Natural and Working Lands

GHG emissions from carbon sinks and sources in natural and working lands are not included in this inventory and forecast due to the lack of granular data and standardized methodology. Natural and working lands are comprised of the forests, woodlands, rangelands, coastal areas, farmlands and urban green spaces of California. GHG emissions from these lands result from the loss of carbon sequestration through land use change and fires. CARB has included a state-level inventory of natural and working lands in the 2017 Scoping Plan Update[7] greenhouse gas inventory; however, at the time of this City of South Pasadena community-wide inventory, sufficient data and tools were not available to conduct a jurisdiction-specific working lands inventory. The Nature Conservancy and

[4] ICLEI. 2012. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions.

[5] Association of Environmental Professionals. 2013. The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Protocol. Accessed at: https://califaep.org/docs/California_Supplement_to_the_National_Protocol.pdf. Accessed on: June 20, 2019

[6] Intergovernmental Panel on Climate Change. 2007. Fourth Assessment Report: Climate Change. Direct Global Warming Potentials.

[7] California Air Resources Board. 2017. California's Climate Change Scoping Plan.

California Department of Conservation[8] are exploring options for a tool which may be able to perform these inventories at a more specific geographic level.

Agricultural Emissions

Emissions from agricultural activities are not included in this inventory as the Community Protocol and California Supplement[9] both note agricultural activity is not a required component of Community Protocol inventories and should be included only if relevant to the community conducting the inventory. Regulations exist to encourage urban agriculture within the City boundaries. Many of the emissions from these activities (e.g. energy) are covered under other sectors included in this inventory and no major commercial-scale livestock activity is noted within the City boundaries.

Industrial Emissions

Emissions from industrial activities are not included in this inventory as the City of South Pasadena does not have direct control of GHG emissions from industrial operations, which are regulated through the state Cap-and-Trade Program. Additionally, energy data was not available for the industrial sector due to the industrial energy data set not meeting Southern California Edison's (SCE's) 5/25 Aggregation Rule, where the data set must contain at least five customers and no single customer makes up more than 25 percent of the total energy consumption.

High GWP

High GWP emissions, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances are not included in this inventory as it is not a required component of the Community Protocol and the California Supplement notes these emissions are not generally included in California inventories.

1.3 Calculating GHG Emissions

GHG emissions are estimated using calculation-based methodologies to derive emissions using activity data and emissions factors. To estimate emissions, the basic equation below is used:

Activity Data x Emission Factor = Emissions

Activity data refer to the relevant measurement of energy use or other GHG-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles travelled. Emission factors are used to convert energy usage or other activity data into associated emissions quantities. They are usually expressed in terms of emissions per unit of activity data (e.g., lbs. CO_2/kWh).

As mentioned in the *Introduction*, GHG emissions calculation methodologies follow the guidance of the ICLEI *U.S. Community Protocols* for the Community Inventory, and the ICLEI *Local Government Operations Protocols (LGOP)* for the Municipal Inventory.

[8] California Department of Conservation. TerraCount Scenario Planning Tool. Accessed at: https://maps.conservation.ca.gov/terracount/. Accessed on: May 15, 2019

[9] Association of Environmental Professionals. 2013. *The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Emissions Protocol.* https://califaep.org/docs/California_Supplement_to_the_National_Protocol.pdf

1.4 Reporting GHG Emissions

The following section discusses reporting of GHG emissions by scope and sector.

1.4.1 GHG Emissions by Scope

For municipal and community-wide inventories, emissions sources can be categorized by "scope" according to the entity's degree of control over the emissions source and the location of the source. Emissions sources are categorized as direct (scope 1) or indirect (scope 2 or scope 3), in accordance with the World Resources Institute and the World Business Council for Sustainable Development's *Global protocol for Community-Scale Emissions* and the ICLEI *LGOP*.

MUNICIPAL SCOPE DEFINITIONS

- **Scope 1:** Direct GHG emissions from sources within a local government's operations that it owns and/or controls. This includes stationary combustion to produce electricity, steam, heat, and power equipment; mobile combustion of fuels; process emissions from physical or chemical processing; fugitive emissions that result from production, processing, transmission, storage and use of fuels; and other sources.
- **Scope 2:** Indirect GHG emissions associated with the consumption of electricity, steam, heating, or cooling that are purchased from a utility provider that also provides energy to other jurisdictions and/or is located outside City boundaries.
- **Scope 3:** All other indirect GHG emissions not covered in scope 2, such as emissions resulting from the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the City (e.g., employee commuting and business travel, outsourced activities, waste disposal, etc.).

COMMUNITY-WIDE SCOPE DEFINITIONS

- **Scope 1:** Direct GHG emissions from sources located within the jurisdictional boundaries of the community, including emissions from fuel combustion vehicles[10] in the community and direct emissions from natural gas combustion in homes and businesses within the community.
- **Scope 2:** Indirect GHG emissions associated with the consumption of electricity within the community.
- **Scope 3:** All other indirect or embodied GHG emissions not covered in scope 2, which occur because of activity within the jurisdictional boundaries (e.g., methane emitted at landfills outside the community resulting from solid waste generated within the community).

1.4.2 Emissions by Sector

In addition to categorizing emissions by scope, ICLEI recommends that local governments examine their emissions in the context of the sector that is responsible for those emissions. Many local governments will find a sector-based analysis more directly relevant to policy making and project management, as it assists in formulating sector-specific reduction measures and Climate Action Plan components.

[10] This accounts for GHG emissions from running exhaust, idle exhaust, starting exhaust, diurnal, resting loss, running loss, and hot soak.

The municipal and community inventories report emissions by the following sectors:

- Energy
- Transportation
- Water consumption and wastewater treatment
- Solid waste

Table 2 summarizes the scopes of each sector in the municipal and community-wide inventories.

Table 2 Emissions by Sector and Scope

Sector	Scope 1	Scope 2	Scope 3
Municipal Inventory			
Energy	Natural Gas	Electricity	NA
Vehicle Fleet	Gasoline, diesel, CNG	NA	Employee Commute
Water and Wastewater	NA	Electricity (associated with water conveyance and treatment)	Electricity (associated with wastewater treatment)
Solid Waste	NA	NA	Methane from decomposition and process emission
Community-wide Inventory			
Energy	Natural Gas	Electricity	NA
Transportation	Gasoline and Diesel	NA	Transit (i.e. public transit)
Water Consumption	NA	NA	Electricity (associated with water conveyance)
Wastewater	NA	NA	Electricity (associated with water treatment)
Solid Waste	NA	NA	Methane from decomposition and process emissions

Notes: CNG: Condensed natural gas; NA: Not applicable

1.5 GHG Emissions Forecast Target Years

The GHG emissions forecast is based on the latest available data from City GHG inventories, in this case the 2016 inventory completed as part of this Climate Action Plan. This forecast uses benchmark years of 2020, 2030, 2040, and 2045, consistent with currently codified state GHG reduction goals set by legislation and executive orders, and the City's General Plan horizon year, as summarized below:

- 2020 (AB 32)
- 2030 (SB 32)
- 2040 (General Plan horizon year)
- 2045 (EO B-55-18)

The 2030 and 2040 targets are required for consistency with SB 32 and the City of 2040 General Plan respectively, while the remainder of the targets identify a clear path and milestones of progress toward the long-term state reduction goals.

2 2016 Municipal GHG Inventory

The Municipal GHG Inventory quantifies the GHG emissions generated by local government operations for the City of South Pasadena. By better understanding the relative scale of emissions from each sector, the City can more effectively focus strategies to achieve the greatest emissions reductions.

Reporting emissions by sector provides a useful way to understand the sources of the City's emissions. The ICLEI *LGOP* further categorizes sectors by the following sub-sectors for local government operations: 1) buildings and other facilities, 2) streetlights and traffic signals, 3) water delivery facilities, 4) port facilities, 5) airport facilities, 6) vehicle fleet, 7) transit fleet, 8) power generation facilities, 9) solid waste facilities, 10) wastewater facilities, and 11) all processes and fugitive emissions. The City of South Pasadena does not have operational control of a port, airport, transit fleet, power generation facility, or wastewater facility. Additionally, the City does not have an operational landfill[11] within the jurisdictional boundaries. Local government operations are discussed only in terms of sectors and sub-sectors the City has operational control over. Accordingly, the GHG emission sectors reported are provided in Table 3, with the associated GHG emissions sources.

Table 3 Municipal GHG Emissions Sectors and Sources

Sector	Emissions Source
Energy	Natural Gas (buildings & facilities)
	Electricity (buildings & facilities)
	Electricity (parks and outdoor lighting)
	Electricity (traffic signals and streetlights)
	Electricity (water delivery facilities)
Transportation	Vehicle Fleet
	Employee Commute
Water and Wastewater	Water Consumption
	Wastewater Generation
Waste	Solid Waste Generation

[11] As mentioned in Section 5.2.4, *Solid Waste*, the City of South Pasadena has a landfill within City jurisdictional boundaries, the South Pasadena City Dump; however, this facility has been closed since 1958, and is excluded from this inventory due to a lack of data.

2.1 Municipal GHG Inventory Methodology

The Municipal GHG Inventory uses activity data obtained from the City of South Pasadena to calculate the GHG emissions associated with the local government operations based on the ICLEI *LGOP*, developed in partnership with CARB, California Climate Action Registry, and the Climate Registry. [12] Activity data was obtained from the City of South Pasadena, primarily through communication with the City's Water Conservation and Sustainability Analyst. The following is a description of the methodology and data used to calculate emissions for each of the municipal GHG emission sectors.

Municipal Energy

Energy emissions consist of natural gas burned in City facilities and buildings for water and space heating (scope 1), and electricity consumed in buildings and facilities, lighting, traffic signals, and water delivery facilities (scope 2). Emissions associated with natural gas and electricity consumption were calculated using ICLEI *LGOP* Method 6.1.1 and 6.2.1, respectively. Table 4 provides the activity data and emission factors used for emission calculations, and the GHG emission results.

Table 4 Energy Sector Municipal GHG Emissions

Sector/Emission Source	Activity	Emission Factor	Total Emissions (MT CO_2e)
Natural Gas[1]			**109**
Buildings and Facilities	20,512 therms	0.00531 MT CO_2e/Therm[2]	109
Electricity[3]			**1,504**
Traffic and Street Lighting	1,053,468 kWh	0.000240 MT CO_2e/kWh[4]	253
Parks and Outdoor Lighting	206,152 kWh		49
Water Delivery Facilities	4,017,424 kWh		964
Building & Other Facility Use	990,594 kWh		238
Energy Sector Total			**1,613**

Notes: MT CO_2e = Metric Tons of Carbon Dioxide Equivalent; kWh = kilowatt-hour
1. Natural Gas activity data was provided by the City of South Pasadena in the form of "SCG - Customer Gas Usage and Total Billed Summary for 2016", on July 5th, 2019 for all municipal natural gas accounts.
2. Emission factors obtained from United States Environmental Protection Agency Emission Factors for Greenhouse Gas Inventories, Table 1. https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf.
3. Electricity consumption activity data was provided by the City of South Pasadena, in the form of total electricity consumption in 2016 for each municipal electricity meter, on July 29th, 2019.
4. Delivered electricity emission factors as CO2e used. Edison International 2017 Sustainability Report (p. 10), June 2018. https://www.edison.com/content/dam/eix/documents/sustainability/eix-2017-sustainability-report.pdf.

Municipal Transportation

Municipal GHG emissions from the transportation sector are categorized into two primary sources, employee commute and municipal fleet, for which the activity data and emission calculations are described in the following section.

[12] CARB, et al.. 2010. Local Government Operations Protocol For the quantification and reporting of greenhouse gas emissions inventories. https://www.theclimateregistry.org/tools-resources/reporting-protocols/local-goverment-operations-protocol/

Employee Commute

Employee commute emissions are a scope 3 emissions source and largely out of the direct control of the City; however, the City can provide incentive for employees to utilize less carbon intensive means of commuting, such as cycling/walking/scooting, ridesharing, or public transit. In 2016, the City of South Pasadena had a total of 152 full-time City employees and 125 part-time employees.[13] Employee commute vehicle miles traveled (VMT) was calculated using the results of an employee commute survey, issued in September 2019. The survey had 47 respondents who also worked at the City of South Pasadena in 2016. Based on the average commute distance and mode for each respondent to the employee commute survey, an annual average employee commute factor was calculated, which equates to each employee traveling an average 4,946 miles by passenger car, 181 miles by motorcycle, 22 miles by bus, and 35 trips by train in 2016 to get to and from work. This annual average employee commute factor was applied to the number of City employees in 2016 to estimate travel for each mode for all employee commutes. It was estimated that full-time employees work an average of 240 days per year, and part-time employees an average of 120 days per year; assuming all employees did not work on federal holidays and that full-time employees would take two weeks of vacation, with part-time employees assumed to work half the time of full-time employees. The average employee commute factor and assumptions above are considered to give a conservative estimate of employee commute patterns. CARB's EMission FACtors (EMFAC) model EMFAC2017[14] emission factors for the Los Angeles County region in 2016 were used to determine employee commute emissions. The activity data, emission factors, and resulting emissions are provided in Table 5.

Table 5 Employee Commute Municipal GHG Emissions

Sector/Emission Source	Activity[1]	Emission Factor	Total Emissions (MT CO_2e)
Passenger Vehicle Commute	1,060,992 VMT/year	0.000322 MT CO_2e/mile[2]	342
Motorcycle Commute	38,778 VMT/year	0.000253 MT CO_2e/mile[2]	10
Public Bus Commute	4,663 VMT/year	0.002290 MT CO_2e/mile[2]	11
Light Rail Commute	7,531 trips/year	0.000044 MT CO_2e/trip[3]	3
Employee Commute Total	**NA**	**NA**	**366**

Notes: MT CO2e = Metric Tons of Carbon Dioxide Equivalent; VMT = Vehicle Miles Traveled.
1. All employee commute activity data was derived from the Employee Commute Survey issued in September of 2019. The compilation of responses for daily commutes (47 in total), was extrapolated for the total number of employees in 2016. Annual values were calculated assuming full-time employees work 240 days per year and par-time employees 120 days per year.
2. Vehicle emission factors were obtained from EMFAC2017 emission rates for Los Angeles County in 2016, aggregated by fuel type.
3. Derivation of the light rail emission factor per trip is further described in the *Community Public Transit* section of the 2016 Community GHG Inventory.

Municipal Fleet

Municipal fleet vehicles and equipment combust gasoline, diesel, and compressed natural gas (CNG), generating scope 1 GHG emissions. The City owns and operates a number of on-road vehicles, including passenger vehicles, light-duty trucks, and light- and medium-heavy duty trucks; as well as off-road equipment, including: a tractor, two backhoes, two trailers, and two air

[13] City of South Pasadena provided employee data via email on August 28, 2019.

[14] CARB 2018. EMFAC2017 v1.0.2. Mobile Source Analysis Branch, Air Quality Planning & Science Division. https://www.arb.ca.gov/emfac/2017/

compressors. In 2015, all of the City-owned landscape equipment used for regular grounds work were converted to electric power, which are accounted for under the energy sector and accounted for in the *Community Off-Road Transportation* sector. GHG emissions are calculated using ICLEI *LGOP* Methods 7.1.1 and 7.1.3.2.1, with emission factors obtained from CARB's EMFAC2017[15] model output and the United States Environmental Protection Agency's (USEPA) *Emission Factors for Greenhouse Gas Inventories.*[16] Each gasoline and diesel fueled on-road vehicle in the fleet were assigned an emission factor according to the vehicle's year, class, and fuel type, from which an average fleet-wide emission factor was derived for both gasoline and diesel fueled vehicles. CNG vehicle emissions were calculated using emission factors from USEPA's *Emission Factors for Greenhouse Gas Inventories*, with fuel volumes attributed equally to each vehicle in the fleet, which includes one passenger vehicle and two medium-duty trucks. Emissions for off-road equipment were calculated using the emission factors provided for diesel and gasoline fueled construction equipment in USEPA's *Emission Factors for Greenhouse Gas Inventories*. Table 6 provides the fuel consumption associated with the municipal fleet, emission factors, and calculated total emissions.

Table 6 Municipal Fleet GHG Emissions

Sector/Emission Source	Activity		Emission Factor	Total Emissions (MT CO_2e)
On-Road Fleet Vehicles				**165**
Diesel	5 Vehicles	1,220 Gal	0.010666 MT CO_2e/Gal[1]	13
Unleaded Gasoline	24 Vehicles	8,382 Gal	0.008763 MT CO_2e/Gal[1]	73
Compressed Natural Gas (GNC)	3 Vehicles	13,395 therms	0.00588 MT CO_2e/Therm[2]	79
Non-Road Equipment				**8**
Diesel	NA	449 Gal	0.010302 MT CO_2e/Gal[2]	5
Unleaded Gasoline	NA	395 Gal	0.08858 MT CO_2e/Gal[2]	4
Municipal Fleet Total				**173**

Notes: MT CO_2e = Metric Tons of Carbon Dioxide Equivalent; Gal = Gallon
Totals may not add up due to rounding.
1. Vehicle emission factors were obtained from EMFAC2017 emission rates for Los Angeles County in 2016, aggregated by fuel type.
2. Emission factors obtained from United States Environmental Protection Agency Emission Factors for Greenhouse Gas Inventories, Table 1. https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf.

Municipal Water and Wastewater

Municipal GHG emissions from water and wastewater were calculated based on the total water consumption of municipal operations. It was conservatively estimated that wastewater generation was equivalent to water consumption. In 2016, the City of South Pasadena used approximately 19 million gallons (MG) of potable water for facilities operations and irrigation of public parks maintained by the City.[17] The City obtains water for use in municipal and irrigation operations

[15] CARB 2018. EMFAC2017 v1.0.2. Mobile Source Analysis Branch, Air Quality Planning & Science Division. https://www.arb.ca.gov/emfac/2017/

[16] USEPA. 2018. Emission Factors for Greenhouse Gas Inventories. https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

[17] The City of South Pasadena provided water consumption totals for 2016 for each of the municipal water accounts.

through City operated groundwater wells. Emissions generated from water usage and wastewater generation is due to the indirect electricity use to distribute water and collect and treat wastewater. The energy intensity for water use in the City of South Pasadena was not available; therefore, the energy intensities for water conveyance and distribution for the San Gabriel Water Valley Company (SGWVC) was used as a proxy, since SGWVC's service area is directly adjacent to the City of South Pasadena and SGWVC obtains most of its water from local groundwater pumping, similar to South Pasadena.[18] The energy intensity factor used for water use was 2.604 MWh/MG and 1.577 MWh/MG[19] for wastewater collection and treatment for LACSD. As such, water usage and wastewater generation by City operations generated approximately 12 MT of CO_2e and 7 MT of CO_2e, respectively. Activity data, energy intensity factors, emission factors , and GHG emission totals are provided in Table 7.

Table 7 Water and Wastewater Sector Municipal GHG Emissions

Emission Source	Activity	Energy Intensity	Emission Factor	Total Emissions (MT CO_2e)
Water Consumption	18.68 MG	2.064 MWh/MG[1]	0.240 MT CO_2e/MWh[3]	12
Wastewater Generation		1.577 MWh/MG[2]		7
Water and Wastewater Sector Total				**19**

Notes: MT CO_2e = Metric Tons of Carbon Dioxide Equivalent; MWh = Megawatt-hour; MG = Million Gallons
1. The City of South Pasadena procures water by pumping from the San Gabriel Basin. Water energy intensities for San Gabriel Valley Water Company (SGVWC), as provided in the CPUC Embedded Energy in water Studies, were used as a proxy for City of South Pasadena since SGVWC is adjacent to the City of South Pasadena, and pumps groundwater from the San Gabriel Basin.
2. California Public Utilities Commission (CPUC). 2010. Embedded Energy in Water Studies; Study 2: Water Agency and Function Component Study and Embedded Energy-Water Load Profiles. http://www.cpuc.ca.gov/general.aspx?id=4388.
3. Delivered electricity emission factors as CO2e used. Edison International 2017 Sustainability Report (p. 10), June 2018. https://www.edison.com/content/dam/eix/documents/sustainability/eix-2017-sustainability-report.pdf.

Municipal Waste

Many local government facilities and operations generate solid waste, much of which is eventually sent to a landfill. Typical sources of solid waste from local government operations include paper and food waste from offices and facilities, construction waste from public works, and plant debris from parks departments. Organic materials generate methane as they decay in the anaerobic environment of a landfill. The City keeps a record of the amount of waste sent to landfills and diverted. In 2016, 1,431 short tons of waste was sent to landfills from City operations and 451 short tons was recycled, resulting in an estimated 584 MT of CO_2e generated from municipal solid waste generation.[20] GHG emissions were calculated using ICLEI *U.S Community Protocol* Method SW.4, where the landfill gas capture rate for the facilities for which the community's waste is sent to was estimated at 73 percent efficiency, and the default emission factor of 0.06 tons of CH_4 per ton of waste. The methodology is further detailed in Section 3.5. Solid waste activity data, emission factors, and total emissions are provided in Table 8.

[18] The City of South Pasadena procures water by pumping from the San Gabriel Basin. Water energy intensities for San Gabriel Valley Water Company (SGVWC), as provided in the CPUC *Embedded Energy in water Studies*, were used as a proxy for City of South Pasadena since SGVWC is adjacent to the City of South Pasadena, and pumps groundwater from the San Gabriel Basin.

[19] California Public Utilities Commission (CPUC). 2010. Embedded Energy in Water Studies; Study 2: Water Agency and Function Component Study and Embedded Energy-Water Load Profiles. (http://www.cpuc.ca.gov/general.aspx?id=4388)

[20] Based on communication with the Water Conservation and Sustainability Analyst, there was no municipal organic waste materials collected in 2016.

Table 8 Waste Sector Municipal GHG Emissions

Emission Source	Activity	LFG capture rate	Emission Factor	Total Emissions (MT CO_2e)
Solid Waste Landfilled	1,431 short tons[1]	0.73 [2]	0.06 MT CH_4/short ton[3]	584[4]
Waste Sector Total				**584**

Notes: MT CO_2e = Metric Tons of Carbon Dioxide Equivalent; MT CH_4 = Metric Tons of Methane; LFG = Landfill Gas Capture
1. Based on communication with the Water Conservation and Sustainability Analyst on August 5, 2019.
2. LFG capture rate was derived based on the average landfill gas capture of each facility that South Pasadena sent waste to in 2016, weighted by the mass of waste sent. The derivation is further detailed in the 2016 Community GHG Inventory section *Community Generated Waste*.
3. Emission factor and oxidation rate used for emission calculations is the default provided in the ICLEI *U.S Community Protocol* Method SW.4.
4. Total GHG emissions are calculated ICLEI *U.S Community Protocol* Method SW.4 as:
GHG Emissions = Activity Data x (1-LFG Capture Rate) x (1-Oxidation Rate) x Emission Factor x CH_4 Global Warming Potential

2.2 Municipal GHG Inventory Results

Municipal operations of the City of South Pasadena generated a total of 2,755 MT CO_2e in 2016. As shown in Table 9 and Figure 1, energy use resulted in the greatest quantity of emissions, resulting in 1,613 MT CO_2e (59% of total municipal emissions) where emissions from natural gas use generated 109 MT CO_2e (4% of total municipal emissions), building electricity use generated 238 MT CO_2e (9% of total municipal emissions), the City's streetlights and traffic signals produced 253 MT CO_2e (9% of total municipal emissions), the City's water delivery facilities produced 964 MT CO_2e (35% of total municipal emissions), and electricity for parks and outdoor lighting resulted in the remaining energy related emissions (49 MT CO_2e or 2% of total municipal emissions). The generation of solid waste was the second largest source of emissions, generating 584 MT CO_2e (21% of total municipal emissions). The City's transportation emissions were the third largest source of emissions in 2016, where 366 MT CO_2e (14% of total municipal emissions) was due to employee commute and 173 MT CO_2e (6% of total municipal emissions) was from City fleet vehicle use. The remaining City emissions resulted from the consumption of water and generation of wastewater (19 MT CO_2e or 1% of total municipal emissions).

Figure 1 Municipal GHG Emissions by Sector

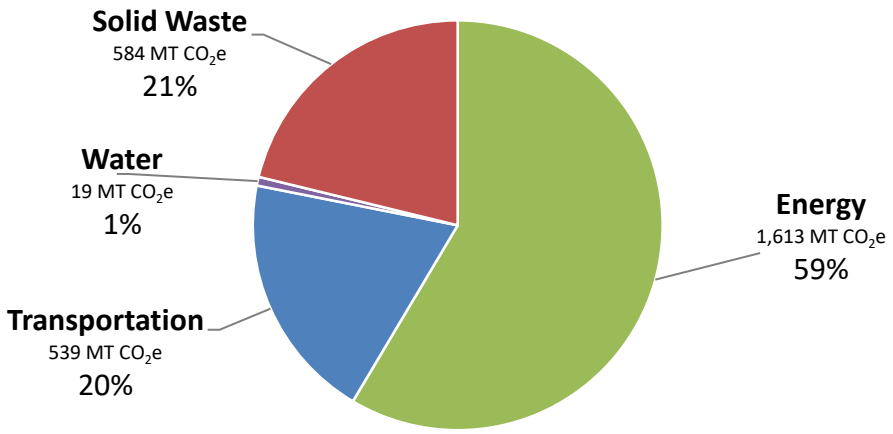


Table 9 Baseline Municipal GHG Emissions Summary by Sector

Sector	GHG Emissions (MT CO_2e)	Percent of Total Emissions
Energy	**1,613**	**59%**
Natural Gas (buildings & facilities)	109	4%
Electricity (buildings & facilities)	238	9%
Electricity (parks and outdoor lighting)	49	2%
Electricity (traffic signals and streetlights)	253	9%
Electricity (water delivery facilities)	964	35%
Transportation	**539**	**20%**
Vehicle Fleet	173	6%
Employee Commute	366	14%
Water and Wastewater	**19**	**<1%**
Water Consumption	12	<1%
Wastewater Generation	7	<1%
Waste	**584**	**21%**
Total Emissions	**2,755**	**100%**

Notes: MT CO_2e = Metric Tons of Carbon Dioxide Equivalent

3 2016 Community GHG Inventory

The 2016 Community GHG Inventory provides a baseline for forecasting of future GHG emissions and setting of GHG reduction targets to be included as part of the CAP. GHG emissions were calculated and reported based on the guidance of the ICLEI *U.S. Community Protocols*. Methodologies, data sources, calculations, and results of the 2016 Community GHG Inventory are included in this section.

3.1 2016 Community GHG Inventory Data Sources

The data used to complete the 2016 Community GHG Inventory came from multiple sources, including utility providers, traffic consultants and the City of South Pasadena. The data sources for the 2016 Community GHG Inventory are summarized in Table 10.

Table 10 Community GHG Inventory Data Sources

Sector	Activity Data	Unit	Source
Inventory			
Energy	Electricity consumption	kWh	SCE
	Natural gas consumption	therms	SCG
Transportation	Vehicle miles traveled	VMT	Iteris Inc., Traffic Consultants
Water	Water consumption	MG	City of South Pasadena
Wastewater	Wastewater generation rate = 60 gallons per person per day for residential and commercial activity	gpcd	Los Angeles County Sanitation Districts (LACSD)
Solid Waste	Landfilled solid waste	Tons	CalRecycle Jurisdiction Disposal Summary Report

Notes: kWh = kilowatt hours; SCE = Southern California Electricity; SCG = Southern California Gas Company; VMT = vehicle miles traveled; gpcd = gallons per capita per day; MG = Million Gallons

3.2 Community Energy

The community energy sector includes GHG emissions resulting from the consumption of electricity and natural gas. Both energy sources are used in residential, commercial, and industrial buildings and for other power needs throughout the City of South Pasadena. A summary of the community energy sector GHG emissions is provided in Table 11, with the methodology of emission calculations detailed in the following section.

Table 11 Community Energy GHG Emissions Summary

Emission Source	Activity Data[1]	Emissions (MT CO_2e)
Natural Gas	NA	23,987
Electricity	NA	24,287
Transmission and Distribution Losses	NA	1,027
Total	**NA**	**49,301**

Notes: kWh = kilowatt-hour; MT CO_2e = metric tons of carbon dioxide equivalent; NA = Not Applicable
1. Due to California Public Utilities customer privacy rules, natural gas and electricity consumption data requested through the Energy Data Request Program cannot be published.

Natural Gas

GHG emissions from community natural gas consumption were calculated using the ICLEI *U.S Community Protocol* Method BE.1.1. The total natural gas consumed was provided by Southern California Gas (SCG) in therms and converted to MMBtu.[21] The natural gas value was then multiplied by the USEPA recommended natural gas emission factors of 53.06 kg CO_2/MMBtu, 0.001. kg CH_4/MMBtu and 0.0001 kg N_2O/MMBtu; equating to 0.00531 MT CO_2e/therm.[22] Due to California Public Utilities Commission (CPUC) privacy regulations, the 2016 industrial natural gas use was not provided and is not included in this GHG inventory. Additionally, the CPUC prohibits the public disclosure of natural gas consumption data that has been provided through the Energy Data Request Program (EDRP). Therefore, only emission totals for the entire community are provided, which aggregates the residential and commercial customer classes. Accordingly, South Pasadena community natural gas consumption in 2016 resulted in GHG emissions equivalent to 23,987 MT CO_2e.

Electricity

GHG emissions from community electricity consumption were calculated using the ICLEI *U.S Community Protocol* Method BE.2 by multiplying annual electricity consumption in the City of South Pasadena by an electricity emission factor representing the average emissions associated with generation of one megawatt hour (MWh) of electricity. In 2016, electricity was supplied to South Pasadena by SCE. To calculate emissions from electricity, the total electricity use reported by SCE was multiplied by the carbon intensity factor of 529 pounds CO_2e per MWh, which was converted to 0.240 MT CO_2e per MWh .[23] The community energy consumption was obtained from SCE through the EDRP. Similar to natural gas activity data, the CPUC prohibits the public disclosure of electricity consumption data that has been provided through the EDRP. Therefore, only emission totals for the entire community are provided, which aggregates the residential and commercial customer classes. Industrial sector consumption is not included in the electricity consumption data. In 2016, a total 24,287 MT CO_2e was generated within the community due to electricity use.

[21] 1 MMBtu = 10.0024 therms; 1 kg Co_2e = 1 kg CO_2 + 1/(25 kg CH_4) + 1/(298 kg N_2O)

[22] USEPA. 2014. Emission Factors for Greenhouse Gas Inventories. Table 1. https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf

[23] Edison International. 2018. Edison International 2017 Sustainability Report. pp. 10 https://www.edison.com/content/dam/eix/documents/sustainability/eix-2017-sustainability-report.pdf.

Community Transmission and Distribution Losses

In addition to energy consumption, the amount of emissions generated due to electricity transmission and distribution (T&D) losses were determined, as recommended by the ICLEI *U.S. Community Protocol*. T&D losses occur as electricity is transported from its generation source to its final end use destination. Transmission losses occur in the form of heat as electricity meets the small resistance in wires, and distribution losses occur when electricity is transformed from higher to lower voltage wires. Although emissions generated due to electricity T&D losses are outside of the City's operational control, emissions related to T&D losses are directly related to electricity use within the community and should be included in the community emissions.[24] GHG emissions from community T&D losses were calculated using the ICLEI *U.S Community Protocol* Method BE.4. T&D loss associated emissions were determined by multiplying the total community electricity consumption in 2016 by 4.23%, the grid loss factor for the California sub-region (CAMX) most recently determined by the United States Environmental Protection Agency (USEPA) *Emissions and Generating Resource Integrated Databases (eGRID)*.[25] Due to the CPUC data privacy restrictions of the EDRP, the total community electricity consumption cannot be published. Emissions associated with community electricity T&D losses were 1,027 MT of CO_2e in 2016. Table 13 provides the activity data, emission factor, and GHG emission calculation results for community T&D losses.

3.3 Community Transportation

The transportation sector for the 2016 Community GHG Inventory consists of GHG emissions from on-road commercial and passenger vehicle travel, public transit buses and light rail, and off-road equipment. A summary of the community transportation sector GHG emissions is provided in Table 12, with the methodology of emission calculations detailed in the following section.

Table 12 Community Transportation GHG Emissions Summary

Emission Source	Activity Data	Emissions (MT CO_2e)
Passenger On-Road Transportation	164,015,449 VMT	60,400
Commercial On-Road Transportation	3,581,387 VMT	4,951
Public Transit - Bus	190,670 VMT	435
Public Transit - Light rail	1,375,500 Annual Riders	613
Off-road Equipment	NA	829
Total	**NA**	**67,228**

Notes: VMT = Vehicle Miles Traveled; MT CO_2e = metric tons of carbon dioxide equivalent; NA = Not Applicable

Community On-Road Transportation

Community on-road transportation emissions were calculated for passenger and commercial vehicles based on VMT. Accordingly, ICLEI *U.S Community Protocol* Methods TR.1.B and TR.2.C were

[24] ICLEI 2019. U.S. Community Protocol for Account and Reporting Greenhouse Gas Emissions. Pg. 36.

[25] USEPA's 2016 eGRID database, February 2018. https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

used to estimate GHG emissions for 2016. Activity data was obtained through transportation modeling for VMT attributed to the City of South Pasadena, completed by Iteris, Inc., a traffic consultant. The Southern California Association of Governments (SCAG) Trip Based Regional Travel Demand Model, based on the SCAG 2016 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), was used to model traffic volumes and quantify VMT attributed to South Pasadena. The VMT modeling results allocate VMT to the City of South Pasadena using the Origin-Destination (O-D) method. The O-D VMT method is the preferred method recommended by the *U.S Community Protocol* in on-road methodology TR.1 and TR.2 to estimate VMT based on trip start and end locations. Under these recommendations, all VMT associated with trips that start and end entirely within the City (Internal-Internal or I-I) are attributed to the City. Additionally, one half of the VMT associated with trips that start internally and end externally and vice versa (Internal-External or I-E and External Internal or E-I) are attributed to the City. The remainder of the trips are not attributed to the City and are instead attributed to the Cities in which the trips originate or end.

The emissions associated with on-road transportation were calculated by multiplying the estimated VMT and the average vehicle emissions rate established by CARB EMFAC2017 modeling for vehicles within the region. Emissions factors are established using the latest CARB and EPA-approved emissions modeling software, state EMFAC2017 Model. Carbon dioxide, nitrous oxide, and methane emissions from engine combustion were multiplied by their GWP to determine emission factors in CO_2e per VMT. Emissions for both passenger and commercial vehicles were established using the EMFAC2017 GHG module and weighted by VMT to establish an average emissions factor per VMT for the City. Emissions from electricity used to charge electric vehicles is captured under the electricity sector. Technical details on the EMFAC2017 modeling tool can be found on the EMFAC Mobile Source Emissions Inventory Technical Support Documentation Portal.[26]

In 2016 on-road transportation attributed to the City of South Pasadena resulted in 65,351 MT CO_2e. The activity data, emission factors and total GHG emissions from on-road transportation are provided in Table 13. Activity data is provided in O-D format, with VMT categorized based on whether the associated trips originate and end within the City (I-I), begin outside of the City and end within (X-I), or vice versa (I-X).

[26] California Air Resources Board. EMFAC Software and Technical Support Documentation. Accessed at: https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-modeling-tools-emfac Accessed on: October 4, 2019.

Table 13 Community On-road Transportation GHG Emissions

O-D Trip Type [1]	Activity Data (Daily VMT)	Annual Aggerated Activity Data (Annual VMT)[2]	Emission Factor (MT CO_2e per VMT)[3]	Emissions (MT CO_2e)
Passenger Vehicle				
I-I	4,846			
X-I	233,909	164,015,449	0.000368	60,400
I-X	233,912			
Commercial Vehicle				
I-I	21			
X-I	5,134	3,581,387	0.01382	4,951
I-X	5,166			
Total Emissions		**NA**	**NA**	**65,351**

Notes: MT CO_2e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled
1. O-D trip type represent the origin destination pair designation of each vehicle trip contributing to community VMT. This is based on whether the associated trips originate and end within the City (Internal-Internal or I-I), begin outside of the City and end within (External- Internal or X-I), or vice versa (Internal-External or I-X)
2. Weekday to annual conversion of 347 is used per CARB guidance on VMT modeling.
3.Emissions factors are established using the latest CARB and EPA-approved emissions modeling software, 2017 state EMissions FACtors (EMFAC) Model. Carbon dioxide, nitrous oxide, and methane emissions from engine combustion are multiplied by their GWP to determine CO_2e per VMT

Community Public Transit

GHG emissions from public transit are attributed to South Pasadena based on the miles of public bus routes within the City and the light rail ridership from stops within the City. Los Angeles County Metropolitan Transportation Authority (LA Metro) operates both the public buses and Gold Line light rail which provide service within South Pasadena. An analysis of the length of each bus route and the number of buses servicing the routes weekly were performed by Iteris, Inc. to provide total VMT from public buses in 2016, as provided in Table 14.

Table 14 VMT for Bus Services within the City of South Pasadena

		Number of Buses				VMT	
Route	Length (miles)	Weekday	Saturday	Sunday	Weekly	Daily	Annual
79	1.48	330	52	52	434	642	33,401
176	2.66	200	0	0	200	532	27,664
258	1.43	190	0	0	190	272	14,128
260/762	2.28	810	88	76	974	2,221	115,477
Total	**7.9**	**1,530**	**140**	**128**	**1,798**	**3,667**	**190,670**

Notes: VMT = Vehicle Miles Traveled
Data provided by Iteris. Inc. Bus routes are LA Metro routes that operate in South Pasadena, with the length of each route that lies within the city borders provided.

Emissions from buses were calculated using vehicle emissions rate established by CARB EMFAC2017 modeling for buses within the region for the year 2016. Light rail activity data was estimated as the annual ridership from the Mission Station in South Pasadena. Because 2016 ridership from the Mission Station was not available, it was estimated from the total light rail ridership in 2016, using the proportion of riders using Mission Station in 2014 compared to total light rail ridership in 2014.[27] It was estimated that there was an average of 3,768 riders boarding or arriving at the Mission Station each day, equating to 1,375,500 riders per year. In order to calcuate GHG emissions from riders on the Gold Line, an energy intensity per rider was derived based on the total ridership for the light rail system and the total energy consumption of the entire light rail system. The derived ridership and energy intensity are provided in Table 15.

Table 15 LA Metro Light Rail Ridership and Energy Intensity

Year	Daily Light Rail Ridership[1]				Annual Ridership	Energy consumption	
	Weekday	Saturday	Sunday	Weekly Average		Total Annual (kWh)[2]	Per Rider (kWh/rider)
2014	351,833	236,085	181,747	311,000	113,514,844	210,937,940	1.858
2016	348,505	220,647	187,851	307,289	112,160,485	208,270,782	1.857

Notes: kWh = kilowatt-hour
1. Metro ridership data provided from Interactive Estimated Ridership Stats: http://isotp.metro.net/MetroRidership/IndexRail.aspx
2. Annual energy consumption obtained from the Metro's 2017 Energy and Resources Report . https://media.metro.net/projects_studies/sustainability/images/report_sustainability_energyandresource_2017.pdf

GHG emissions were calculated for light rail by mulitplying the energy consumption per rider by the total number of riders and the SCE electricty emission factor. The activity data, emission factors, and resulting GHG emission for public transit are provided in Table 16.

Table 16 Community Public Transit GHG Emissions

Emission Source	Activity Data	Energy Consumption	Emission Factor	Emissions (MT CO_2e)
Bus	190,670 VMT	NA	0.002281 MT CO_2e/VMT	435
Light Rail	1,375,500 Annual Riders	2,554,168 kWh[1]	0.000240 MT CO_2e/kWh	613
Total	**NA**	**NA**	**NA**	**1048**

Notes: kWh = kilowatt hours; MT CO_2e = metric tons of carbon dioxide equivalent; VMT = Vehicle Miles Traveled; NA = Not Applicable
1. The total energy consumption of light rail attributed to South Pasadena was derived by multiplying the estimated energy consumption per rider for 2016, as provided in Table 17, by the annual riders at Mission Station in South Pasadena.

Community Off-Road Transportation

GHG emission from off-road transportation was estimated using ICLEI *U.S. Community Protocol* Method TR. 8, based on the CARB's OFFROAD2007 model and the population of South Pasadena. The OFFROAD2007 model provides emissions data related to various sub-categories and use of off-road equipment, such as construction or lawn and garden equipment, based on county inventories

[27] Metro ridership data provided from Interactive Estimated Ridership Stats: http://isotp.metro.net/MetroRidership/IndexRail.aspx

(i.e. Los Angeles County). The 2016 emissions from each sub-category applicable to South Pasadena were converted from tons per day to annual emissions by multiplying the daily emissions by 365.25 days per year.[28] The data was scaled by South Pasadena's population estimating that 0.26 percent of the total Los Angeles County population lives in South Pasadena, with emissions from off-road equipment attributed to the City of South Pasadena accordingly. To ensure the emissions were representative of South Pasadena, emissions from off-road equipment that would not be used in South Pasadena were excluded, including emissions related to: railroad activities, airport activities, port activities, and boat use; as there is not a railyard, airport, port, or access to a large body of water within South Pasadena. Additionally, emissions from "Transport Refrigeration Units" were excluded due to a lack of specific information related to these types of units within South Pasadena. "Recreational Equipment" emissions was limited to specialty vehicle or golf cart emissions, as South Pasadena has a golf course. All-terrain vehicles (ATVs), off-road motorcycles, minibikes, and snowmobiles were not included as there is no designated open space within South Pasadena's jurisdictional boundaries to use such off-road recreational equipment. Thus, off-road equipment included in the OFFORAD2007 model pertained to the following sectors: construction, entertainment, lawn and garden, light commercial, and recreational.

The City of South Pasadena converted City-operated regular maintenance and grounds equipment from diesel and gas powered to electric, resulting in an annual reduction of off-road equipment emissions of 41 MT of CO_2e per year.[29] Thus, this reduction is subtracted from the OFFROAD2007 output, equating to community-wide off-road transportation emissions totaling 829 MT CO_2e.

3.4 Community Water and Wastewater

Water sector GHG emissions include those generated from electricity used in water consumption, centralized wastewater treatment plant (WWTP) processes, and fugitive emissions. The inclusion of these emission sources in the water sector is based on the guidance of the ICLEI *U.S. Community Protocol*. A summary of the water and wastewater emissions is provided in Table 17, with the methodology of emission calculations detailed in the following section.

Table 17 Community Water and Wastewater GHG Emissions Summary

Emission Source	Activity Data	Emissions (MT CO_2e)
Water Supply	1,118 MG	700
Wastewater Fugitive and Process Emissions	540 MG	111
Wastewater Treatment and Collection Emissions		216
Total	**NA**	**1,027**

Notes: MG = Million Gallons; MT CO_2e = metric tons of carbon dioxide equivalent

[28] 365.25 days were used to account for leap year, which occurs every four years.

[29] South Coast Air Quality Management District 2019. Cities in Action – South Pasadena. *ADVISOR*. Vol. 26 No.3. May/June 2019.

Community Water Supply

Water supplied to the community indirectly contributes emissions through the use of energy to extract, convey, treat, and deliver water. The amount of energy required for community water usage was calculated following ICLEI *U.S. Community Protocol* Method WW.14, where energy required for each segment of the water cycle was estimated using energy intensities specific to the water segment. Water supplied to South Pasadena is approximately 99.5% sourced from well production from the San Gabriel Basin with the remainder purchased from Pasadena Water and Power (PWP) and Metropolitan Water District (0.47 and 0.07 percent, respectively). The energy intensity for the City of South Pasadena was not available; therefore, the energy intensities for water conveyance and distribution for the SGWVC was used as a proxy, since SGWVC's service area is directly adjacent to the City of South Pasadena and SGWVC obtains most of its water from local groundwater pumping of the San Gabriel Basin.[30] The City of South Pasadena uses chlorination treatment for local groundwater which requires additional energy.[31] Since water purchases from Metropolitan Water District are very small, they are considered negligible (<0.1 percent of water) and are not included in the inventory calculations. The total water volume undergoing each process (conveyance, treatment, and pumping) was multiplied by the energy intensity of each process to obtain a total energy consumption, which was then multiplied by the SCE electricity emission factor to obtain total GHG emissions. The volume of water, process, energy intensity, and resulting emissions are provided in Table 18. In 2016, the City of South Pasadena generated 700 MT CO_2e of GHG emissions from electricity consumed as a result of water supplied to the community.

[30] San Gabriel Valley Water Company (SGVWC) Energy Intensity values are used as a surrogate for local groundwater because the agency's supply is almost wholly pumped from San Gabriel Basin (CPUC 2010. Embedded Water Study 2. Appendix B, pg. 265. Water Agency and Function Component Study and Embedded Energy-Water Load Profiles). The energy intensities used are the averages of the lower and upper ranges: 2,501.5 kWh/MG for groundwater conveyance, and 93.5 kWh/MG for booster and raw water pumps.

[31] Treatment for City of South Pasadena water is chlorination. According to *Energy requirements of water production, treatment, end use, reclamation and disposal* published in Renewable and Sustainable Energy Review 2012, energy intensity of chlorination treatment is 0.0024 kWh per cubic meter, which equates to 9.0. kWh per Million Gallons.

Table 18 Community Water Consumption GHG Emissions

Water Supplier	Water Process	Water Volume (MG)	Energy Intensity (kWh/MG)[1,2]	Emission Factor(MT CO_2e/kWh)	Emissions (MT CO_2e)
City of South Pasadena	Groundwater Pumping	1,113	2,502	0.000240	668
	Treatment		9		2
	Distribution		94		25
Pasadena Water and Power	Conveyance, Treatment and Distribution	5	3,428		4
Total	**NA**	**NA**	**NA**	**NA**	**700**

Notes: kWh = kilowatt hours; MT CO_2e = metric tons of carbon dioxide equivalent; MG = Million Gallons; NA = not applicable
1. Energy intensity of the City of South Pasadena water supply was estimated to be similar to that of San Gabriel Valley Water Company (SGVWC), for which both agencies obtain their water supply almost entirely from groundwater pumping in the San Gabriel Basin. The energy intensity for SGVWC was obtained from the CPUC 2010 *Embedded Energy Water Studies Study 2: Water Agency and Function Component Study and Embedded Energy-Water Load Profiles*; Appendix B-Agency Profiles (pg 333). The average of high and low values were used from Table 3-22.
2. The energy intensity of the entire water supply for Pasadena Water and Power was obtained from the 2015 Urban Water Management Plan. https://ww5.cityofpasadena.net/water-and-power/wp-content/uploads/sites/54/2017/08/2015_Final_UWMP.pdf.

Community Wastewater

Wastewater generated in the City of South Pasadena is collected in local sewer lines that ultimately discharge into regional treatment and disposal facilities managed by the LACSD. Community-wide generated wastewater is accounted for as a per capita generation rate (PCGR) and includes both residential and commercial wastewater flows. In 2016, the PCGR was 60 gallons per day.[32] A population estimate for 2016 of 26,018, was provided by the Department of Finance, to estimate the total wastewater generated in South Pasadena.[33] Accordingly, it was estimated that in 2016 the South Pasadena community generated approximately 1.56 million gallons of wastewater per day (MGD) The City of South Pasadena does not operate a wastewater facility nor is there one within the City boundaries. According to the City of South Pasadena 2015 Urban Water Management Plan (UWMP), generated wastewater entering the sewer system is conveyed to the Whittier Narrows Water Reclamation Plant (WNWRP) where primary, secondary, and tertiary treatment is provided. WNWRP treats an average flow of 7.4 million gallons of wastewater per day, serving a population of approximately 150,000 from which effluent flow is primarily discharged to the San Gabriel and Rio Hondo Rivers for groundwater recharge purposes.[34][35] Primary and secondary biosolids generated from processing at the WNWRP are returned to the LACSD outfall system and are pumped to anaerobic digestors at the Joint Waters Pollution Control Plant (JWPCP) which processes

[32] City of South Pasadena 2015 UWMP. Pg. 6-15. (https://www.southpasadenaca.gov/home/showdocument?id=2905).

[33] Department of Finance. E-5 Population and Housing Estimates for Cities, Counties, and the State, 2011-2019 with 2010 Census Benchmark. (http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-5/)

[34] Whittier Narrows average treatment: City of El Monte Downtown Main Street TOD Specific Plan Final EIR. Update of the EIR. 2017. Pg. 42. http://www.elmonteca.gov/DocumentCenter/View/1420/Final-EIR-and-Responses-to-Comments-March-2017?bidId=

[35] Sanitation District of Los Angeles. 2012. Joint Outfall Systems 2010 Master Facilities Plan Final EIR/EIS. Chapter 2. Pg. 2-17. https://www.lacsd.org/civicax/filebank/blobdload.aspx?blobid=3258

approximately 257 million gallons of wastewater per day, serving a population of approximately 3,500,000.[36]

Since separate phases of the wastewater treatment occur at separate facilities, ICLEI *U.S. Community Protocol* Method WW.13 was used to attribute these emissions to the plant associated with the emission sources, scaled by the population of South Pasadena relative to the total population served by the plant. Accordingly, emissions associated with anaerobic digesters were attributed to the JWPCP facility using ICLEI *U.S. Community Protocol* Method WW.1 and WW.2, and fugitive emissions associated with the nitrification-denitrification process and effluent discharge from the plant were attributed to the WNWRP using ICLEI *U.S. Community Protocol* Method WW.7 and WW.12. The total emissions, as calculated from each of the wastewater treatment facilities and the attribution of these emissions to South Pasadena, are provided in Table 19.

[36] Sanitation District of Los Angeles. 2012. Joint Outfall Systems 2010 Master Facilities Plan Final EIR/EIS. Chapter 2. Pg. 2-12. https://www.lacsd.org/civicax/filebank/blobdload.aspx?blobid=3258

Table 19 Community Wastewater Treatment Process and Fugitive GHG Emissions

Emission Source	Population Served[1,2]	Emission Process	Total Facility Emissions (MT CO_2e)[3]	South Pasadena Attribution Factor (City Pop./Facility Service Pop.)[4]	Attributed Emissions (MT CO_2e)
Whittier Narrows Water Reclamation Plant (WNWRP)	150,000	Process N_2O from Nitrification-Denitrification	278	0.1735	48
		Fugitive N_2O from Effluent Discharge	360		62
Joint Waters Pollution Control Plant (JWPCP)	1,000,000	CH_4 Emissions from Combustion of Digester Gas	<1	0.0074	<1
		N_2O Emissions from Combustion of Digester Gas	<1		<1
Total	**NA**	**NA**	**NA**	**NA**	**111**

Notes: Value may not add up due to rounding
MT CO_2e = metric tons of carbon dioxide equivalent; CH_4 = Methane; N_2O = Nitrous Oxide; Pop. = Population; NA = not applicable
1. Population served by LACSD's WNWRP by LACSD website https://lacsd.org/wastewater/wwfacilities/joint_outfall_system_wrp/whittier_narrows.asp.
2. Population served by LACSD's JWPCP by LACSD website https://lacsd.org/wastewater/wwfacilities/jwpcp/default.asp
3. N_2O and CH_4 emissions were converted to MT CO_2e using the appropriate global warming potentials (CH_4 GWP = 28; N_2O HGWP = 265).
4. The South Pasadena attribution factor is used to attribute a portion of the total emissions from each wastewater treatment facility to the City of South Pasadena based on population, as recommended by ICLEI *U.S. Community Protocol* WW.13. The South Pasadena 2016 population of 26,018 was divided by the total population served by the respective facility to derive the attribution factor.

Wastewater treatment technology specifications can vary widely between jurisdictions, as a result of process specifics, influent characteristics, and the age of infrastructure. As noted in the U.S. *Community Protocols*, the wastewater emissions calculation methodologies used here were designed as a generalized top-down approach for countries where detailed information was not available; they are a simplified approach that sacrifice accuracy. These methods have a range of accuracy for CH_4 emissions of +37% to -47% and +76% to -93% for N_2O, compared to direct source measurements.[37] While there is significant uncertainty in the fugitive and process emissions associated with wastewater treatment, providing estimates of their emissions provides a general understanding of the magnitude of this emission source in comparison to others.

Energy-related emissions associated with the collection and treatment of wastewater generated in South Pasadena were calculated using ICLEI *U.S. Community Protocol* Method WW.15 where emissions are due to the amount of energy required to collect and treat wastewater. LACSD specific energy intensity factors for wastewater collection and treatment were used to calculate emissions.[38] Based on the 1.56 MGD wastewater generation rate, it was estimated that approximately 570 MG

[37] ICLEI 2019. U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions. Appendix F – Wastewater and Water Emission Activities and Sources.

[38] California Public Utilities Commission (CPUC). 2010. Embedded Energy in Water Studies; Study 2: Water Agency and Function Component Study and Embedded Energy-Water Load Profiles. (http://www.cpuc.ca.gov/general.aspx?id=4388)

of wastewater was collected and treated in 2016, resulting in 216 MT CO_2e being generated from the associated electricity consumption. Table 20 provides the activity data, energy intensity, energy consumption, and emissions associated with wastewater collection and treatment. In 2016, approximately 216 MT CO_2e were generated from electricity used to collect and treat wastewater in South Pasadena.

Table 20 Community Wastewater Treatment and Collection GHG Emissions

Process	Annual Wastewater Flow (MG)	Energy Intensity (kWh/MG)[1]	Annual Energy Consumption (kWh)	Emission Factor(MT CO_2e/kWh)	Emissions (MT CO_2e)
Wastewater Collection	570	302	172,196	0.000240	41
Wastewater Treatment		1,275	726,985		174
Total	**NA**	**NA**	**NA**	**NA**	**216**

Notes: kWh = kilowatt hours; MT CO_2e = metric tons of carbon dioxide equivalent; MG = Million Gallons; NA = not applicable
Totals may not add due to rounding
1. Agency specific (LACSD) energy intensities were obtained from CPUC 2010. Embedded Energy Water Studies Study 2: Water Agency and Function Component Study and Embedded Energy-Water Load Profiles; Table 4.2 Appendix B-Agency Profiles (pg. 134); average of low and high value were applied.

3.5 Solid Waste

GHG emissions result from solid waste management and decay of organic material in solid waste. ICLEI *U.S. Community Protocol* provides multiple accounting methods to address both emissions arising from solid waste generated by a community (regardless of where it is disposed of) as well as emissions arising from solid waste disposed of inside a community's boundaries (regardless of where it was generated). GHG emissions from the decomposition of organic material in this sector are broken down into two parts:

- Methane emissions from solid waste generated by the community in the year of the inventory, using ICLEI *U.S. Community Protocol* Method SW.4.
- Methane emissions from existing solid waste-in-place at landfills located within the community limits (waste-in-place), using ICLEI *U.S. Community Protocol* Method SW.1.

Due to the slow rate of emissions generation associated with decomposition of solid waste, this two-pronged approach also allows policy makers to target solid waste activity in a particular year, similar to other sectors (e.g., fuel combustion resulting in immediate emissions). Accounting for both of these sources will lead to some double counting in the waste sector; however, both methodologies convey different aspects of the solid waste emissions profile and are included for consistency with previous inventories. No landfills exist within the South Pasadena's jurisdictional boundary; therefore, solid waste decay methane emissions were estimated using only ICLEI *U.S. Community Protocol* Method SW.4 to calculate the methane commitment of solid waste generated by South Pasadena in 2016. While these methane emissions are attributed to a single inventory year, the actual emissions will occur over time as waste decays in the landfill.

In addition to the GHG emissions resulting from the decomposition of solid waste in landfills, the collection, transportation, and processing of solid waste produces GHG emissions. Specifically, for

the City of South Pasadena, a small portion of the waste stream is sent to combustion facilities, which produces additional GHG emissions. The emissions from the collection of solid waste are included in the transportation sector; therefore, they are not included in the solid waste sector total emissions. However, it is beneficial to quantify these emissions for informational purposes in policy development. The following ICLEI methodologies are used to quantify solid waste process emissions:

- Process emissions, generated at landfills, associated with landfilling of community-generated waste, using ICLEI *U.S. Community Protocol* Method SW.5
- Combustion emissions associated with community-generated waste sent to combustion facilities, using ICLEI *U.S. Community Protocol* Method SW.7

A summary of the community waste sector GHG emissions is provided in Table 21, with the methodology of emission calculations detailed in the following section.

Table 21 Community Waste GHG Emissions Summary

Emission Source	Activity Data	Emissions (MT CO_2e)
Landfill Methane Emissions	18,484 tons	7,509
Landfilling Process Emissions	18,484 tons	203
Waste Sent to Combustion Facilities	3 tons	1
Total	**NA**	**7,713**

Notes: Totals may not add due to rounding.
kWh = kilowatt-hour; MT CO_2e = metric tons of carbon dioxide equivalent; NA = Not Applicable

Community Generated Waste

In 2016, South Pasadena produced 18,484 tons of waste which was disposed of in landfills.[39] ICLEI *U.S. Community Protocol* Method SW.4.1 was used to calculate methane emissions based on the mass of waste landfilled, organic content of waste, and the landfill gas (LFG) capture rate of the facilities to which waste was sent. Waste generated in South Pasadena was sent to numerous landfills; therefore, the LFG capture rate used for waste generated in South Pasadena was derived from the average LFG capture of each facility, weighted by the mass of waste received. The estimated LFG capture rate was 73%, with calculation details provided in Table 22.

[39] Waste disposed of by landfill from South Pasadena was obtained via CalRecycle 2016 Disposal Reports by Jurisdiction. https://www2.calrecycle.ca.gov/LGCentral/DisposalReporting/Destination/DisposalByFacility

Table 22 Community Waste Landfill Gas Capture Rate

Facility	Waste Received (tons)[1]	Percent of Total Landfilled Waste	LFG Capture Rate[2]	Weighted LFG Capture Rate
Mid-Valley Sanitary Landfill	7,602	41.1%	67.4%	73%
Scholl Canyon Sanitary Landfill	3,913	21.2%	79.0%	
Chiquita Canyon Sanitary Landfill	3,639	19.7%	96.9%	
San Timoteo Sanitary Landfill	2,602	14.1%	54.6%	
Azusa Land Reclamation Co. Landfill	286	1.6%	42.7%	
Victorville Sanitary Landfill	183	1.0%	29.1%	
Olinda-Alpha Sanitary Landfill	173	0.9%	88.6%	
Frank R. Bowerman Sanitary Landfill	45	0.2%	None Reported	
Antelope Valley Public Landfill	32	0.2%	77.6%	

Notes: LFG = Landfill Gas
1. Total waste sent to destination landfills was obtained from CalRecycle 2016 Disposal Reports by Jurisdiction. https://www2.calrecycle.ca.gov/LGCentral/DisposalReporting/Destination/DisposalByFacility
2. LFG capture rates determined from the United States Environmental Protection Agency's Landfill Methane Outreach Program (LMOP) database. https://www.epa.gov/lmop/project-and-landfill-data-state

Using the above calculated LFG capture rate, it was estimated that the waste sent to landfill by the community in 2016 would generate approxiamtely 7,509 MT CO_2e. The activity data, calculation details, emission factors, and GHG emissions are provided in Table 23.

Table 23 Community Waste Landfill Methane Emissions

Process[1]	Solid Waste (tons)	Emission Factor (MT CH_4/ton of waste)[2]	Oxidation Rate[3]	LFG Capture Rate[4]	Emissions (MT CO_2e)[5]
Landfilled Solid Waste	18,484	0.06	0.01	0.73	7,509

Notes: LFG = Landfill Gas ; MT CO_2e = metric tons of carbon dioxide equivalent; MT CH_4 = metric tons of methane
1. Emissions calculated using *U.S. Community Protocol* Method SW.4.1.
2. Default emission factor from *U.S. Community Protocol* Method SW.4.1 used for calculations.
3. Oxidation rate represents the remaining fraction of waste mass that is not converted to methane.
4. LFG capture rate derivation provided in Table 24.
5. Total emissions are converted to CO_2e using the appropriate methane global warming potential.

Landfilling Process Emissions

Landfilling process emissions encompass the contribution of the City of South Pasadena's waste to the emissions associated with operations at the destination landfill. These emissions were calculated using ICLEI *U.S. Community Protocol* Method SW.5. The primary destination landfills for South Pasadena's waste are assumed to use natural gas to fuel their equipment.[40] In 2016,

[40] It is assumed that the primary fuel used for processing equipment is natural gas; however, EPA GHG Reports the primary landfills South Pasadena waste is disposed at use natural gas and propane to power stationary combustion equipment rather than purely natural gas. https://ghgdata.epa.gov/ghgp/main.do

landfilling process emissions attributed to South Pasadena were 203 MT of CO_2e. The activity data, calculation details, emission factors, and GHG emissions are provided in Table 24.

Table 24 Community Waste Landfilling Process GHG Emissions

Process[1]	Solid Waste (tons)	Emission Factor (MT CO_2/ton of waste)[2]	Emissions (MT CO_2e)[5]
Landfilled Solid Waste	18,484	0.011	203

Notes: MT CO_2e = metric tons of carbon dioxide equivalent
1. Emissions calculated using *U.S. Community Protocol* Method SW.5
2. Default emission factor from *U.S. Community Protocol* Method SW.5 used for calculations, assuming natural gas fueled equipment.

Waste Sent to Combustion Facilities

A small portion of the waste generated in the City of South Pasadena is sent to waste combustion facilities and ICLEI *U.S. Community Protocols* Method SW.7 was used to calculate these emissions. In 2016, the City of South Pasadena sent 3 tons of waste to waste combustion facilities.[41] Emission from the waste-to-energy facilities were attributed to South Pasadena based on the attribution factor of the proportion of waste sent to the facilities to the total annual waste processed by the facility. Table 25 provides the total emissions generated from each facility for which waste from South Pasadena was sent, the total GHG emissions from the facility, and the emissions attributed to South Pasadena.

Table 25 Community Waste Sent to Combustion Facilities GHG Emissions

Facility	Total Facility Waste Processed (Tons)[1]	Waste Sent from South Pasadena (Tons)[2]	Attribution Factor	Total Facility Emissions (MT CO_2e)[3]	Emissions (MT CO_2e)[5]
Commerce Refuse-To-Energy Facility	109,103	2	0.00002	58,222	1
Southeast Resource Recovery Facility	417,925	1	0.000002	141,708	<1
Total	**NA**	**NA**	**NA**	**NA**	**1**

Notes: MT CO_2e = metric tons of carbon dioxide equivalent
1. Total waste received by the facility in 2016 obtained from CalRecycle Single-year Countywide Destination Detail for Los Angeles County. https://www2.calrecycle.ca.gov/LGCentral/DisposalReporting/Destination/CountywideDetail
2. Total waste sent to destination landfills was obtained from CalRecycle 2016 Disposal Reports by Jurisdiction. https://www2.calrecycle.ca.gov/LGCentral/DisposalReporting/Destination/DisposalByFacility.
3. Total facility emissions obtained from the U.S. EPA Facility Level Information on Greenhouse gases Tool (FLIGHT). https://ghgdata.epa.gov/ghgp/main.do

[41] Total waste sent to destination landfills was obtained from CalRecycle 2016 Disposal Reports by Jurisdiction. https://www2.calrecycle.ca.gov/LGCentral/DisposalReporting/Destination/DisposalByFacility

3.6 Community GHG Inventory Results

In 2016, the South Pasadena community emitted approximately 125,269 MT CO_2e. As shown in Figure 2 and Table 26, the transportation sector was the largest source of emissions, generating approximately 67,228 MT CO_2e, or 54% of total 2016 GHG emissions. Electricity and natural gas consumption within the residential and commercial sectors were the second largest source of 2016 emissions, generating 49,301 MT CO_2e, or 39%of the total. Waste generation, including waste decay and processing resulted in 6% of the City's emissions, while water use and wastewater generation resulted in the remaining 1%.

Figure 2 2016 Community-wide GHG Emissions by Sector

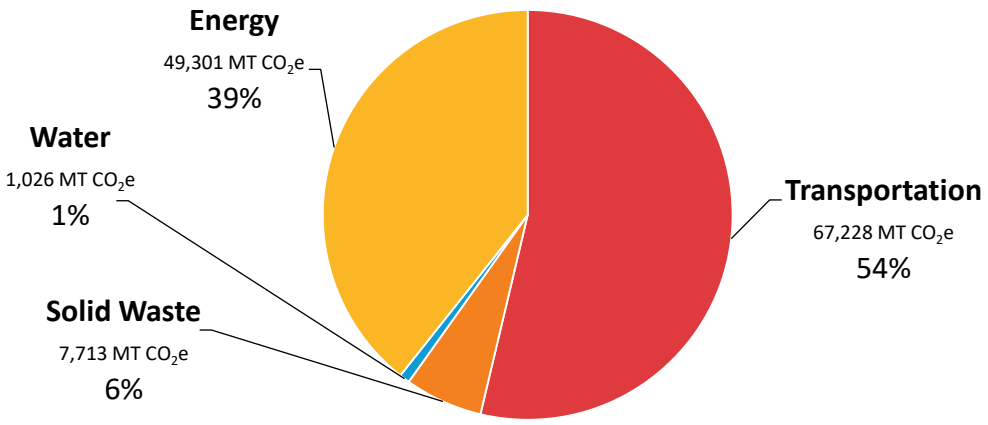


Table 26 Baseline Community-wide GHG Emissions Summary by Sector

Sector	Emissions (MT CO_2e)	Percent of Total Emissions
Energy	**49,301**	**39%**
Electricity	23,987	19%
Natural Gas	24,287	19%
Electricity Transmission and Distribution Losses	1,027	1%
Transportation	**67,228**	**54%**
On-road Transportation	65,351	52%
Off-road Equipment	829	1%
Public Transit	1,048	1%
Water	**1,026**	**1%**
Water conveyance, distribution, and treatment	700	1%
Wastewater collection and treatment	216	<1%
Wastewater Fugitive and Process Emissions	111	<1%
Solid Waste	**7,712**	**6%**
Waste Sent to Landfills	7,509	6%
Process Emissions	203	<1%
Waste Sent to Combustion Facilities	1	<1%
Total	**125,269**	**100%**

Notes: Emissions have been rounded and therefore sums may not match
MT CO_2e : Metric tons of Carbon Dioxide Equivalent

4 GHG Emissions Forecast

A baseline inventory (i.e., the City of South Pasadena's 2016 community inventory) sets a reference point for a single year; however, annual emissions change over time due to external factors such as population and job growth. An emissions forecast accounts for projected growth and presents an estimate of GHG emissions in a future year. Calculating the difference between the GHG emissions forecast and the reduction targets set by the City determines the gap to be closed through City Climate Action Plan policies. This section quantifies an estimate of the future GHG emissions in South Pasadena and the reduction impact state regulations will have on the forecasted GHG emissions for the years 2020, 2030, 2040 and 2045.

Several indicator growth rates were developed from demographic growth projections and the results of the 2016 Community GHG Inventory and applied to the various emissions sectors to forecast future GHG emissions. These growth rates were developed from the SCAG 2016 RTP/SCS population and job projections. This forecast based solely on the 2016 GHG inventory and growth projections is considered the *business-as-usual scenario* (*BAU*), where it is assumed that no additional action will occur to reduce future GHG emissions. Once *BAU* forecasted GHG emissions are established, a *legislative adjusted* (*adjusted*) *scenario* of future GHG emissions is developed which considers the GHG reduction impact of state and federal legislation on the *BAU* forecasted GHG emissions. The applicable state and federal regulatory requirements, including Corporate Average Fuel Economy standards, Advanced Clean Car Standards, Renewable Portfolio Standard, and Title 24 efficiencies, are then incorporated to accurately reflect expected reductions from state programs. The *adjusted scenario* provides a more accurate picture of future emissions growth and the responsibility of the City and community for GHG reductions to algin with state GHG reduction goals.

4.1 Business-as-Usual Scenario GHG Emissions Forecast

The City of South Pasadena *BAU scenario* forecast provides an estimate of how GHG emissions would change in the forecast years if consumption trends continue as in 2016, absent any new regulations or actions that would reduce local emissions. Several indicator growth rates were developed from the 2016 GHG inventory activity levels and applied to the various emissions sectors to project future year activity data. Additionally, as part of the *BAU scenario,* forecast emission factors are assumed to remain the same as in 2016. Table 27contains growth and emission factors used to develop the business-as-usual scenario forecast. Not included in this table is on-road transportation VMT and off-road equipment. VMT as provided from the SCAG Trip Based Regional Travel Demand Model is linked to the same SCAG 2016 RTP/SCS demographic projections used for this *BAU scenario* forecast. Forecasted emission from off-road equipment was estimated using the CARB OFFROAD2007 model and the methodology described in the *Community Off-Road Transportation* Section.

Table 27 Business-as-Usual Growth and Emission Factors

Sector	Growth Factor	Emission Factor
Residential Electricity	2,317 kWh/capita	0.000240 MT CO_2e/kWh
Commercial Electricity	4,323 kWh/job	0.000240 MT CO_2e/kWh
Residential Natural Gas	144 therm/capita	0.00531 MT CO_2e/therm
Commercial Natural Gas	80.1 therm/job	0.00531 MT CO_2e/therm
Solid Waste	0.521 tons/SP	0.417 MT CO_2e/ton
Water Conveyance, Distribution and Treatment Electricity	82.2 kWh/SP	0.000240 MT CO_2e/kWh
Wastewater Collection and Treatment Electricity	25.3 kWh/SP	0.000240 MT CO_2e/kWh
Wastewater Fugitive and Process Emissions	NA	0.0197 MT CO_2e/SP
Public Transit – Buses	5.37 VMT/SP	0.00228 MT CO_2e/VMT
Public Transit – Light Rail	71.7 kWh/SP	0.000240 MT CO_2e/kWh
Passenger On-Road Transportation	See Table 30	0.000368 MT CO_2e/VMT
Commercial On-Road Transportation	See Table 30	0.00138 MT CO_2e/VMT

Notes: kwh = kilowatt-hour; MT CO_2e = Metric Tons of Carbon Dioxide Equivalent; SP = Service Population; VMT = Vehicle Miles Traveled; NA = Not Applicable

To estimate future activity data and GHG emissions for the *BAU scenario* forecast, the growth and emission factors were applied to the demographic and VMT projections as provided in Table 28.

Table 28 Business-as-Usual Demographic and VMT projections

Sector	2020	2030	2040	2045
Population[1]	26,198	26,649	27,100	27,327
Employment[1]	9,643	10,071	10,500	10,716
Service Population[2]	35,841	36,720	37,600	38,043
Passenger VMT[3]	164,447,117	164,913,485	166,607,886	167,455,087
Commercial VMT[3]	3,750,723	4,174,063	4,597,750	4,809,594

Notes: VMT = Vehicle Miles Traveled
1. Employment and Population projections obtained from the SCAG 2016 RTP/SCS Demographics and Growth Forecast. http://scagrtpscs.net/Documents/2016/final/f2016RTPSCS_DemographicsGrowthForecast.pdf.
2. Service population is the sum of employment and population in the jurisdiction
3. Projected VMT attributed to the City of South Pasadena was completed by Iteris, Inc.. The SCAG Trip Based Regional Travel Demand Model, based on the SCAG 2016 RTP/SCS was used to model traffic volumes and quantify VMT attributed to South Pasadena.

Under the *BAU scenario* forecast, the City of South Pasadena's GHG emissions are projected to continue increasing through 2045, as shown in Table 29.

Table 29 Business-as-usual Forecast by Sector

Sector	2020 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Residential Electricity	14,562	14,813	15,063	15,189
Non-residential Electricity	10,002	10,447	10,892	11,116
Transmission and Distribution Losses	1,039	1,068	1,098	1,113
Residential Gas	20,095	20,441	20,787	20,961
Non-Residential Natural Gas	4,102	4,285	4,467	4,559
Passenger On-road Transportation	60,559	60,731	61,355	61,667
Commercial On-road Transportation	5,203	5,832	6,462	6,776
Public Transit	1,056	1,082	1,107	1,121
Off-Road Equipment	892	1,050	1,184	1,251
Waste	7,789	7,981	8,172	8,268
Water	707	724	742	750
Wastewater	330	338	346	350
Total Emissions	**126,337**	**128,792**	**131,675**	**133,121**

Notes: Emissions have been rounded and therefore sums may not match
MT CO_2e = Metric Tons of Carbon Dioxide Equivalent;

4.2 Legislative Adjusted Scenario GHG Emissions Forecast

The *adjusted scenario* is based on the same base data as the *BAU scenario* but includes an adjustment for the legislative actions and associated emissions reductions occurring at the state and federal levels. These actions include regulatory requirements to increase vehicle fuel efficiency or standards to reduce the carbon intensity of electricity. The difference between the emissions projected in the *adjusted scenario* and the GHG reduction targets established for each horizon year is the amount of GHG reductions which are the responsibility of the City to align with California goals. This "gap analysis" provides the City with the total GHG emissions reduction required as well as information on the emissions sectors and sources which have the most GHG reduction opportunities.

The *adjusted scenario* forecast estimates future City of South Pasadena emissions under codified GHG reduction strategies currently being implemented at the state and federal level. The 2017 Scoping Plan Update identified several existing state programs and targets, or known commitments required by statute which can be assumed to achieve GHG reductions without City action, such as increased fuel efficiency standards of mobile vehicles. The following known commitments are factored into the *adjusted scenario* projection and a summary of the programs can be found in Table 30.

Table 30 Summary of Legislative Reductions

Legislation	2020 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Senate Bill 100 and Renewable Portfolio Standards	2,636	12,035	23,235	29,054
Title 24	31	346	660	96
Transportation (Pavley, Innovative Clean Transit, etc.)	6,971	22,671	28,852	30,001
Total	**9,638**	**35,052**	**52,747**	**59,152**

Notes: Emissions have been rounded and therefore sums may not match
MT CO_2e = metric tons of carbon dioxide equivalent

Significant GHG reductions realized by state programs in South Pasadena will occur from the increasing decarbonization of the electricity supply due to SB 100 and the Renewable Portfolio Standard (RPS), avoiding an estimated 29,054 MT CO_2e by 2045. The City's transportation sector will also experience a reduction ofapproximately 30,000 MT CO_2e by 2045 through state and federal fuel efficiency and tailpipe emissions standards. The following discussion provides an overview of the legislation included in the *adjusted scenario* forecast and the emission reduction impact of each of the legislation categories addressed.

4.2.1 Transportation Legislation

The CARB EMFAC2017 transportation modeling program incorporates legislative requirements and regulations including the Advanced Clean Cars program (Low Emissions Vehicles III, Zero Emissions Vehicles program, etc.) and Phase 2 federal GHG Standards. Signed into law in 2002, AB 1493 (Pavley Standards) required vehicle manufactures to reduce GHG emissions from new passenger vehicles and light-duty trucks from 2009 through 2016, with a target of 30 percent reductions by 2016, while simultaneously improving fuel efficiency and reducing motorists' costs.[42]

Prior to 2012, mobile emissions regulations were implemented on a case-by-case basis for GHG and criteria pollutant emissions separately. In January 2012, CARB approved a new emissions-control program (the Advanced Clean Cars program) combining the control of smog, soot causing pollutants, and GHG emissions into a single coordinated package of requirements for passenger cars and light-duty trucks model years 2017 through 2025. The Advanced Clean Cars program coordinates the goals of the Low Emissions Vehicles, Zero Emissions Vehicles, and Clean Fuels Outlet programs. The new standards will reduce Californian GHG emissions by 34 percent in 2025.[43]

Reductions in GHG emissions from the above referenced standards were calculated using the CARB EMFAC2017 model for Los Angeles County. The EMFAC2017 model integrates the estimated reductions into the mobile source emissions portion of the model.[44]

[42] California Air Resources Board. Clean Car Standards – Pavley, Assembly Bill 1493. May 2013.

[43] California Air Resources Board. Facts About the Advanced Clean Cars Program. December 2011. Accessed at: http://www.arb.ca.gov/msprog/zevprog/factsheets/advanced_clean_cars_eng.pdf. Accessed on: May 20, 2019

[44] Additional details are provided in the EMFAC2017 Technical Documentation, July 2018. Accessed at: https://www.arb.ca.gov/msei/downloads/emfac2017-volume-iii-technical-documentation.pdf. Accessed on: May 20, 2019. The Low Carbon Fuel Standard (LCFS) regulation is excluded from EMFAC2017 because most of the emissions benefits due to the LCFS come from the production cycle (upstream emissions) of the fuel rather than the combustion cycle (tailpipe). As a result, LCFS is assumed to not have a significant impact on CO_2 emissions from EMFAC's tailpipe emissions estimates.

At the time of this forecast, the future impacts of state legislation on tailpipe emission standard in California remains uncertain due to the federal Safer Affordable Fuel Efficient (SAFE) Rule. The SAFE Rule proposes to amend certain existing Corporate Average Fuel Economy (CAFE) and GHG emission standards.[45] This specifically affects the ability of California to set its own fuel efficiency standards that supersede federal standards. The sunset year of the SAFE Rule is 2026, which is before the 2030 and 2045 target years of this CAP. Thus, there is uncertainty in the long-term impact the SAFE Rule may have on GHG emissions.

Public transit GHG emissions will also be reduced in the future through the Innovative Clean Transit (ICT) regulation, which was adopted in December 2018. It requires all public transit agencies to gradually transition to a 100-percent zero-emission bus fleet by 2040. Under ICT, large transit agencies are expected to adopt Zero-Emission Bus Rollout Plans to establish a roadmap towards zero emission public transit busses.[46]

GHG Emission Reduction Impact

Transportation legislation will reduce forecasted GHG emissions from the *BAU scenario* for on-road transportation and public transit. The emission reductions are calculated based on the incorporation of the impact on vehicle emission factors, as provided in the CARB EMFAC2017 emission factor modeling software. *BAU scenario* emissions were calculated based on projected activity data and the emission factors that were used in the 2016 Community GHG Inventory. The legislative adjustments for passenger and commercial on-road transportation are calculated by using the emission factors provided by EMFAC for the indicated forecast target year. Legislative adjustments for public transit buses are estimated by assuming emission from public transit buses will be zero in 2040, in alignment with the ICT Rule, with a gradual reduction of bus emission factors to zero from 2016 levels. The activity data, emission factors, legislative reductions, and adjusted emissions for each of the emission sources impacted by transportation legislation are provided in Table 31.

[45] USEPA. Regulations for Emissions from Vehicles and Engines. https://www.epa.gov/regulations-emissions-vehicles-and-engines/safer-affordable-fuel-efficient-safe-vehicles-proposed. Accessed July 26th, 2020.

[46] Innovative Clean Transit. Approved August 13, 2019. https://ww2.arb.ca.gov/sites/default/files/2019-10/ictfro-Clean-Final_0.pdf?utm_medium=email&utm_source=govdelivery

Table 31 Transportation Adjusted Scenario Forecast Results by Target Year

Calculation Factor	2020	2030	2040	2045
Passenger Vehicles				
VMT	164,447,117	164,913,485	166,607,886	167,455,087
Adjusted Emission Factor (MT CO_2e/VMT)	0.000332	0.000245	0.000214	0.000209
Adjusted Emissions (MT CO_2e)	54,555	40,351	35,611	34,981
BAU Emissions (MT CO_2e)	60,559	60,731	61,355	61,667
Legislative Reductions (MT CO_2e)	6,004	20,380	25,744	26,684
Commercial Vehicles				
VMT	3,750,723	4,174,063	4,597,750	4,809,594
Adjusted Emission Factor (MT CO_2e/VMT)	0.001149	0.000911	0.000830	0.000816
Adjusted Emissions (MT CO_2e)	4,308	3,803	3,814	3,926
BAU Emissions (MT CO_2e)	5,203	5,832	6,462	6,776
Legislative Reductions (MT CO_2e)	894	2,029	2,648	2,850
Public Transit - Buses				
VMT	192,560	197,286	202,012	204,391
Adjusted Emission Factor (MT CO_2e/VMT)	0.000332	0.000950	0	0
Adjusted Emissions (MT CO_2e)	366	187	0	0
BAU Emissions (MT CO_2e)	439	450	461	466
Legislative Reductions (MT CO_2e)	73	262	461	466
Total Legislative Reductions	**6,971**	**22,671**	**28,852**	**30,001**

Notes: Emissions have been rounded and therefore sums may not match
MT CO_2e = metric ton of carbon dioxide equivalent; VMT = vehicle miles traveled

4.2.2 Title 24

Although it was not originally intended to reduce GHG emissions, California Code of Regulations Title 24, Part 6: California's Energy Efficiency Standards for Residential and Nonresidential Buildings, was adopted in 1978 in response to a legislative mandate to reduce California's energy consumption, which in turn reduces fossil fuel consumption and associated GHG emissions. The standards are updated triennially to allow consideration and possible incorporation of new energy-efficient technologies and methods. Starting in 2020, new residential developments will include on-site solar generation and near-zero net energy use. For projects implemented after January 1, 2020, the California Energy Commission estimates the 2019 standards will reduce consumption by 53% for residential buildings and 30% for commercial buildings, relative to the 2016 standards. These percentage savings relate to space heating and cooling, lighting, and water heating only and do not include other appliances, outdoor lighting not attached to buildings, plug loads, or other energy

uses. The calculations and GHG emissions forecast assume all growth in the residential and commercial/industrial sectors is from new construction.

The 2017 Scoping Plan Update calls for the continuation of ongoing triennial updates to Title 24 which will yield regular increases in the mandatory energy and water savings for new construction. Future updates to Title 24 standards for residential and non-residential alterations past 2023 are not taken into consideration due to uncertainty about the magnitude of energy savings realized with each subsequent update.

GHG Emission Reduction Impact

Emission reduction from Title 24 impact the electricity and natural gas used in buildings. Emission reductions are based only on efficiency gained in new buildings from the 2019 code cycle, as the impact of future code cycles are uncertain. Reductions in future energy consumption from Title 24 were calculated from the estimated increase in energy consumption from new development in South Pasadena. This is assumed to be equivalent to the increase in energy consumption as estimated from employment and population growth in the *BAU scenario* forecast, above the baseline 2016 Community Inventory energy consumption. To account for the requirements of Title 24, new estimated residential energy consumption was reduced by 53% and new estimated non-residential energy consumption was reduced by 30%. The emission reductions from Title 24 are equivalent to the difference between *BAU scenario* energy consumption and the adjusted energy consumption multiplied by the baseline emission factor. The activity data, emission factors, legislative reductions, and adjusted emissions for each of the emission sources impacted by Title 24 are provided in Table 34. The total emissions and emission reductions provided in Table 32 are not representative of the final emission totals for the *adjusted scenario* forecast and are instead provided to show emission reductions from Title 24. Some of the emission reductions from Title 24 are offset by the emission reduction from the Renewable Portfolio Standards (RPS) and SB 100.

Table 32 Title 24 Adjusted Scenario Forecast Results by Target Year

Calculation Factor	2020	2030	2040	2045
Electricity				
BAU Residential Consumption (kWh)	60,690,232	61,734,618	62,779,004	63,304,243
Adjusted Residential Consumption (kWh)	60,634,879	61,125,741	61,616,602	61,863,465
BAU Non-Residential Consumption (kWh)	41,686,415	43,539,985	45,393,555	46,327,940
Adjusted Non-Residential Consumption (kWh)	41,630,808	42,928,307	44,225,806	44,879,876
BAU T&D Losses Consumption (kWh)	4,330,532	4,453,116	4,575,699	4,637,441
Adjusted T&D Losses Consumption (kWh)	4,325,839	4,401,486	4,477,134	4,515,243
Total Title 24 Energy Reduction (kWh)	115,653	1,272,185	2,428,717	3,011,042
Baseline Electricity Emission Factor (MT CO_2e/kWh)	0.000240	0.000240	0.000240	0.000240
Legislative Reductions (MT CO_2e)	28	305	583	722
Natural Gas				
BAU Residential Consumption (Therm)	3,784,340	3,849,463	3,914,586	3,947,337
Adjusted Residential Consumption (Therm)	3,783,884	3,844,448	3,905,012	3,935,471
BAU Non-Residential Consumption (Therm)	772,558	806,909	841,261	858,577
Adjusted Non-Residential Consumption (Therm)	772,317	804,264	836,211	852,315
Total Title 24 Energy Reduction (Therm)	696	7,660	14,623	18,127
Baseline Natural Gas Emission Factor (MT CO_2e/Therm)	0.00531	0.00531	0.00531	0.00531
Legislative Reductions (MT CO_2e)	4	41	78	96
Total Legislative Reductions[1]	**32**	**346**	**661**	**818**

Notes: Values have been rounded and therefore sums may not match
MT CO_2e = metric ton of carbon dioxide equivalent; T&D Losses = Transmission and Distribution Losses; kWh = kilowatt-hour
1. Total legislative reductions may not add up to the values provided in Table 32. Some of the emission reductions that would have been realized in absence of other legislation are eroded by Renewable Portfolio Standards and Senate Bill 100. The full emission reductions are provided here for informational purposes; however, the effective emission reductions are provided in Table 38.

4.2.3 Renewables Portfolio Standard & Senate Bill 100

Established in 2002 under SB 1078, enhanced in 2015 by SB 350, and accelerated in 2018 under SB 100, California's RPS is one of the most ambitious renewable energy standards in the country. The RPS program requires investor-owned utilities, public owned utilities, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources to 50 percent of total procurement by 2026 and 60 percent of total procurement by 2030. The RPS program further requires these entities to increase procurement from GHG-free sources to 100 percent.

SCE provides electricity in South Pasadena and is subject to the RPS requirements. SCE forecast emissions factors include reductions based on compliance with RPS requirements through 2045. In 2016, SCE reported an emissions factor of 529 pounds CO_2e per MWh.

GHG Emission Reduction Impact

GHG emission reduction from the RPS and SB 100 impact the GHG emissions from electricity used in buildings, electric powered light rail, and water and wastewater movement and treatment. Emission reductions are the change in emissions when calculating emissions based on baseline SCE electricity emission factor and the RPS-adjusted electricity emission factors. The baseline RPS for SCE in 2016 was 28%, with an emission factor of 0.000240 MT CO_2e per kWh. Adjusted electricity emission factors are calculated based on the RPS carbon-free energy percentage as compared to the baseline emission factor. The activity data, emission factors, legislative reductions, and adjusted emissions for each of the emission sources impacted by RPS and SB 100 are provided in Table 33.

Table 33 RPS and SB 100 Adjusted Scenario Forecast Results by Target Year

Calculation Factor	2020	2030	2040	2045
Adjusted Emission Factor				
RPS percentage	37%	60%	87%	100%
Adjusted Emission Factor (MT CO_2e/kWh)	0.000217	0.000137	0.000046	0
Building Electricity				
Adjusted Residential Consumption (kWh)	60,634,879	61,125,741	61,616,602	61,863,465
Adjusted Residential Emissions (MT CO_2e)	13,135	8,279	2,577	0
Adjusted Non-Residential Consumption (kWh)	41,630,808	42,928,307	44,225,806	44,879,876
Adjusted Non-Residential Emissions (MT CO_2e)	9,018	5,795	1,785	0
Adjusted T&D Losses Consumption (kWh)	4,325,839	4,401,486	4,477,134	4,515,243
Adjusted T&D Losses Emissions (MT CO_2e)	937	595	184	0
Legislative Reductions (MT CO_2e)	2,486	11,354	21,924	27,418
Public Transit – Light Rail				
Adjusted Light Rail Consumption (kWh)	2,569,390	2,632,446	2,695,502	2,727,251
Adjusted Light Rail Emissions (MT CO_2e)	557	547	123	0
Legislative Reductions (MT CO_2e)	60	272	524	654
Water Conveyance, Treatment and Distribution				
Adjusted Water Consumption (kWh)	2,946,398	3,018,707	3,091,015	3,127,422
Adjusted Water Emissions (MT CO_2e)	638	412	141	0
Legislative Reductions (MT CO_2e)	69	312	601	750
Wastewater Collection and Treatment				
Adjusted Wastewater Consumption (kWh)	908,095	930,381	952,667	963,888
Adjusted Wastewater Emissions (MT CO_2e)	197	127	43	0
Legislative Reductions (MT CO_2e)	21	96	185	231
Total Legislative Reductions	**2,636**	**12,035**	**23,235**	**29,054**

Notes: Values have been rounded and therefore sums may not match
MT CO_2e = metric ton of carbon dioxide equivalent; T&D Losses = Transmission and Distribution Losses; kWh = kilowatt-hour

4.2.4 Assembly Bill 939 & Assembly Bill 341

In 2011, AB 341 set the target of 75 percent recycling, composting, or source reduction of solid waste by 2020 calling for the California Department of Resources Recycling and Recovery (also known as CalRecycle) to take a statewide approach to decreasing California's reliance on landfills. This target was an update to the former target of 50 percent waste diversion set by AB 939.

As actions under AB 341 are not assigned to specific local jurisdictions, actions beyond the projected waste diversion target of 5.9 pounds per person per day set under AB 939 for the City of South Pasadena were quantified and credited to the City during the Climate Action Plan Play/Move development process.

4.2.5 Senate Bill 1383

SB 1383 established a methane emissions reduction target for short-lived climate pollutants in various sectors of the economy, including waste. Specifically, SB 1383 establishes targets to achieve a 50 percent reduction in the level of the statewide disposal of organic waste from the 2014 level by 2020 and a 75 percent reduction by 2025.[47] Additionally, SB 1383 requires a 20 percent reduction in "current" edible food disposal by 2025. Although SB 1383 has been signed into law, compliance at the jurisdiction-level has proven difficult. For example, Santa Clara County suggests the 75 percent reduction in organics is not likely achievable under the current structure; standardized bin colors are impractical; and the general requirement is too prescriptive.[48] As such, SB 1383 is not included as part of the adjusted forecast. Instead measures addressing compliance with SB 1383 are addressed through newly identified GHG reduction measures included in the Climate Action Plan.

4.3 Adjusted Scenario GHG Emissions Forecast Results

In the *adjusted scenario* emissions forecast, the electricity and water and wastewater sectors all experience a strong downward trend, approaching near-zero in 2045 due to stringent RPS requirements from SB 100. Natural gas emissions are expected to continue an upward trajectory until 2035 due to population and employment growth projections. This trend is partially offset due to the increasingly stringent efficiency requirements for new construction in the upcoming Title 24 code cycles. Transportation emissions are expected to decrease sharply in the next 10 to 15 years due to existing fuel efficiency requirements and fleet turnover rates. As most current regulations expire in 2025 or 2030, emissions standards will experience diminishing returns while VMT continues to increase, leading to lower rates of emissions reduction in the transportation sector. A detailed summary of South Pasadena's projected GHG emissions under the *adjusted scenario* forecast by sector and year through 2045 can be found Table 34.

[47] CalRecycle. April 16, 2019. Short-Lived Climate Pollutants (SLCP): Organic Waste Methane Emissions Reductions (General Information). Accessed at: https://www.calrecycle.ca.gov/climate/slcp. Accessed on: Maty 20, 2019

[48] Santa Clara County. June 20, 2018. SB 1383 Rulemaking Overview. Accessed at: https://www.sccgov.org/sites/rwr/rwrc/Documents/SB%201383%20PowerPoint.pdf. Accessed on: May 20, 2019

Table 34 Adjusted Scenario Forecast Summary by Target Year

Sector	2016 (MT CO_2e)	2020 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Demographics					
Population	26,018	26,198	26,649	27,100	27,327
Jobs	9,471	9,643	10,071	10,500	10,716
Emissions					
Residential Electricity	14,462	13,135	8,279	2,577	0
Nonresidential Electricity	9,825	9,018	5,795	1,785	0
Transmission and Distribution Losses	1,027	937	595	184	0
Residential Natural Gas[1]	NA	20,102	20,424	20,745	20,907
Non-residential Natural Gas[1]	NA	4,103	4,273	4,442	4,528
Waste	7,713	7,789	7,981	8,172	8,268
Water Conveyance, Treatment, and Distribution	700	638	412	141	0
Wastewater Collection and Treatment	216	197	127	43	0
Wastewater Process and Fugitive Emissions	111	112	114	117	119
On-Road Transportation (Passenger)	60,400	54,555	40,351	35,611	34,981
On-Road Transportation (Commercial)	4,951	4,308	3,803	3,814	3,926
Public Transit - Buses	435	366	187	0	0
Public Transit – Light Rail	613	557	359	123	0
Off-Road Transportation and Equipment	829	892	1,050	1,184	1,251
Total Emissions	**125,269**	**116,699**	**93,740**	**78,927**	**73,969**
Emissions Per Capita[2]	**4.8**	**4.5**	**3.5**	**2.9**	**2.7**

Notes: Emissions have been rounded and therefore sums may not match
MT CO_2e = metric tons of carbon dioxide equivalent; NA = Not available
1. Residential and Non-residential natural gas consumption cannot be disclosed due to California Public Utilities Commission data privacy policies.
2. Emissions per Capita are the total emissions divided by the population of South Pasadena.

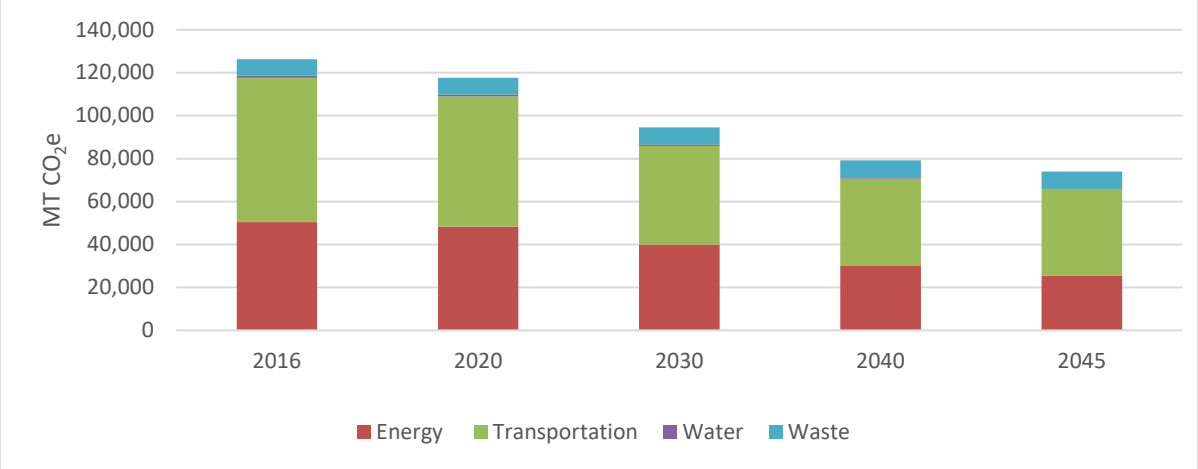
Table 35 and Figure 3 provide a summary of the *adjusted scenario* GHG emissions forecast categorized into the four primary emission sectors: energy, transportation, water and waste.

Table 35 Adjusted Scenario Forecast Sector Consolidated Summary by Target Year

Sector	2016 (MT CO_2e)	2020 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Energy	49,301	47,284	39,355	29,723	25,424
Transportation	67,228	60,678	45,751	40,732	40,159
Water[1]	1,026	947	653	301	119
Waste	7,713	7,789	7,981	8,172	8,268
Total Emissions	**125,269**	**116,699**	**93,740**	**78,927**	**73,969**

Notes: Emissions have been rounded and therefore sums may not match
MT CO_2e = metric tons of carbon dioxide equivalent
1. Water sector emissions include Wastewater emissions

Figure 3 Summary of Adjusted Scenario GHG Emissions Forecast by Sector



GHG emissions in the energy, transportation, and water sector are expected to decline due to the influence of state legislation. The primary emission reduction driver of the energy and waste sectors is the increased renewable energy requirements of the RPS and SB 100. These reductions decrease electricity associated emissions to zero by 2045. The transportation sector emissions are primarily reduced from increased fuel efficiency and vehicle emission standards, while some reductions come from the ICT impact to public buses and the RPS and SB 100 impact to GHG emissions from electricity used by light rail. These emission reductions from legislation offset the emissions impact from increased activity data that would be expected under the *BAU scenario*. The RPS and SB 100 emissions reductions also have an influence on water sector emissions, as the energy used for the conveyance, treatment, and distribution of water and the treatment and collection of wastewater will be reduced to zero by 2045.

GHG emission sources that are not impacted by legislation included in the *adjusted scenario* forecast are waste, off-road equipment, and wastewater process and fugitive emissions. These emissions sources are expected to continue to scale upwards with population and employment growth. Natural gas consumption is slightly reduced by Title 24 requirements, but this emissions source cannot be reduced below the baseline consumption in the 2016 Community GHG Inventory without additional action by the City of South Pasadena.

4.4 GHG Emissions Forecast Results Summary

The *BAU scenario* and *adjusted scenario* forecasts provide an assessment of how the City of South Pasadena's future GHG emissions will change based on current conditions (*BAU scenario*) and the impact that state legislation will have on these GHG emissions (*adjusted scenario*). The *adjusted scenario* provides a metric to compare future GHG emissions against state GHG emissions targets. The difference between the adjusted forecast and the state targets, or "the gap", represents the GHG emission reduction that South Pasadena will be responsible with the policies included in this Climate Action Plan. Table 36 and Figure 4 provide a summary of the *adjusted scenario* forecast in comparison to the *BAU scenario* emission and the baseline 2016 Community GHG Inventory.

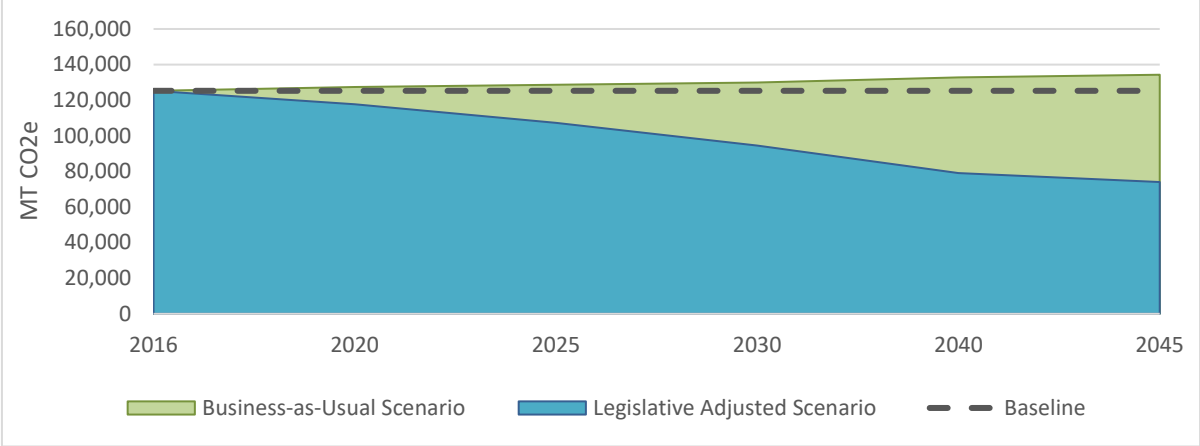
Table 36 BAU and Adjusted Scenario Forecast Summary by Target Year

Scenario	2016 (MT CO_2e)[1]	2020 (MT CO_2e)	2030 (MT CO_2e)	2040 (MT CO_2e)	2045 (MT CO_2e)
Business-as-Usual Scenario	125,269	126,337	128,792	131,675	133,121
Emission Reductions from Legislation	0	9,638	35,052	52,747	59,152
Legislative Adjusted Scenario	125,269	116,699	93,740	78,927	73,969

Notes: Emissions have been rounded and therefore sums may not match
MT CO2e = metric tons of carbon dioxide equivalent

1. 2016 GHG emission totals are the baseline from which the emission forecast scenarios are assessed.

Figure 4 Summary of GHG Emissions Forecast Scenarios



5 GHG Emissions Reduction Target Setting

GHG-reduction targets can be set as either an efficiency target (MT CO_2e per capita or per service population per year) or as a community wide mass emissions target (total MT CO_2e). With CARB's publication in 2017 of the Scoping Plan Update, the state recommended using efficiency metrics for local targets to incentivize growth in a coordinated manner and not penalize cities which are growing at significant rates.[49] Throughout this section, targets are discussed in terms of per capita metrics; however, they must occasionally be translated into absolute emissions reductions to quantify reduction measures and identify the magnitude of reductions required.

5.1 GHG Emissions Reduction Target Setting

Target setting is an iterative process which must be informed by the reductions that can realistically be achieved through the development of feasible GHG reduction measures. The purpose of target setting is to develop the trajectory toward achieving the state's 2030 goal and prepare for the deep decarbonization needed by 2045 in a cost-effective manner by setting an incremental path toward achieving the EO B-55-18 goals. There are several target pathways available to be consistent with state reduction goals, discussed further below.

- **SB 32 Target Pathway** is the pathway toward achieving the minimum reductions required by state law. This will require minimal reductions until 2030 and then steep reductions from 2030 to 2045.
- **Linear Carbon Neutrality Pathway** is an incremental linear pathway from current per capita emissions levels straight to carbon neutrality in 2045. This pathway is also compliant with the 2030 state goal.
- **Mass Emissions Reduction Pathway** is the pathway determined by reducing mass emissions without consideration to population growth. This pathway will require steep reductions to 2030 and then a slightly more gradual reduction to the 2045 carbon neutrality goal. This pathway is also compliant with the 2030 goal.

The City's baseline GHG emission inventory was completed for this CAP. As summarized in the GHG Emission Inventory (October 2019), the City generated 125,269 metric tons (MT) of carbon dioxide equivalents (CO_2e) in 2016. Based on the South Pasadena's population of 26,018 in 2016, the emissions per capita were approximately 4.81 MT CO_2e.

California achieved its 2020 goal of reaching the 1990 emissions level in 2016[50] and it is assumed that South Pasadena likewise is currently at 1990 levels;[51] therefore, the 2016 baseline emissions were reduced by 40 percent to establish a 2030 target for the City. In accordance with the new CARB methodology and the statewide goal established in SB 32, this absolute emissions[52] target was

[49] California Air Resources Board. 2017. California's Climate Change Scoping Plan, p. 99-102.

[50] CARB. July 11, 2018. Climate pollutants fall below 1990 levels for the first time. https://ww2.arb.ca.gov/news/climate-pollutants-fall-below-1990-levels-first-time

[51] Although there may have been GHG emission reductions between 2016 and 2017 at the state and local level, the most recent state inventory that is available was completed in 2016; therefore, 2017 emissions are conservatively assumed to be the same as they were in 2016 as this methodology is the most conservative pathway to calculate South Pasadena's 1990 baseline.

[52] Absolute emissions refer to the total quantity of GHG emissions being emitted.

then translated into a 2030 per capita efficiency target of 2.9 MT CO_2e per year by dividing the 2030 absolute target by the South Pasadena's projected population in 2030.

South Pasadena would require local reduction measures to meet the state goals established for 2030 and 2045. Since it is assumed that South Pasadena's 2016 emissions were equivalent to 1990 levels, South Pasadena will exceed the 2020 emissions target with no further action. The year 2030 coincides with the state targets established by SB 32, which equates to a 40% reduction below the baseline 2016 year GHG Inventory. The year 2040 is included as an interim target for reaching the 2045 state goal set by EO-B-55-18, establishing a carbon neutral emission target. South Pasadena would be required to reduce 18,578 MT CO_2e per year by 2030, 53,874 MT CO_2e per year by 2040, and 73,969 MT CO_2e per year by 2045. The *adjusted scenario* forecast emissions and the emission reduction targets are provided in Table 37, in both absolute emissions and per capita emissions metrics.

Table 37 GHG Emissions Reduction Target and Gap Analysis

Scenario	2020 (MT CO_2e)[3]	2030 (MT CO_2e)[4]	2040 (MT CO_2e)[5]	2045 (MT CO_2e)[6]
Absolute Emissions Target and Gap				
Absolute Emissions Adjusted Forecast (MT CO_2e)	116,699	93,740	78,927	73,969
Absolute Emissions Targets (MT CO_2e)[2]	125,269	75,161	25,054	0
Remaining Emissions Gap (MT CO_2e)	-8,570	18,578	53,874	73,969
Per Capita Emissions Target and Gap				
Population[1]	26,198	26,649	27,100	27,327
Per Capita Adjusted Forecast (MT CO_2e per capita)	4.5	3.5	2.9	2.7
Per Capita Targets (MT CO_2e per capita)[2]	4.8	2.9	1.0	0.0
Remaining Per Capita Emissions Gap (MT CO_2e per capita)	-0.4	0.6	1.9	2.7

Notes: MT CO_2e = metric tons of carbon dioxide equivalent
Emissions have been rounded to the nearest whole number and therefore sums may not match.
1. Population from SCAG 2016 RTP/SCS Demographic and Growth Forecast.
http://scagrtpscs.net/Documents/2016/final/f2016RTPSCS_DemographicsGrowthForecast.pdf.
2. These provisional targets are consistent with both SB 32 and a trajectory set forth to achieve EO B-55-18 targets set by the state.
3. According to CARB, climate pollutants fell below 1990 levels for first time in 2016; therefore, the 2020 emissions target is equivalent to 2016 emission levels.
4. SB 32 requires the CARB to ensure that statewide GHG emissions are reduced to 40 percent below the 1990 level by 2030
5. Recommended interim target year
6. EO-B-55-18 sets a 2045 target of Carbon Neutrality.

5.2 Meeting the Targets

The 2020, 2030, 2040, and 2045 targets identified above will be achieved through a combination of existing state measures and the implementation of local measures that are identified in the South Pasadena Climate Action Plan. Local measures were identified through a comprehensive assessment of existing local and regional policies, programs, and actions and by assessing any gaps and identifying additional opportunities. Additional measures were developed from best practices of other similar and neighboring jurisdictions, as well as those recommended by organizations and

agencies, such as the California Air Pollution Control Officers Association (CAPCOA), the Office of Planning and Research, CARB's 2017 Scoping Plan, and Association of Environmental Professionals (AEP). Measures were vetted by City staff, stakeholders, and the community and were quantified to identify their overall contribution to meeting the City's 2020, 2030, 2040, and 2045 GHG reduction targets in the Climate Action Plan.

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Appendix D:

Technical Appendix – Substantial Evidence for Plays and Moves

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City of South Pasadena Climate Action Plan

Play and Move Substantial Evidence and Reduction Quantification

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Figure 1 GHG Emissions Forecasts, Reduction Targets and Impact of Plays 5

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1 Introduction

The California Environmental Quality Act (CEQA) Guidelines Section 15183.5(b) establishes criteria to guide the preparation of a "plan for the reduction of greenhouse gas emissions." Subsection (D) notes that a CEQA Guideline-consistent climate action plan (CAP) must include, "measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level."

In support of achieving compliance with the greenhouse gas (GHG) emission reduction targets developed by City of South Pasadena's (City's) which are consistent with the states GHG reduction goals established by Senate Bill (SB) 32 and Executive Order (EO) B-55-18. SB 32 establishes a statewide goal of reducing GHG emission to 40% below 1990 levels, while EO-B-55-18 sets the long-term goal of statewide carbon neutrality by 2045. The City has also established GHG emissions sector specific GHG reduction targets and foundational actions (Plays and Moves) to achieve them. The sector targets were developed by quantifying the GHG reductions anticipated through the implementation of the foundational Plays and Moves. The GHG reductions utilize evidence provided through adequately controlled investigations, studies, and articles carried out by qualified experts that establish the effectiveness for Plays and Moves. The estimates and underlying calculations, provided in this report, include the substantial evidence and a transparent approach to achieving the City's GHG emissions reduction target.

To focus efforts on achieving the 2030 and 2045 goals, the City is building upon previous efforts in the South Pasadena Green Action Plan, adopted November of 2019, to exceed the near-term state GHG reduction targets and achieve carbon neutrality by 2045. The City partnered with Rincon Consultants Inc. (Rincon) to identify a quantified path to achieving these goals. Rincon worked closely with City staff, stakeholders, and the community to craft and refine comprehensive and realistic Plays and Moves that will achieve the GHG reduction goals while reflecting the conditions and character of the South Pasadena community. The quantification in this report is intended to illustrate one of several viable paths to pursue as the Plays and Moves of the CAP are implemented at full scale. As required in CEQA Guidelines Section 15183.5(b)(e), mechanisms to monitor the CAP's progress toward achieving the GHG emission reductions provided in this report will be established through the CAP development process. If the emission reduction targets of the Plays and Moves are found to not be on target to reach the GHG reduction levels specified here for meeting SB 32 targets, the CAP as a whole or specific Plays and Moves will be required to be amended.

The quantification in this report also provides substantial evidence that the City can achieve consistency with SB 32's target of 40% below 1990 by 2030 and ensure defensibility for streamlining development under the CAP as identified in CEQA Guidelines Section 15183.5(a).

Strategies are summarized by specific sector, with supporting Plays as outlined below:

- **Cornerstone**

- **Play Cornerstone 1 (C.1):** Engage South Pasadena youth in climate change action and provide education on ways to live a sustainable lifestyle.[1]
- **Sector: Energy**
  - **Play Energy 1 (E.1)**: Maximize the usage of renewable power within the community, by continuing to achieve an opt-out rate lower than 4% for the Clean Power Alliance.
  - **Play Energy 2 (E.2):** Require electrification of 100% of newly constructed buildings.
  - **Play Energy 3 (E.3):** Electrify 5% of existing buildings by 2030 and 80% by 2045.
  - **Play Energy 4 (E.4):** Develop and promote reduced reliance on natural gas through increased clean energy systems that build off of renewable energy development, production, and storage.
- **Sector: Transportation**
  - **Play Transportation 1 (T.1):** Increase zero-emission vehicle and equipment adoption to 13% by 2030 and 25% by 2045.
  - **Play Transportation 2 (T.2):** Implement programs for public and shared transit that decrease passenger car vehicle miles traveled 2% by 2030 and 4% by 2045.
  - **Play Transportation 3 (T.3):** Develop and implement an Active Transportation Plan to shift 3% of passenger car vehicle miles traveled to active transportation by 2030, and 5% by 2045.
- **Sector: Water**
  - **Play Water 1 (W.1):** Reduce per capita water consumption by 10% by 2030 and 35% by 2045.
- **Sector: Solid Waste**
  - **Play Solid Waste 1 (SW.1):** Implement and enforce Senate Bill 1383 organics and recycling requirements to reduce landfilled organics waste emissions 50% by 2022 and 75% by 2025.
  - **Play Solid Waste 2 (SW.2):** Reduce residential and commercial waste sent to landfills by 50% by 2030 and 100% by 2045.
- **Sector: Carbon Sequestration**
  - **Play Carbon Sequestration (CS.1):** Increase carbon sequestration through increased tree planting and green space.
- **Sector: Municipal**
  - **Play Municipal 1 (M.1):** Reduce carbon intensity of City operations.
  - **Play Municipal 2 (M.2):** Electrify the municipal vehicle fleet and mobile equipment.
  - **Play Municipal 3 (M.3):** Increase City's renewable energy production and energy resilience.

Under each of the above Plays are a number of Moves that ensure establishment of mechanisms and supportive actions for complete implementation of the Plays.

[1] The Cornerstone play is separated from other sectors as it is intended to provide example of the critical elements of an effective and successful GHG reduction strategy or Play. The Cornerstone Play demonstrates education of climate change, sets the foundations for structural change, has associated GHG emission reductions, ensures equity and inclusivity, provides connectivity through access to community resources, and is economical in that it supports local businesses and promotes resilience and sustainability.

1.1 Greenhouse Gas Emission Reductions from Moves and Plays

This report presents an analysis of the GHG reduction pathway to achieve the City's fair share of GHG emissions reductions necessary to support the state's achievement of the SB 32 GHG reduction goal and provide substantial progress to achieve the 2045 goal of carbon neutrality. The reduction Plays and Moves reflect local policy, and documented industry best practices for achieving deep decarbonization. The emission reductions from the Moves are calculated individually to identify which Moves are most impactful for each Play and then combined to determine the total emissions reductions that can be achieved by the Play. Some Plays and Moves provide minimal or non-quantifiable GHG emission reductions; however, they support the implementation and sustainability of the play through education, teaming with the community, identifying funding, evaluating feasibility, and provide increased resilience to the impacts of climate. These Plays and Moves are considered "supportive," as they do not directly result in GHG emission reductions; however, they support the overall goals of the CAP. The supportive Plays include: E.4, and M.3. A summary of the expected GHG emission reductions from each of the quantifiable Plays in 2030 and 2045 are provided Table 1.

Table 1 Summary of GHG Emission Reduction from CAP Plays

Move	2030 Emission Reductions (MT CO_2e)	2045 Emission Reductions (MT CO_2e)
Cornerstone 1 (C.1)	25	78
Energy 1 (E.1)	13,408	0
Energy 2 (E.2)	240	984
Energy 3 (E.3)	1,184	19,355
Energy 4 (E.4)	Supportive	Supportive
Transportation 1 (T.1)	3,774	6,629
Transportation 2 (T.2)	807	1,399
Transportation 3 (T.3)	1,186	2,015
Water 1 (W.1)	414	0
Solid Waste 1 (SW.1)	1,702	1,764
Solid Waste 2 (SW.2)	415	859
Carbon Sequestration (CS.1)	19	39
Municipal 1 (M.1)	188	188
Municipal 2 (M.2)	23	23
Municipal 3 (M.3)	Supportive	Supportive
Total	**23,386**	**33,333**

Notes: MT CO_2e = metric tons of carbon dioxide equivalent

Supportive Plays are not discussed in this document because they do not have quantifiable emission reductions. The nature of the supportive Plays are to improve resilience and promote sustainability.

To assess the magnitude of GHG emission reductions needed to provide a fair share GHG emission reduction and contribute to achieving the state's goal for 2030 (40% below 1990 levels) and 2045 (carbon neutrality), the City developed a *business-as-usual scenario* GHG emissions forecast which assessed the impact of growth on the City's GHG emissions. From the *business-as-usual scenario*, a

legislative adjusted scenario was developed which accounts for the impacts of state and federal policies on GHG emissions, to assess the GHG emission reductions the City would be responsible for to meet its emission reduction targets[2]. The combined annual reductions from existing state and federal law is expected to result in a reduction of 35,052 metric tons of carbon dioxide equivalent (MT CO_2e) by 2030 and 59,152 MT CO_2e by 2045. The combined local reductions from the Plays and Moves, if implemented entirely, could result in a reduction of 23,751 MT CO_2e by 2030 and 33,645 MT CO_2e in 2045. In reference to the GHG reduction targets established using the 2016 Community GHG Inventory as the 1990 baseline, this results in a total 55,280 MT CO_2e, or 44%, reduction below the baseline in 2030, and an 84,945 MT CO_2e, or 68%, reduction below the baseline projected in 2045. Accordingly, the total GHG emission reductions exceed the state targets established by SB 32, of a 40% reduction in GHG emissions below 1990 levels, by 5,172 MT CO_2e. The remaining gap to reach carbon neutrality in 2045 remains at 40,324 MT CO_2e. While the Plays and Moves identified in this CAP will lead to a significant reduction in GHG emissions and provide a foundation for achieving net carbon neutrality; achieving carbon neutrality will require significant additional changes to the technology and systems currently in place at both the state and local level and will require further policies and programs that build on this plan. Future CAP updates will outline new measures needed to reach the ultimate target of carbon neutrality[3]. The GHG emissions forecast scenarios, targets, and emission reductions attained from the Plays are provided in Table 2 and Figure 1.

[2] The city has identified targets for 2030 (40% below 1990 levels) and 2045 (carbon neutrality) that are consistent with the state's goals and are intended to establish a level, based on substantial evidence, below which the contribution to greenhouse gas emissions from activities covered by this CAP would not be cumulatively considerable

[33] Consistent with AEP Climate Change Committee recommendations, SB 32 is considered an interim target toward meeting the 2045 State goal. Consistency with SB 32 is considered to be contributing substantial progress toward meeting the State's long-term 2045 goals. Avoiding interference with, and making substantial progress toward, these long-term State targets is important as these targets have been set at levels that achieve California's fair share of international emissions reduction targets that will stabilize global climate change effects and avoid the adverse environmental consequences described under Section 3.1.3, *Potential Effects of Climate Change* (Executive Order B-55-18).

Table 2 GHG Emissions Forecasts, Reduction Targets and Impact of Plays

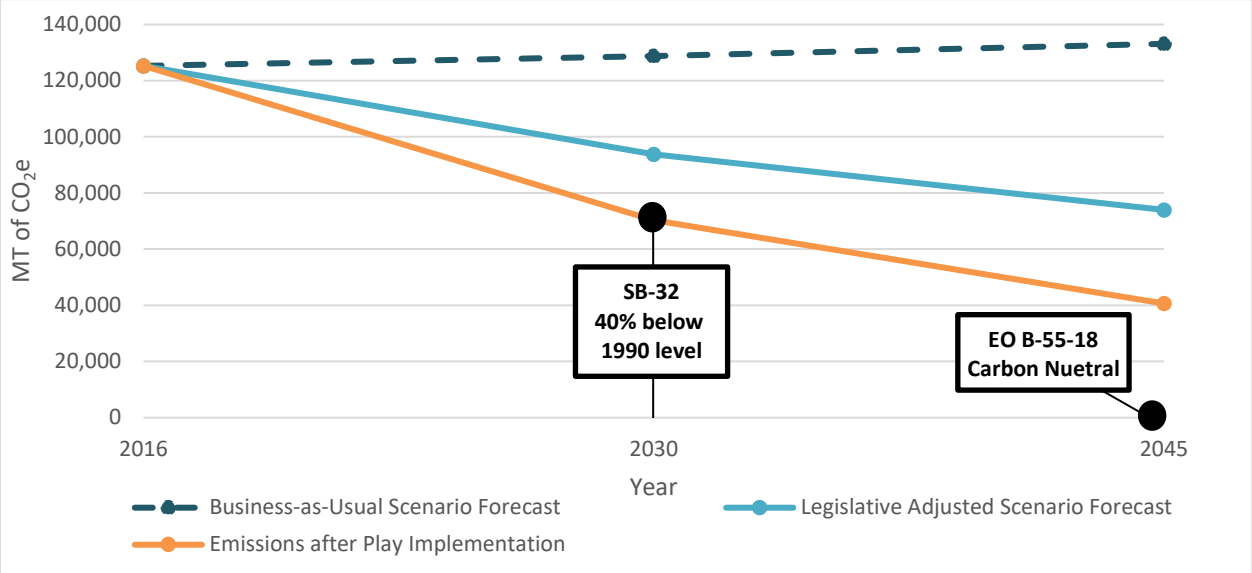
GHG Emissions Scenario	2030 (MT CO_2e)	2045 Emission (MT CO_2e)
Business-as-Usual Scenario Forecast[1]	128,792	133,121
Legislative Adjusted Scenario Forecast[1]	93,740	73,969
Targets (SB 32 and Carbon Neutrality)[1]	75,161	0
Reductions from Plays	23,386	33,333
GHG Emissions after Reductions from Plays	70,354	40,636
Remaining Gap to Meet Targets	**Target Met (-4,807)**	**40,636[2]**

Notes: MT CO_2e = metric tons of carbon dioxide equivalent

1. See Appendix C for the methodology and details for establishing the forecast scenarios and the reduction targets.

2. The emissions reductions required to meet the 2045 goal will be addressed in future iterations of the Climate Action Plan through new and potentially unknown technologies that allow furthering of the following efforts: full electrification of building and transportation systems, an increased shift to shared and active mobility, and increased waste reduction and diversion

Figure 1 GHG Emissions Forecasts, Reduction Targets and Impact of Plays



With implementation of the Plays and Moves in the CAP, the 2030 state goals can be reasonably achieved through local actions and substantial progress towards reaching the long-term goal of carbon neutrality can be demonstrated. While the CAP does not provide the GHG emissions reductions to achieve carbon neutrality by 2045, it provides evidence-based actions the City can take towards eventually attaining this target. It also illustrates the that reaching carbon neutrality will require significant additional effort and support from the state and federal governments.

1.2 Greenhouse Gas Emission Reduction Calculation Methodology

The analysis and emission reduction calculations for each of the Plays of the CAP outlined in the following pages includes:

- Description of background behind the Play and the basis for GHG emission reductions
- Description of the methodology and assumptions for calculating GHG emissions reductions for applicable Plays and Moves, including reference to data sources.
- A summary of the GHG reduction impact results of GHG emissions reduction calculations.
- Summary table of the impact that the specific Play has on the overall GHG profile of the City in 2030 and 2045

GHG emission reduction calculations use conservative values to avoid over-representing the GHG emission reduction potential for any individual Move or Play. Special care has been taken to avoid double counting GHG emission reductions for Plays and Moves. Specifically, potential overlap between Municipal Sector reductions from Play M.1 and Energy Sector Play E.1, or between Transportation Sector Plays, have been closely scrutinized to eliminate potential for double counting.

Limitations and uncertainties regarding future trends in technology, behavior, and social norms are discussed in the final section of this analysis. Given time and the increasing shifts in financial markets, private industry, and governmental programs towards carbon reduction programs, these shifts may be able to help close the gap between South Pasadena's projected GHG reductions and true carbon neutrality.

2 Greenhouse Gas Emission Reductions

As mentioned above, the Moves and Plays are summarized by Sector: cornerstone, energy, transportation, water, carbon sequestration, waste, and municipal operations. This document is summarized similarly and the substantial evidence for each quantifiable Play and Move is discussed in detail below.

2.1 Cornerstone

Play C.1 Engage South Pasadena youth in climate change action and provide education on ways to live a sustainable lifestyle.

Background

The Cornerstone Play represents a GHG reduction Play that contains the six essential components that lay the foundation for the transformational change by engaging the community and fulfilling GHG emission reduction goals. Effective Plays will contain the six components of a well drafted-designed GHG reduction strategy:

- **Education**: engage and empower residents
- **Structural Change**: set institutional and policy framework to support proposed changes
- **Associated GHG Reductions**: target emissions reductions for long-term sustainability and short-term air quality improvements
- **Equity**: ensure inclusive participation in decision making
- **Connectivity**: promote access to community resources
- **Economical**: support local businesses for resilience and sustainability

Play C.1 embodies these ideas by working to establish a climate change education and tree planting program through the South Pasadena Unified School District.

Methodology and Assumptions

The emission reduction impact of Play C.1 results from the increased carbon sequestration capacity that is realized through an increased number of trees in South Pasadena. Move C.3. will attain the GHG Emission reductions through providing students with plants and trees that they can plant in their own yards or keep in pots when planting is not feasible. A number of assumptions were made to estimate the number of students who would participate in a tree planting program where new trees could be planted in the yards of a student's homes. GHG emission reductions only account for the number of trees that are expected to reach maturity, which is assumed to be a proportion of those that could be planted in the yards of single-family detached homes. This number also assumes that the program would be implemented in one single grade school level each year across all of South Pasadena Unified School District, beginning in 2023.

The number of students that would participate in the program each year was estimated as the number of students in each grade level during a school year in South Pasadena Unified School

District. In 2020, there were 4,800 students enrolled in South Pasadena School District Schools.[4] Based on national statistics, it was estimated that each grade level makes up about 8% of the student population; therefore, in South Pasadena, the total number of students in each grade level would be about 370.[5]

An estimate of the percentage of students living in detached single-family homes and the participation and results of a similar residential tree giveaway program was used to estimate the number of trees that would be planted annually and expected to reach maturity of greater than 5 years. It was assumed that the number of students in a single grade that would be living in a single family detached home would be proportional to the number of single family detached homes compared to the total homes in South Pasadena, which is approximately 46%.[6] Accordingly, it is estimated that 171 students in each grade would live in a single-family detached home. A review of a similar residential tree giveaway program in Sacramento found that about 85% of trees given to community members were actually planted, and 71% of the trees planted reached a maturity of 5 years or older.[7] Applying these percentages to the total trees planted at single-family detached homes results in an estimate that approximately 100 trees would be planted each year that would reach a maturity of 5 years. While the life span of these trees beyond 5 years is uncertain, it is assumed that this proportion of the trees planted would eventually reach full maturity and provide carbon sequestration value.

The total amount of carbon sequestered in 2030 and 2045 is estimated using the assumption that 100 trees would be planted that would provide carbon sequestration value consistent with the amount of sequestration per tree provided in the California Air Pollution Control Officers Association (CAPCOA) *Quantifying Greenhouse Gas Mitigation Measures*. The full implementation of Play C.1 is expected by 2023, which equates to 7 full years of implementation as of 2030 and 22 years as of 2045. With 100 trees planted per year expected to reach maturity, Play C.1 would result in 700 and 2200 new trees expected to provide carbon sequestration value in 2030 and 2045 respectively. Applying the CAPCOA carbon sequestration of 0.0354 MT CO_2e[8], play C.1 would result in 25 MT CO_2e and 78 MT CO_2e sequestered in 2030 and 2045, respectively. The calculations and assumptions used to estimate emission reductions from Play C.1 are provided in Table 11.

[4] City of South Pasadena 2020 General Plan Update Draft, Introduction. https://www.southpasadenaca.gov/home/showdocument?id=18657.

[5] Kurt Bauman and Jessica Davis, 2013, Estimates of School Enrollment by Grade in the American Community Survey, the Current Population Survey, and the Common Core of Data. U.S. Census Bureau. https://www.census.gov/content/dam/Census/library/publications/2013/demo/acs-cps-ccd_02-18-14.pdf

[6] City of South Pasadena 2020 General Plan Update Draft, Introduction. https://www.southpasadenaca.gov/home/showdocument?id=18657.

[7] Lara A. Roman. 2013. Urban Tree Mortality. https://escholarship.org/content/qt0sh9g9gk/qt0sh9g9gk_noSplash_ad0c50431b856312557f037a2bda0dd1.pdf?t=mtgqar

[8] CAPCOA Quantifying Greenhouse Gas Mitigation Measures

Table 3 Play C.1 GHG Emission Reduction Calculations

Calculation Factor	2030	2045
Total South Pasadena Unified School District Students[1]	4,800	4,800
National Average Proportion of Students at Each Grade Level [2]	8%	8%
Estimated Number of Students Participating in Tree/Plant Giveaway[3]	370	370
Students Participating in Program living in Single-Family Detached Homes[4]	171	171
Percentage of Trees Planted [5]	85%	85%
Percentage of Trees Reaching Maturity of 5 Years or Older [5]	71%	71%
Total Trees Planted each Year that Provide Carbon Sequestration Value	100	100
Cumulative Trees Planted through Play C.1[6]	700	2200
Carbon Sequestration Value of One Mature Tree (MT CO_2e/tree/year)[7]	0.0354	0.0354
Total Play C.1 GHG Emissions Reductions (MT CO_2e)	**25**	**78**

Notes: MT CO_2e = metric tons of carbon dioxide; kWh =-kilowatt-hour

1. City of South Pasadena 2020 General Plan Update Draft, Introduction. https://www.southpasadenaca.gov/home/showdocument?id=18657.

2. Kurt Bauman and Jessica Davis, 2013, Estimates of School Enrollment by Grade in the American Community Survey, the Current Population Survey, and the Common Core of Data. U.S. Census Bureau. https://www.census.gov/content/dam/Census/library/publications/2013/demo/acs-cps-ccd_02-18-14.pdf

3. The Estimated Number of Students Participating in Tree/Plant Giveaway assumes that the program would be implemented for one grade level each year.

4. It is conservatively assumed that trees planted at single-family detached homes would provide carbon sequestration value. This number is based on 46% of total homes in South Pasadena being single-family detached homes, and the assumption that an equivalent proportion of students live in single-family detached homes. City of South Pasadena 2020 General Plan Update Draft, Introduction. https://www.southpasadenaca.gov/home/showdocument?id=18657.

5. Lara A. Roman. 2013. Urban Tree Mortality. https://escholarship.org/content/qt0sh9g9gk/qt0sh9g9gk_noSplash_ad0c50431b856312557f037a2bda0dd1.pdf?t=mtgqar

6. Assumes Play C.1 is fully implemented by 2023; therefore 2030 would be the 7th year of implementation and 2045 would be the 22nd.

7. CAPCOA Quantifying Greenhouse Gas Mitigation Measures

Results

Play C.1 would result in a reduction of 25 MT CO_2e in 2030 and 78 MT CO_2e in 2045, as shown in Table 10.

Table 4 GHG Emission Reductions Associated with Play C.1

Moves	Emission Reductions (MT CO_2e) 2030	2045	Source
C.1.a Support South Pasadena Unified School District by providing students with information on climate change and the beneficial roles of trees.	Supportive		N/A
C.1.b Utilize South Pasadena's historic neighborhoods to demonstrate to students the importance of mature urban trees in providing shade and reducing the urban heat island effect.	Supportive		N/A
C.1.c. Identify grant funding opportunities and engage with local nurseries to identify appropriate and cost-effective California native plants/trees that can be both planted in the ground or remain potted for students living in rental/multi-family homes..	25	78	N/A

2.2 Energy Sector

Play E.1 Maximize the usage of renewable power within the community, by continuing to achieve an opt-out rate lower than 4% for the Clean Power Alliance.

Background

In 2019, the residential electricity customers in the City of South Pasadena began receiving "100% Green Power" (100% renewable energy), and non-residential customers began receiving "Clean Power" (50% renewable energy) under the Clean Power Alliance (CPA). This transition from the transitional grid mix that South Pasadena residents purchased power at the time of the 2016 Community GHG Inventory, meant that customers would begin to receive electricity purchased primarily from renewable sources. Residential customers have the option to opt-down to lower percentages of renewable sourced energy to "Clean" or "Lean" (36% renewable energy) power options, while non-residential customers can opt-up to "100% Green Power" or opt-down to "Lean Power." Additionally, all customers have the ability to opt-out of the program entirely and continue to purchase their electricity from Southern California Edison (SCE). This is included in the CAP as a GHG Reduction Play, as it is a specific action taken by the City that will reduce the GHG emissions associated with electricity consumption. As of 2020, the City had maintained an effective 4% opt-out rate, which it will work to maintain at this level through a concerted effort to encourage customers to remain at or opt-up to the "100% Green Power" option. Through public outreach and education, the City of South Pasadena can reasonably retain the participation rates of 2020 and can also engage in more aggressive tactics if the established monitoring of CPA participation finds that participation begins to decline.

Methodology and Assumptions

The emission reduction impact of Play E.1 results from the increased renewable and carbon free electricity supplied to South Pasadena from participation in the CPA. The adjusted scenario GHG emission forecast, from which emission reduction targets are established, assumes that energy will

continue to be purchased from SCE through 2045, with the renewable and carbon free energy supply, which influences the carbon emissions from electricity generation, generally following the Renewable Portfolio Standards (RPS) established by Senate Bill 100.[9] The benefit of participation in the CPA is the ability to procure its own energy sources and exceed RPS requirements. In 2020, the CPA already exceeds the RPS with its lowest renewable power option, "Lean Power," at 81% renewable and carbon free electricity. As the RPS requirements continue to increase, it is assumed that the renewable energy procured by CPA will increase linearly until reaching 100% in 2045. The effective future emission reductions that South Pasadena will achieve from Play E.1. are calculated by assessing the GHG emissions that would be generated under a scenario with the same current 2020 participation rates in the CPA, with increased RPS for both the CPA and SCE.

In 2020, the City of South Pasadena had an effective CPA opt-out rate of 4.0% across both the residential and non-residential customer classes, with 2.5% of the 1,373 non-residential customers and 4.2% of the 11,052 residential customers having opted-out to receive electricity from SCE.[10] The 2020 rates of participation are provided in Table 5.

Table 5 2020 CPA Participation Rates

	Power Option Participation Percentage			
Customer Class	100% Green Power	Clean Power	Lean Power	Opt-out
Non-Residential	7.6%	88.5%	1.4%	2.5%
Residential	91.7%	0.7%	3.5%	4.2%
Total	82.4%	10.4%	3.2%	4.0%

Source: South Pasadena CPA Customer Statistics Report for June 2020.

The RPS percentage of each of the CPA options for 2030 and 2045 is estimated based on the 2018 Power Content Label,[11] while SCE RPS percentage is based on the minimum RPS requirements of SB 100. As mentioned previously, the CPA RPS percentage is assumed to be a gradual increase to 100% in 2045, while SCE is presumed to be 60% in 2030 and 100% in 2045. The RPS percentage assumptions for 2018, 2030, and 2045 are provided in Table 6.

Table 6 CPA and SCE Renewable Portfolio Standards Percentage Assumptions

	RPS Percentage			
Year	100% Green Power	Clean Power	Lean Power	Opt-out
2018	100%	87%	81%	NA
2030	100%	93%	89%	60%
2045	100%	100%	100%	100%

Source: https://cleanpoweralliance.org/power-sources/

An emission factor for electricity consumption for each of the CPA options can be calculated from the respective RPS, assuming that the energy that is not from a renewable or carbon-free source

[9] Senate Bill (SB) 100 established a landmark policy requiring renewable energy and zero-carbon resources supply 100% of electric retail sales to end-use customers by 2045. SB 100 also sets in interim target of 60% renewable or carbon free electricity by 2030.

[10] South Pasadena CPA Customer Statistics Report for June 2020.

[11] https://cleanpoweralliance.org/power-sources/

(unspecified source) is provided at the same emission factor as the United States Environmental Protection Agency's (USEPA) Emissions and Generation Resource Integrated Database (eGRID) 2018 Western Electricity Coordinating Council California (CAMX) emission factor of 0.2262 MT CO_2e per megawatt-hour (MWh).[12] The estimated effective emission factor for each CPA option is weighted by the percentage of unspecified source energy. These respective emission factors for 2030 and 2045 for each of the CPA power option, as well as opting out to SCE's standard power mix, are provided in Table 7. In 2045, it is expected that all electricity generation in California will have 100% RPS, consistent with SB 100 and will therefore generate no GHG emissions.

Table 7 CPA and SCE Future Emission Factors

	Electricity Generation Emission Factor (MT CO_2e/kWh)			
Year	100% Green Power	Clean Power[1]	Lean Power[1]	Opt-out[2]
2030	0	0.0000158	0.0000249	0.0001465
2045	0	0	0	0

Notes: MT CO_2e = metric tons of carbon dioxide; kWh =-kilowatt-hour

1. Emission factors for CPA electricity are estimated based on the Renewable Portfolio Standards provided in Table 6 and the USEPA CAMX eGRID2018 emission factors. https://www.epa.gov/sites/production/files/2020-01/documents/egrid2018_summary_tables.pdf.

2. To maintain consistency with the *Legislative Adjusted* Forecast GHG Emissions estimates used to develop GHG reduction targets, the same 2030 emissions factors for forecasted GHG emissions provided in Appendix C.

Using the estimated emission factors in Table 7 and the estimated future electricity consumption provided in the *Legislative Adjusted* GHG Emissions Forecast, as provided in Appendix C of the Climate Action Plan, the future GHG emissions under the scenario of maintaining the CPA opt-out rates of 2020 can be calculated. The difference in total GHG emissions in these two scenarios provides the expected GHG emission reductions from Play E.1. The forecasted electricity consumption, GHG emission calculations and expected GHG emission reductions for the year 2030 are provided in Table 8.

[12] USEPA. 2019. Emissions & Generation Resource Integrated Database (eGRID). https://www.epa.gov/egrid/emissions-generation-resource-integrated-database-egrid. Accessed July 24th, 2020.

Table 8 2030 Play E.1 GHG Emission Reduction Calculations

Calculation Factor	100% Green Power	Clean Power[1]	Lean Power[1]	Opt-out[2]	Total
2030 Non-Residential Electricity Consumption (kWh)[1 2]	3,262,551	37,991,552	600,996	1,073,208	**42,928,307**
2030 Residential Electricity Consumption (kWh)[1 2]	56,052,304	427,880	2,139,401	2,567,281	**61,186,866**
2030 Transmission and Distribution Losses (kWh)[1 2 3]	2,509,018	1,625,142	115,919	153,993	**4,404,072**
2030 Total Energy Consumption (kWh)	61,823,874	40,044,574	2,856,316	3,794,481	**108,519,245**
Play E.1 CPA Scenario GHG Emissions (MT CO_2e) [4]	0	634	71	556	**1,261**
2030 *Legislative Adjusted* GHG Emissions Forecast Electricity Emissions (MT CO_2e) [1]			14,669		
Total 2030 Play E.1 GHG Emissions Reductions [-5]			**13,408**		

Notes: MT CO_2e = metric tons of carbon dioxide; kWh =-kilowatt-hour

1. Electricity consumption by customer class, transmission and distribution losses, and total electricity GHG emissions are obtained from the *Legislative Adjusted* Forecast GHG Emissions estimates used to develop GHG reduction targets, provided in Appendix C.

2. Electricity consumption is attributed to each of the Clean Power Alliance power options according to the power option participation percentages provided in Table 5.

3. Transmission and distribution losses occur from energy lost as heat through the transmission of electricity over long distances and the distribution to lower voltage power lines. This energy is attributed by multiplying the sum of the non-residential and residential energy consumption of each customer class by the CAMX eGRID general loss factor of 4.23% for 2016. USEPA's 2016 eGRID database, February 2018. https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

4. Play E.1 Scenario GHG Emissions are calculated by multiplying the 2030 total energy consumption by the appropriate electricity emission factors for 2030 each power option, as provided in Table 7.

5. Total Play E.1 GHG Emissions Reductions are calculated by subtracting the total Play E.1 CPA Scenario GHG Emissions from the 2030 *Legislative Adjusted* GHG Emissions Forecast Electricity Emissions.

Continued implementation of Play E.1, to maintain an effective opt-out rate from the CPA of 4% or below would result in GHG emissions reductions of 13,408 MT CO_2e in 2030. No emission reductions from Play E.1 will be achieved in 2045, as GHG emissions from all electricity sources is expected to be zero. Nonetheless, the 2045 calculations are demonstrated in Table 9 for consistency.

Table 9 2045 Play E.1 GHG Emission Reduction Calculations

Calculation Factor	Total
2045 Non-Residential Electricity Consumption (kWh)[1 2]	61,863,465
2045 Residential Electricity Consumption (kWh)[1 2]	44,879,876
2045 Transmission and Distribution Losses (kWh)[1 2 3]	4,515,243
2045 Total Energy Consumption (kWh)	111,258,584
Play E.1 CPA Scenario GHG Emissions (MT CO_2e) [4]	0
2045 *Legislative Adjusted* GHG Emissions Forecast Electricity Emissions (MT CO_2e) [1]	0
Total 2045 Play E.1 GHG Emissions Reductions (MT CO_2e)[-5]	**0**

Notes: MT CO_2e = metric tons of carbon dioxide; kWh =-kilowatt-hour

1. Electricity consumption by customer class, transmission and distribution losses, and total electricity GHG emissions are obtained from the *Legislative Adjusted* Forecast GHG Emissions estimates used to develop GHG reduction targets, provided in Appendix C.

2. Electricity consumption for all power options is aggregated as all have the same emission factor and RPS percentages, as provided in Table 7.

3. Transmission and distribution losses occur from energy lost as heat through the transmission of electricity over long distances and the distribution to lower voltage power lines. This energy is attributed by multiplying the sum of the non-residential and residential energy consumption of each customer class by the CAMX eGRID general loss factor of 4.23% for 2016. USEPA's 2016 eGRID database, February 2018. https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

4. Play E.1 Scenario GHG Emissions are calculated by multiplying the 2045 total energy consumption by the emission factor of 0 MT CO_2e/kWh , as provided in Table 7.

5. Total Play E.1 GHG Emissions Reductions are calculated by subtracting the total Play E.1 CPA Scenario GHG Emissions from the 2045 *Legislative Adjusted* GHG Emissions Forecast Electricity Emissions.

Results

Play E.1 would result in a reduction of 13,408 MT CO_2e in 2030 and 0 MT CO_2e in 2045, as shown in Table 10.

Table 10 GHG Emission Reductions Associated with Play E.1

	Emission Reductions (MT CO_2e)		
Moves	**2030**	**2045**	**Source**
E.1.a Monitor progress and perform public outreach and education campaigns highlighting the benefits of 100% renewable energy, including: ▪ Monitoring opt-out rates on an annual basis, ▪ Tabling at community events ▪ Establishing an informational resource page on the City website ▪ Regular social media posts ▪ Energy bill inserts.	13,408	0	City provided effective opt-out rate of 4% in 2020

Play E.2 Require electrification of 100% of newly constructed buildings.

Background

In order for South Pasadena to reach carbon neutrality by 2045, the majority of the buildings in the City, including those that have not yet been constructed, will need to be carbon neutral. Natural gas

combustion for heating and cooking in commercial and residential buildings currently[13] contributes nearly 14% of South Pasadena's total GHG emissions. By transitioning buildings from the consumption of natural gas to electricity, emissions from this source can be reduced as the GHG emissions associated with electricity continue to decrease through increased renewable sources. A variety of studies have found that electrification of buildings, combined with renewable power generation is a potential path towards reaching carbon neutrality.[14] Additionally, the benefits in annual utility bill savings and decreased cost associated with piping of natural gas into new construction makes some all-electric buildings more cost effective in some California Building Climate Zones; including, Zone 9 where South Pasadena is located.[15,16] As of May 2020, 30 California cities have adopted building codes that reduce reliance on natural gas.[17]

Methodology and Assumptions

Move E.2.e, the adoption of an Electrification Readiness reach code banning the piping of natural gas in new buildings and accessory dwelling units, would result in all of the emissions reductions associated with Play E.2 by transitioning the energy consumption of any new construction to primarily renewable electricity. All other Moves included would incrementally support the Play. The timing of the adoption of the Electrification Readiness ordinance will decide the amount of emission reductions that are achieved, as delaying its adoption may allow for additional developments to include mixed fuels, for which the natural gas emissions will not be reduced by this ordinance. Therefore, for the purposes of this calculation, it is assumed that the ordinance will be adopted by 2025, as time will be needed from the adoption of the Final CAP and completion of the necessary actions under Moves E.2.e and E.2.f. The amount of future new development that will occur in the South Pasadena is evaluated based on increases in employment and population provided by the Southern California Association of Governments (SCAG) 2016 *Regional Transportation Plan/Sustainable Communities Strategy* (RTP/SCS) demographic projections. This growth is assumed to be constant year-over-year in the GHG emissions forecast, with each additional resident's or employee's contribution towards natural gas consumption being equivalent to the per capita or per employment natural gas consumption in the baseline inventory year, while also accounting for efficiency increases from future Title 24 requirements. The resulting calculated increase in natural gas consumption is assumed to be purely from new construction, and any increases beyond the time the ordinance is adopted would be shifted to electricity consumption.

Electrification of new residential and commercial construction is largely to eliminate the use of natural gas for space heating, water heating, clothes drying, and cooking. Space heating is the

[13] Based on 2016 Community GHG Inventory. See Appendix C.

[14] Williams, James et al., Pathways to Deep Decarbonization in the United States (San Francisco: Energy and Environmental Economics, 2014); Northeastern Regional Assessment of Strategic Electrification (Northeast Energy Efficiency Partnerships, 2017); Steinberg, Daniel et al., Electrification and Decarbonization: Exploring US Energy Use and Greenhouse Gas Emissions in Scenarios with Widespread Electrification and Power Sector Decarbonization (National Renewable Energy Laboratory, 2017).

[15] California Energy Codes and Standards. 2019. 2019 Cost Effectiveness Study: Low-Rise Residential New Construction. https://localenergycodes.com/content/2019-local-energy-ordinances/. Accessed May 25th, 2019.

[16] California Energy Codes and Standards. 2019. 2019 Nonresidential New Construction Reach Code Cost Effectiveness Study. https://localenergycodes.com/content/2019-local-energy-ordinances/. Accessed May 25th, 2019.

[17] Gough, Matt. 2020. Sierra Club. California's Cities Lead the Way to a Gas-Free Future. https://www.sierraclub.org/articles/2020/03/californias-cities-lead-way-gas-free-future. Accessed May 25th, 2020.

largest energy end use in buildings and is dominated by non-electric fuels.[18] According to the U.S. Energy Information Administration (EIA) *2020 Annual Energy Outlook,* electric heat pumps for commercial space heating and cooling are two to five times more efficient than natural gas fueled equipment.[19] Residential electric heat pumps for space heating and cooling are six to 20 times more efficient than natural gas equipment.[20] Emission reductions account for this increased efficiency by conservatively assuming all electric constructions will use electric equipment that is three times more efficient than natural gas fueled equipment.

As mentioned above, emission reduction calculations assume the ordinance will be adopted by 2025; therefore, increased natural gas consumption from population and employment growth beyond 2025 would be replaced by electricity consumption. Since electric end use appliances are approximately 200% more efficient over similar natural gas burning equipment and appliances,[21] the use of electric equipment instead of natural gas would result in an efficiency increase. This electricity consumption would generate GHG emissions that would offset the reduction in natural gas emissions from electrification; however, these emissions would be minimized assuming full implementation of Play E.1. The calculations and assumptions used to estimate emission reductions from Play E.2 are provided in Table 11.

[18] Deason, Jeff. et al.. 2018. Electrification of buildings and Industry in the United States. pp.10. https://pdfs.semanticscholar.org/27f0/d125d5316ee10565560545c0fc17d6c447a8.pdf?_ga=2.3238896.1101123906.1590438648-1004765093.1590438648. Accessed May 25th, 2020.

[19] EIA. 2020. Annual Energy Outlook. Table 22. Commercial Sector Energy Consumption, Floorspace, Equipment Efficiency, and Distributed Generation. https://www.eia.gov/outlooks/aeo/data/browser/#/?id=32-AEO2020&cases=ref2020&sourcekey=0. Accessed May 25th, 2020.

[20] EIA. 2020. Annual Energy Outlook. Table 21. Residential Sector Equipment Stock and Efficiency, and Distributed Generation. https://www.eia.gov/outlooks/aeo/data/browser/#/?id=30-AEO2020&cases=ref2020&sourcekey=0. Accessed May 25th, 2020.

21 Dennis, Keith. 2015. Environmentally Beneficial Electrification: Electricity as the End-Use Option. The Electricity Journal. 28(9). pp. 100-112. https://doi.org/10.1016/j.tej.2015.09.019

Table 11 Play E.2 GHG Emission Reduction Calculations

Calculation Factor	2030	2045
Natural Gas Consumption Growth Beyond 2025 (therms)[1]	46,255	185,330
Natural Gas Emission Factor (MT CO_2e/therm)[2]	0.00531	0.00531
Natural Gas GHG Emissions Avoided (MT CO_2e)	246	984
Resulting Increase in Electricity Consumption (kWh) [3 4]	451,762	1,810,053
Electricity Emission Factor Assuming Implementation of Play E.1.(MT CO_2e/kWh)[5]	0.00001162	0
Additional GHG Emissions from Increased Electricity Consumption (MT CO_2e)	5	0
Total Play E.2 GHG Emissions Reductions (MT CO_2e)[-6]	**241**	**984**

Notes: MT CO_2e = metric tons of carbon dioxide; kWh =-kilowatt-hour

1. Natural gas consumption beyond 2025 is obtained from the *Legislative Adjusted* Forecast GHG Emissions estimates used to develop GHG reduction targets, provided in Appendix C.

2. Emission factors obtained from United States Environmental Protection Agency Emission Factors for Greenhouse Gas Inventories, Table 1. https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf.

3. The resulting increase in electricity consumption estimates a 200% increase in efficiency due to the improved efficiency of electric heat pumps and other electrical equipment of natural gas. Dennis, Keith. 2015. Environmentally Beneficial Electrification: Electricity as the End-Use Option. The Electricity Journal. 28(9). pp. 100-112. https://doi.org/10.1016/j.tej.2015.09.019

4. Natural gas consumption converted to electricity using the conversion: 1 Therm = 29.3 kWh. https://dothemath.ucsd.edu/useful-energy-relations/

5. The electricity emission factor assuming full implementation of Play E.1 is estimated by dividing the total Play E.1 CPA Scenario GHG Emissions by the Total Energy Consumption in Table 8.

6. Total Play E.2 GHG Emissions Reductions are calculated by subtracting the Additional GHG Emissions from Increased Electricity Consumption from the Natural Gas GHG Emissions Avoided.

Results

The Moves associated with Play E.2 would result in a reduction of 241 MT CO_2e in 2030 and 984 MT CO_2e in 2045, as shown in Table 12.

Table 12 GHG Emission Reductions Associated with Play E.2

Moves	Emission Reductions (MT CO_2e) 2030	2045	Source
E.2.a Develop a webpage and materials for display at City Hall promoting the benefits of electrification and resources that can assist with the fuel-switching process.	Supportive		N/A
E.2.b Provide financial and technical resources, including hosting workforce development trainings for installers and building owners/operators to discuss benefits and technical requirements of electrification.	Supportive		N/A
E.2.c Perform regular internal trainings with planners and building officials on current state decarbonization goals and incentives available for electric homes.	Supportive		N/A
E.2.d Provide education around cooking with electric appliances, including demonstrations from chefs and/or local restaurants, as available.	Supportive		N/A
E.2.e Adopt an Electrification Readiness reach code for all new buildings and accessory dwelling units which bans the piping of natural gas. In doing so the City will: ▪ Engage with stakeholders, both internal stakeholders, such as City staff and officials, and external stakeholders, such as local developers regarding the purpose and impact of the reach code ▪ Conduct a cost effectiveness study ▪ Develop and draft an ordinance ▪ Conduct public hearings, public notices, and formally adopt the ordinance ▪ Submit the adopted ordinance to the California Energy Commission (CEC)	241	984	California Energy Codes and Standards. 2019 Cost Effectiveness Study: Low-Rise Residential New Construction. California Energy Codes and Standards. 2019 Nonresidential New Construction Reach Code Cost Effectiveness Study. Gough, Matt. 2020. Sierra Club. California's Cities Lead the Way to a Gas-Free Future. Deason, Jeff. et al.. 2018. Electrification of buildings and Industry in the United States. EIA. 2020. Annual Energy Outlook.
E.2.f Adopt an ordinance that allows granting of minor allowances for certain site development standards when there is no practical ways to design a project to be all electric.	Supportive		N/A

Play E.3 Electrify 5% of existing buildings by 2030 and 80% by 2045.

Background

To further the efforts of Play E.2 in electrifying South Pasadena, the City intends to support the electrification of existing buildings through voluntary adoption of all electric appliances. The Moves the City will take to encourage fuel switching include:

- Maintaining an updated list of rebates and incentives for electric conversions and appliances (Move E.3.b)
- Providing education on the benefits of electric appliances when building permits and permits for replacement are obtained (Moves E.3.c and E.3.e)

- Working with utility providers to provide rebates on electric HVAC and water heating equipment (Move E.3.d)
- Establishing a coordinated education campaign to reduce use of natural gas (Move E.3.g)

In addition to these voluntary efforts, South Pasadena will make steps towards developing and adopting an electrification retrofit ordinance through performing an existing buildings analysis and a cost-effectiveness study (Moves E.3.f and E.3.h).

Methodology and Assumptions

The 5% target for electrification of existing buildings by 2030 is based on the voluntary replacement of natural gas fueled equipment with electric equipment, through strategic education and public outreach efforts by South Pasadena. The 2045 target of electrifying 80% of existing buildings assumes the adoption of an electrification ordinance banning the installation or replacement of natural gas burning equipment in any existing building, with the majority of the natural gas fueled equipment in the City to have reached its operational end of life by 2045.

A 2016 analysis of the effectiveness of marketing, education, and outreach associated with the Energy Upgrade California program found that approximately 10% of people reached through one-on-one interactions had decided to purchase ENERGY STAR certified appliances after the interaction.[22] Similarly, South Pasadena expects to encourage 10% of the people reached through their efforts in public education and one-on-one interactions at the permitting counter to purchase electric appliances and equipment instead of natural gas fueled alternatives. Additionally, the promotion of rebates and incentives offered through SCE would provide motivation for voluntary electrification.[23]

It is assumed that the majority of natural gas fueled equipment would be replaced with electric equipment at its operational end-of-life. The 2018 EIA report, *Updated Buildings Sector Appliance and Equipment Cost and Efficiencies*, provides the average lifespans of various equipment types. Residential gas fired furnaces, water heaters, and stoves/cook tops have an average lifespan of 21.5, 13, and 12 years, respectively; while commercial natural gas fired furnaces, boilers, and water heaters have an average lifespan of 23, 25, and 10 years, respectively.[24] Taking the average lifespan of these equipment types, it is estimated that in the 10 years between 2020 and 2030, approximately 65% of all of these types of equipment in South Pasadena will have been replaced. Furthermore, under this same assumption, in the fifteen years between 2030 and 2045 approximately 80% of all of these types of equipment would reach their end of life and need to be replaced.

By 2030, with a 10% voluntary participation rate in converting to all electric equipment and an approximate 65% turnover of all natural gas appliances and equipment in South Pasadena, it is conservatively estimated that 5% of the existing buildings would be electrified. Under the assumption that replacement of natural gas equipment will be required in South Pasadena with the

[22] California Public Utilities Commission (CPUC). 2016. 2013-2015 California Statewide Marketing, Education, and Outreach Program: Verification and Integrated Effectiveness Study. pp. 88. https://www.cpuc.ca.gov/statewidemeo/. Accessed May 25th, 2020.

[23] In regions where natural gas and electric utilities are separate entities, electrification incentives are strongest. Deason, Jeff. et al.. 2018. Electrification of buildings and Industry in the United States. pp. 39. https://pdfs.semanticscholar.org/27f0/d125d5316ee10565560545c0fc17d6c447a8.pdf?_ga=2.3238896.1101123906.1590438648-1004765093.1590438648

[24] EIA. 2018. Updated Buildings Sector Appliance and Equipment Cost and Efficiencies. Appendix C. pp. 9, 51, 75, 90, 98, 120 https://www.eia.gov/analysis/studies/buildings/equipcosts/pdf/full.pdf. Accessed May 25, 2020.

adoption of an Electrification Retrofit Ordinance by 2030, the estimated turnover of 80% of natural gas equipment would result in 80% of South Pasadena buildings being electrified.

Play E.3 GHG emission reduction calculations assume that baseline natural gas consumption would be reduced by 5% by 2030 and 80% by 2045. Since electric end use appliances are approximately 200% more efficient over similar natural gas burning equipment and appliances,[25] the use of electric equipment instead of natural gas would result in an effective efficiency increase. This electricity consumption would generate GHG emissions that would offset the reduction in natural gas emissions from electrification; however, these emissions would be minimized assuming full implementation of Play E.1. The calculations and assumptions used to estimate emission reductions from Play E.3 are provided in Table 13.

Table 13 Play E.3 GHG Emission Reduction Calculations

Calculation Factor	2030	2045
Electrification Retrofit Goal	5%	80%
Natural Gas Consumption Reductions from Retrofits Below 2020 Baseline Consumption (therms)[1]	227,810	3,644,961
Natural Gas Emission Factor (MT CO_2e/therm)[2]	0.00531	0.00531
Natural Gas GHG Emissions Avoided (MT CO_2e)	1,210	19,355
Resulting Increase in Electricity Consumption (kWh) [3] [4]	2,224,945	35,599,120
Electricity Emission Factor Assuming Implementation of Play E.1.(MT CO_2e/kWh)[5]	0.00001162	0
Additional GHG Emissions from Increased Electricity Consumption (MT CO_2e)	26	0
Total Play E.3 GHG Emissions Reductions (MT CO_2e)[6]	**1,184**	**19,355**

Notes: MT CO_2e = metric tons of carbon dioxide; kWh =-kilowatt-hour

1. 2020 Baseline Natural Gas Consumption is obtained from the *Legislative Adjusted* Forecast GHG Emissions estimates used to develop GHG reduction targets, provided in Appendix C.

2. Emission factors obtained from United States Environmental Protection Agency Emission Factors for Greenhouse Gas Inventories, Table 1. https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf.

3. The resulting increase in electricity consumption estimates a 200% increase in efficiency due to the improved efficiency of electric heat pumps and other electrical equipment of natural gas. Dennis, Keith. 2015. Environmentally Beneficial Electrification: Electricity as the End-Use Option. The Electricity Journal. 28(9). pp. 100-112. https://doi.org/10.1016/j.tej.2015.09.019

4. Natural gas consumption converted to electricity using the conversion: 1 Therm = 29.3 kWh. https://dothemath.ucsd.edu/useful-energy-relations/

5. The electricity emission factor assuming full implementation of Play E.1 is estimated by dividing the total Play E.1 CPA Scenario GHG Emissions by the Total Energy Consumption in Table 8.

6. Total Play E.3 GHG Emissions Reductions are calculated by subtracting the Additional GHG Emissions from Increased Electricity Consumption from the Natural Gas GHG Emissions Avoided.

Results

Play E.3 would result in a reduction of 1,184 MT CO_2e in 2030 and 19,355 MT CO_2e in 2045, as shown in Table 14.

25 Dennis, Keith. 2015. Environmentally Beneficial Electrification: Electricity as the End-Use Option. The Electricity Journal. 28(9). pp. 100-112. https://doi.org/10.1016/j.tej.2015.09.019

Table 14 GHG Emission Reductions Associated with Play E.3

Moves	Emission Reductions (MT CO_2e) 2030	2045	Source
E.3.a Develop an existing building electrification permit tracking program to track annual progress in achieving the targeted electrification goal.	Supportive		N/A
E.3.b Keep an updated list of rebates and incentives available to residents who would like to convert their buildings to electric power.	1,187	19,355	CPUC. 2016. 2013-2015 California Statewide Marketing, Education, and Outreach Program: Verification and Integrated Effectiveness Study. Deason, Jeff. et al.. 2018. Electrification of buildings and Industry in the United States. EIA. 2018. Updated Buildings Sector Appliance and Equipment Cost and Efficiencies. Appendix C.
E.3.c Provide education on the potential savings energy savings and benefits of electric heat pumps for water heating and space heating when permits for replacement are obtained.			
E.3.d Work with Southern California Edison (SCE) and/or the Clean Power Alliance to provide rebates for residential replacement of natural gas-powered air and water heating appliances with electric-powered.			
E.3.e Promote water heater, space heating, and appliance (electric stoves/dryers) replacement programs and incentives (residential) at time of construction permit.			
E.3.f Perform an existing buildings analysis in order to understand the potential for electrification retrofitting in South Pasadena and establish a roadmap for eliminating natural gas from existing buildings.			
E.3.g Establish a comprehensive, coordinated education campaign focused towards property owners, landlords, property management companies, and occupants for reducing the use of natural gas in homes and businesses. Establish a shared understanding of existing incentives for electric appliances and upgrades, and how to access them, including SCE incentive programs and rebates.			
E.3.h Perform a cost-effectiveness study for electrification retrofitting, including requirements for newly permitted HVAC/hot water heaters and other appliances to be electric.	Supportive		N/A
E.3.i Develop a best practices model based on the progress electrifying existing buildings in South Pasadena and outside of South Pasadena to significantly increase electrification post-2030.	Supportive		N/A

Play E.4 Develop and promote reduced reliance on natural gas through increased clean energy systems that build off of renewable energy development, production, and storage.

Background

Efforts under Play E.4 are intended to increase South Pasadena's energy resilience instead of emission reductions. South Pasadena will reduce its reliance on natural gas and the electricity grid as natural disasters and warming temperatures pose significant risk to the disruption of power supply and safety. Reducing reliance on natural gas can reduce the risk of disasters such as major gas leaks, as well improving public health by reducing the inhalation of combustion by-products known to degrade indoor air quality.[26] Reducing reliance on the electricity grid can also help maintain resilience during Public Safety Power Shutoffs, which will continue to occur as wildfire

[26] CARB. 2020. Indoor Air Pollution from Cooking. https://ww2.arb.ca.gov/resources/documents/indoor-air-pollution-cooking. Accessed May 25th, 2020

seasons become longer and more destructive.[27] The City has already included many of the Moves under this Play as part of their General Plan and Strategic Plans. Play E.4 and the associated Moves are not expected to reduce overall GHG emissions and are therefore not quantified; however, they are provided in Table 15 for reference.

Table 15 GHG Emission Reductions Associated with Play E.4

Play	Emission Reductions (MT CO_2e) 2030	2045	Source
E.4.a Conduct a Feasibility Study to assess cost and applicable locations for installation of battery back-up systems or generators throughout the City in support of General Plan.	Supportive		N/A
E.4.b Promote installation of storage technology in concert with renewable energy infrastructure through educational programs, outreach, and information provided via City platforms.	Supportive		N/A
E.4.c Conduct "micro-grid" Feasibility/Pilot Study in support of General Plan.	Supportive		N/A
E.4.d In support of General Plan, develop and implement a Solar Action Plan with a goal of meeting 50% of South Pasadena's power demand through solar by 2040.	Supportive		N/A
E.4.e In support of the 2018-2019 City Strategic Plan, develop a strategy and implementation schedule for the Renewable Energy Plan, after feasibility study.	Supportive		N/A
E.4.f Adopt a PV (solar) Ordinance requiring newly constructed and majorly renovated multi-family and commercial buildings to install PV systems with an annual output greater or equal to 25% of buildings electricity demand. Ensure consistency of ordinance with City General Plan.	Supportive		N/A
E.4.g Require all new structures or major retrofits to be pre-wired for solar panels, consistent with General Plan.	Supportive		N/A
E.4.h Work with various City departments to establish and streamline battery storage requirements to allow for easier implementation of these technologies throughout the City.	Supportive		N/A
E.4.i Work with home and business owners, including those in the historic districts, to identify and promote renewable energy demonstration projects to showcase the benefits.	Supportive		N/A
E.4.j Work with SCE and the CPA to develop a program and timeline for increasing resilience to power losses, including Public Safety Power Shutoffs (PSPS), and climate-driven extreme weather events for low-income, medically dependent, and elderly populations through installation of renewable energy and onsite energy storage with islanding capabilities, following appropriate project-level environmental review.	Supportive		N/A

[27] California Public Utilities Commission (CPUC). De-Energization (PSPS). https://www.cpuc.ca.gov/deenergization/. Accessed May 25th, 2020.

2.3 Transportation Sector

Play T.1 Increase zero-emission vehicle and equipment adoption to 13% by 2030 and 25% by 2045.

Background

A transition to zero-electric vehicles (ZEV) will play an essential role in the reduction of fossil fuel consumption needed for South Pasadena, and California as a whole, to reach GHG reduction targets. South Pasadena has established a 2030 target of having 13% of the passenger vehicle fleet be ZEV, and 25% by 2045, which aligns with the state target set by Governor Brown with Executive Order (EO) B-48-18.[28] While the state and South Pasadena cannot require the purchase of ZEVs, they can work to provide sufficient electric vehicle (EV) charging infrastructure that would be required to support ZEV adoption. As market trends continue to shift towards more EVs being purchased, South Pasadena can facilitate this transition by:

- Developing, implementing, and funding a plan for providing, and assessing the challenges associated with, adequate EV infrastructure (Moves T.1.a. and T.1.h)
- Ensuring adequate charging is available at commercial land uses and workplaces (Moves T.3.b and T.3.g)
- Promoting to the public the benefits of ZEVs and available rebates and incentives for ZEVs and fueling infrastructure (Move T.1.d)
- Streamlining the permitting process for ZEV infrastructure (Move T.1.c)

Methodology and Assumptions

While these EV adoption rate targets align with state targets established by EO B-48-18, the recent federal Safer Affordable Fuel Efficient (SAFE) Vehicles Rule creates uncertainty in California's ability to set policies to reach the desired ZEV adoption. Although California may not be able to take direct action that increases ZEV adoption, EO B-48-18 outlines EV charging infrastructure needs that would allow the state to reasonably reach its target of five million ZEVs on the road in 2030. EO B-48-18 indicates that 250,000 public charging stations installed by 2025 would support the desired EV adoption, which would equate to approximately one public EV charger for every 112 passenger vehicles on the road.[29] In order to meet the state target for ZEV public charging, this would equate to approximately 180 public EV charging stations in South Pasadena. The actual number and ideal locations for these EV charging stations would need to be further investigated through an EV Readiness Plan and Feasibility Study.

In addition to well-planned public charging stations, workplace and residential EV charging infrastructure would further support EV adoption. A 2015 report by Idaho National Laboratory,

[28] Executive Order B-48-18 provides a target of 5 million ZEVs to be in California's vehicle fleet in 2030. While this target does not provide what amount are to be passenger and light-duty vehicles, as compared to medium- and heavy- duty vehicles, it is assumed that 80% of ZEVs will be light-duty passenger vehicles, which is consistent with the previous target of 1.5 million ZEVs by 2030 (1.2 million of which are expected to be light-duty passenger vehicles, as shown in Figure 15 of the CARB 2016 *Mobile Sources Strategy*). Under these assumptions, of the 30 million expected passenger vehicles in California in 2030 (CARB 2016 *Mobile Sources Strategy*, page 67), 13% would be ZEVs. Assuming the same increase of ZEV adoption between 2030 and 2045, as occurred before 2030, there would be an approximate doubling of ZEVs by 2045.

[29] According to California Department of Motor Vehicles Registration Statistics, as of October 2018, there were approximately 20,000 light-duty vehicles registered in South Pasadena, 326 of which were ZEVs (1.6 percent). https://www.dmv.ca.gov/portal/dmv/detail/pubs/media_center/statistics. Accessed May 21st, 2020.

Plugged In: How Americans Charge Their Electric Vehicles, found that nearly 98% of all EV charging events occurred at home or work. In support of these findings, and to address the challenges faced by those who may not be able to install their own home chargers, adoption of an EV Readiness Reach Code would support increased infrastructure at new and existing commercial and multi-family residential developments.

GHG emission reductions from the adoption of ZEVs assumes that the collective impact of each of the Moves under this Play will incentivize and provide the infrastructure needed for South Pasadena to meet the ZEV adoption targets that align with state targets. The calculations assume that the 13% adoption rate in 2030 and 25% adoption rate in 2045 will result in an equivalent reduction in vehicle miles traveled (VMT) powered by fossil fuels, and emissions associated with these miles traveled would instead be accounted for in additional electricity use. The emission factors used in the *Legislative Adjusted* GHG Emissions Forecast assume that approximately 3% of total South Pasadena Passenger VMT in 2030 would be by ZEVs, and 4% in 2045.[30] Increasing ZEV adoption to 13% by 2030 and 25% by 2045 would reduce GHG emissions from fossil fuel combustion by 10% and by 21% in 2045. The GHG emission reductions of Play T.1 are applied after the VMT reductions attained by Play T.2 and T.3 through increased public and shared transit and active transportation. This GHG reduction would be offset by electricity consumption which would generate a small amount of GHG emissions. The calculations and assumptions used to estimate emission reductions from Play T.1 are provided in Table 16.

[30] Emission factors for the *Legislative Adjusted* GHG Emissions Forecast were obtained from the California Air Resources Board (CARB) EMFAC2017 vehicle emissions model. The model was run for 2030 and 2045 for Los Angeles County. https://arb.ca.gov/emfac/2017/

Table 16 Play T.1 GHG Emission Reduction Calculations

Calculation Factor	2030	2045
EV adoption target	13%	25%
Legislative Adjusted GHG Forecast Projected EV adoption	3%	4%
Effective Increase in EV Adoption Above *Legislative Adjusted* GHG Forecast[1]	10%	21%
Forecasted Passenger Vehicle VMT(VMT)[2]	156,766,759	151,111,470
Play T.1 Reduction in VMT from Fossil Fuel Combustion (VMT)[3]	15,676,676	31,733,409
Forecasted Passenger Vehicle GHG Emissions (MT CO_2e) [2]	38,358	31,567
Play T.1 Reduction in GHG Emissions from Fossil Fuel Combustion (MT CO_2e) [3]	3,836	6,629
Estimated 2020 Model Year Average Electricity Consumption (kwh/100 miles)[4]	34	34
Estimated Increase in Electricity Consumption Resulting from Increased EV Adoption (kWh)	5,330,070	10,789,359
Electricity Emission Factor Assuming Implementation of Play E.1.(MT CO_2e/kWh)[5]	0.0000116	0.0000000
Additional GHG Emissions from Increased Electricity Consumption (MT CO_2e)	62	0
Total Play T.1 GHG Emissions Reductions (MT CO_2e)[-6]	**3,774**	**6,629**

Notes: MT CO_2e = metric tons of carbon dioxide; kWh =-kilowatt-hour; VMT = vehicle miles traveled; EV = electric vehicle

1. The Effective Increase in EV Adoption Above *Legislative Adjusted* GHG Forecast represents the gap in EV adoption in the Los Angeles County vehicle fleet that will allow South Pasadena to reach its EV adoption target. The *Legislative Adjusted* GHG Forecast obtained EV adoption rates from the California Air Resources Board (CARB) EMFAC2017 vehicle emissions model. The model was run for 2030 and 2045 for Los Angeles County. https://arb.ca.gov/emfac/2017/.

2. Total Forecasted Passenger VMT and Total Forecasted Passenger Vehicle GHG Emissions account for the reductions in VMT and GHG emissions that would be realized upon full implementation of Play T.2 and T.3. See Table 20 for derivation of these values.

3. Play T.1 Reduction in VMT from Fossil Fuel Combustion and Play T.1 Reduction in GHG Emissions from Fossil Fuel Combustion are calculated as the reduction resulting from the increased adoption of EV above baseline EV adoption.

4. The Estimated 2020 Model Year Average Electricity Consumption is used to convert the reduction of VMT from fossil fuel combustion to consumption by the increased adoption of electric vehicles. 2020 model year all electric vehicles, excluding Porsche make vehicles, consume an average 34 kWh per 100 miles. https://www.fueleconomy.gov/feg/powerSearch.jsp. Search Criteria: 2020 model year, All Electric vehicle type. Accessed May 21st, 2020.

5. The electricity emission factor assuming full implementation of Play E.1 is estimated by dividing the total Play E.1 CPA Scenario GHG Emissions by the Total Energy Consumption in Table 8.

6. Total Play T.1 GHG Emissions Reductions are calculated by subtracting the Additional GHG Emissions from Increased Electricity Consumption from the Play T.1 Reduction in GHG Emissions from Fossil Fuel Combustion.

Results

There is no single Move under Play T.1 that will reduce GHG emission on its own. Instead, all of the Moves are collectively supportive towards increasing ZEV adoption to a level consistent with state goals. Play T.3 would result in a reduction of 3,774 MT CO_2e in 2030 and 6,629 MT CO_2e in 2045, as shown in Table 17.

Table 17 GHG Emission Reductions Associated with Play T.1

Move	Emission Reductions (MT CO_2e) 2030	2045	Source
T.1.a Develop an EV Readiness Plan to establish a path forward to increase EV infrastructure within the City and promote mode shift to EVs, that is consistent with the City General Plan. In conjunction with an EV Readiness Plan, conduct a community EV Feasibility Study to assess infrastructure needs and challenges.	3,774	6,629	CARB. 2016. Mobile Sources Strategy California Department of Motor Vehicles Registration Statistics https://www.fueleconomy.gov/feg/powerSearch.jsp
T.1.b Adopt an EV Charging Retrofits in Existing Commercial and Multifamily Buildings reach code requiring major retrofits, with either a permit value over $200,000 or including modification of parking surfaces or electric panels, to meet CalGreen requirements for "EV Ready" charging spaces and infrastructure.			
T.1.c Streamline permit processes (city, county, state, utility) for electric vehicle charging infrastructure and alternative fuel stations.			
T.1.d Enhance promotion of public and private conversion to zero-emission vehicles through implementation of the City General Plan including use of City events, social media, and the City website to educate on benefits of zero-emission vehicles and available incentives.			
T.1.e Establish an ordinance that restricts use of gas-powered lawn equipment, including leaf blowers, and provide information on the City website outlining available incentives.			
T.1.f Adopt an EV Readiness Reach Code requiring new commercial construction to provide the minimum number of EV capable spaces to meet Tier 2 requirements (20% of total). In doing so the City will: ▪ Engagement with stakeholders, both internal stakeholders, such as local government staff and officials, and external stakeholders, such as local developers regarding the purpose and impact of the reach code ▪ Conduct a cost effectiveness study ▪ Develop and draft an ordinance ▪ Conduct public hearings, public notices, and formally adopt the ordinance; and ▪ Submit the adopted ordinance to the California Energy Commission (CEC)			
T.1.g Earmark and identify additional funding for implementation of the EV Readiness Plan to include public charging infrastructure in key locations.			

Play T.2 Implement programs for public and shared transit that decrease passenger car vehicle miles traveled 2% by 2030 and 4% by 2045.

Background

Reducing VMT means reducing the number of miles and trips taken by on-road vehicles both intercity and intracity. One way South Pasadena will reduce VMT is by moving trips from single occupancy vehicles to shared mobility option, such as ride-shares, buses, and LA Metro Gold Line. To do this, the City must work to increase the ease of access to various types of safe shared and public transit. South Pasadena intends to do so by:

- Conducting a Feasibility and Community Interest Study for transit improvement options to maximize utilization of near term transit improvements (Move T.2.a)
- Adopting a Transportation Demand Management (TDM) Plan that incentivizes shared transit options to and from new developments, with a focus on increasing access to public transit (MoveT.2.d)
- Pursuing shared "micro-transit" options to improve first/last mile connectivity (Move T.2.b)

- Better understanding the community's need and motivation for traveling by car instead of by public transit (Move T.2.c)
- Providing programs that encourage minority, low-income, and senior populations to use public or shared transportation (Move T.2.e)

Methodology and Assumptions

South Pasadena is expected to experience an increase in transit ridership that is consistent with the SCAG 2016 RTP/SCS projections because Play T.2 aligns with SCAG's strategies and recommendations. According to the SCAG 2016 RTP/SCS, an increased mode shift away from passenger vehicles will require improved operational and accessibility strategies for public transit.[31] The majority of these improvements will need to come from the transit agencies themselves; however, South Pasadena will work with these agencies to understand the needs of their community and increase public transit accessibility for all social and demographic groups. Approximately 4.5% of trips in Los Angeles County are by public transit, and through the proposed strategies for improve operations and accessibility included in the SCAG 2016 RTP/SCS, a 67% increase of trips by transit is expected by 2040.[32,33] This corresponds to an increase of transit ridership of 3% by 2030, and a 4%increase by 2045.

It is unclear how future increases in transit ridership will change the GHG emissions associated with public transit in South Pasadena. Emissions associated with increases in service frequency by LA Metro's Gold Line and buses are likely to be offset largely by decreased electricity emission factors and decreased tailpipe emissions from buses. Thus, for calculation replicability and transparency, it is assumed that the reductions in passenger vehicle GHG emissions associated with increased transit ridership will not be offset by additional GHG emissions from increased transit ridership. The calculations and assumptions used to estimate emission reductions from Play T.2 are provided in Table 18.

[31] Southern California Association of Governments (SCAG). 2016 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS). Transit Appendix. Pp. 74-76. http://scagrtpscs.net/Documents/2016/final/f2016RTPSCS_Transit.pdf

[32] Southern California Association of Governments (SCAG). 2016 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS). Transit Appendix. Table 4. Pp. 12. http://scagrtpscs.net/Documents/2016/final/f2016RTPSCS_Transit.pdf

[33] Southern California Association of Governments (SCAG). 2016 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS). Transit Appendix. Table 29. Pp. 76. http://scagrtpscs.net/Documents/2016/final/f2016RTPSCS_Transit.pdf

Table 18 Play T.2 GHG Emission Reduction Calculations

Calculation Factor	2030	2045
Target Reduction in Passenger Vehicle VMT	2%	4%
Total Forecasted Passenger VMT (VMT)[1]	164,913,485	167,455,087
Reduction in Passenger Vehicle VMT from Play T.2 (VMT)	3,298,270	6,698,203
Total Forecasted Passenger Vehicle GHG Emissions (MT CO_2e) [1]	40,351	34,981
Play T.2 GHG Emissions Reductions from Reductions in Passenger Vehicle VMT (MT CO_2e)[-6]	**807**	**1,399**

Notes: MT CO_2e = metric tons of carbon dioxide; VMT = vehicle miles traveled

1. Total Forecasted Passenger VMT and Total Forecasted Passenger Vehicle GHG Emissions are obtained from the *Legislative Adjusted* Forecast GHG Emissions estimates used to develop GHG reduction targets, provided in Appendix C.

Results

There is no single Move under Play T.2 that will reduce GHG emission on its own. Instead, all of the Moves are collectively supportive towards increasing transit ridership to a level consistent with the SCAG 2016 RTP/SCS. Play T.2 would result in a reduction of 807 MT CO_2e in 2030 and 1,399 MT CO_2e in 2045, as shown in Table 19.

Table 19 GHG Emission Reductions Associated with Play T.2

Move	Emission Reductions (MT CO_2e) 2030	2045	Source
T.2.a Conduct a Feasibility and Community Interest Study on the four transit improvement options of the City's General Plan.	807	1,399	Southern California Association of Governments (SCAG). 2016 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS)
T.2.b Pursue a community car, bike, or e-scooter "micro-transit" share pilot consistent with City General Plan.			
T.2.c Conduct local transportation surveys to better understand the community's needs and motivation for travelling by car versus other alternatives such as bus or Metro Gold Line light rail. Use survey results to inform transit expansion and improvement projects.			
T.2.d Adopt a Transportation Demand Management (TDM) Plan for the City that includes a transit system focus. Provide incentives for implementation of TDM measures at local businesses and new developments.			
T.2.e Facilitate transportation equity through targeted provision of programs that encourage minority, low-income, disabled, and senior populations to take transit, walk, bike, use rideshare or car share.			

Play T.3 Develop and implement an Active Transportation Plan to shift 3% of baseline passenger car VMT to active transportation by 2030, and 6% by 2045.

Background

Increasing active transportation is an essential aspect of reducing the amount of VMT in South Pasadena. An Active Transportation Plan, which provides an understanding of the current conditions of sidewalks and bike lanes, will provide a framework and timeline for making the most effective infrastructure improvements to increase trips by biking and walking and reduce trips by passenger

car. A successful plan also includes identification of funding sources for which South Pasadena will pursue the establishment of developer fees. The SCAG 2016 RTP/SCS outlines specific measures and actions that are to be implemented, effectively shifting 6% of trips to active transportation by 2040, from the 2012 baseline. As part of this plan, local governments are expected to develop and implement active transportation plans that include the development of a comprehensive local bikeway and pedestrian network, using Complete Streets principles.

Move T.3.a, to develop and implement an Active Transportation Plan consistent with the General Plan and the SCAG 2016 RTP/SCS, is the cornerstone Move of Play T.3, from which the majority of GHG emission reductions will be attained. South Pasadena will provide equitable and safe access to active transportation through additional supportive Moves under Play T.3, including identifying funding for plan implementation, increasing availability of bicycle storage, conducting intersection studies, and requiring new active transportation infrastructure be developed with safety as a primary focus.

Methodology and Assumptions

This analysis assumes of South Pasadena's design and implementation of an Active Transportation Plan that is consistent with the strategies of the SCAG 2016 RTP/SCS. It is therefore assumed that South Pasadena would attain the same active transportation mode-shift estimated for a "Semi Urban place",[34] under implementation of the SCAG 2016 RTP/SCS.[35] Under the SCAG 2016 RTP/SCS, mode share for active transportation trips are expected to increase by 6% from the baseline year (2012) to the plan horizon year of 2040. Reduction calculations assume that this mode shift will result in a 6% reduction of passenger vehicle trips by 2040, and the baseline year for South Pasadena is the 2016 inventory year. Accordingly, with successful implementation the Active Transportation Plan, South Pasadena is expected to attain a 3% decrease in passenger vehicle VMT by 2030, and a 6% decrease in 2040. As the horizon year for the SCAG 2016 RTP/SCS is 2040, it is assumed that VMT reductions will remain at 6% beyond 2040, and into 2045. The calculations and assumptions used to estimate emission reductions from Play T.3 are provided in Table 20.

Table 20 Play T.3 GHG Emission Reduction Calculations

Calculation Factor	2030	2045
Target Reduction in Passenger Vehicle VMT	3%	6%
Forecasted Passenger VMT (VMT)[1]	161,615,215	160,756,883
Reduction in Passenger Vehicle VMT from Play T.3 (VMT)	4,848,456	9,645,413
Total Forecasted Passenger Vehicle GHG Emissions (MT CO_2e) [1]	39,544	33,582
Play T.3 GHG Emissions Reductions from Reductions in Passenger Vehicle VMT (MT CO_2e)[-6]	**1,186**	**2,015**

Notes: MT CO_2e = metric tons of carbon dioxide; VMT = vehicle miles traveled

1. Total Forecasted Passenger VMT and Total Forecasted Passenger Vehicle GHG Emissions account for the reductions in VMT and total GHG emissions from implementation of Play T.2. See Table 18for derivation of VMT and GHG emissions.

[34] Under the SCAG 2016 RTP/SCS Active Transportation Appendix the City of South Pasadena is designated as a Semi-Urban place. http://scagrtpscs.net/Documents/2016/final/f2016RTPSCS_ActiveTransportation.pdf

[35] Southern California Association of Governments (SCAG). 2016 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS). Active Transportation Appendix. Table 20. Pp. 69. http://scagrtpscs.net/Documents/2016/final/f2016RTPSCS_ActiveTransportation.pdf

Results

Move T.3.a associated with Play T.3 would result in a reduction of 1,186 MT CO_2e in 2030 and 2,015 MT CO_2e in 2045, as shown in Table 21. The additional Moves under this Play are considered supportive towards effectively implementing Move T.3.a and reaching the overall goal of Play T.3.

Table 21 GHG Emission Reductions Associated with Play T.3

Move	Emission Reductions (MT CO_2e) 2030	2045	Source
T.3.a Develop and adopt an Active Transportation Plan consistent with SCAG 2016 RTP/SCS that will identify funding strategies and policies for development of pedestrian, bicycle, and other alternative modes of transportation projects. Establish citywide events, outreach, educational programs, and platforms to promote active transportation in the community in support of General Plan Policy P4.2, and Actions A4.7a and A4.7b.	1,186	2,015	SCAG 2016 RTP/SCS
T.3.b Conduct a Street/Intersection Study to identify streets and intersections that can be improved for pedestrians and bicyclists through traffic calming measures and/or where multi-use pathway opportunities exist to increase active transportation.	Supportive		N/A
T.3.c Annually review and update the City's Bicycle and Pedestrian Network Map and post throughout City.	Supportive		N/A
T.3.d Work with the Community Service Department or South Pasadena Police Department to develop programs and classes to teach and promote bicycle riding education and safety to residents of all ages and skill levels.	Supportive		N/A
T.3.e Conduct a nexus study and develop an ordinance requiring payment of fees from development projects to implement safe active transportation routes and infrastructure citywide.	Supportive		N/A
T.3.f Amend zoning code to require installation of bike stalls or lockers at new developments, "mobility hubs", and during change of use of existing buildings, consistent with General Plan.	Supportive		N/A
T.3.g Adopt a Trip Reduction Ordinance that incudes requirements in the Zoning Code to require end-of-trip facilities for cyclists (e.g., showers, bike repair kiosks, and lockers) in new, non-residential building projects of a specified size.	Supportive		N/A

2.4 Water Sector

Play W.1 Reduce per capita water consumption by 10% by 2030 and 35% by 2045.

Background

Water use and wastewater collection and treatment resulted in less than 1% (0.8%) of total community emissions in the City of South Pasadena in 2016. Although this is a small amount of overall emissions, a holistic approach to climate change allows for GHG emission reductions and the co-benefits of protecting one of California's scarcest resources. A majority of emissions associated with water use and wastewater generation is associated with the electricity use for the pumping and treatment of potable water (68%) and the collection and conveyance of generated wastewater (21%). Therefore, strategies related to this sector include promoting water conservation by reducing per capita potable water consumption, increasing access to and use of recycled water, and utilizing renewable power for the pumping and treatment of local water sources.

Methodology and Assumptions

In 2016, approximately 1,119 MG of potable water was delivered to South Pasadena community with 99.46% supplied by local well production from the San Gabriel Basin. Based on the City's service population of 35,489 in 2016,[36] per capita water consumption is approximately 31,523 gallons annually or approximately 86 gallons per capita per day (gpcd).

Because the City of South Pasadena is primarily made up of low-density residential development, it was assumed that 30-70% of community water use is associated with outdoor usage as found in a 2006 analysis of California water demand trends.[37] As such, a majority of the Moves supporting Play W.1 focus on the regulation of landscaping and the switch from use of potable water to recycled water for purposes such as irrigation that do not require potable water.

The 10% target for reduction in per capita water consumption by 2030 is based on the continued support and implementation of the City's current water conservation policies and programs incorporated into the City General Plan – 2020 Update, the 2020 Draft Downtown Specific Plan, and the City Green Action Plan. The 2045 target of reduction in per capita water use by 35% assumes the adoption of ordinances restricting the use of potable water for non-potable uses and the implementation of the Integrated Water and Wastewater Resources Management Plan (IWWRMP) that will aid in increased usage of greywater and recycled water over potable water for specific land-uses and support management strategies as it relates to infrastructure needs. These reduction potential assumptions are based on studies that have shown that the use of devices such as smart controllers can reduce residential outdoor water use by approximately 20-30% while transitioning to water-wise landscape options can reduce outdoor water use up to 70%.[37]

As previously mentioned, a majority of emissions associated with the water sector are associated with energy usage for water pumping, treatment, conveyance, and wastewater collection and treatment. Therefore, emission reductions achieved through Move W.1 are based on the energy savings associated with the reduction in water use per service population. It was also assumed that the reduction in water consumption would also be directly reflected in a reduction in wastewater generated. Water consumption and wastewater generation was calculated based on the forecasted service population of South Pasadena in 2030 and 2045 and the 2030 and 2045 target of 10% and 35% reduction in per capita water consumption from the 2016 baseline, respectively. Energy savings for water consumption is based on the water cycle energy intensity of 2,604 kWh/MG.[38] Energy savings for wastewater collection and treatment is based on Los Angeles County Sanitation Districts (LACSD) specific energy intensities where the overall energy intensity for wastewater is 1,577 kWh/MG.[38] Accordingly, it is estimated that there would be an energy savings of 428,326 kWh in 2030 and 1,553,006 kWh in 2045. Based on the forecasted SCE electricity emission factor in 2030 of 0.0001365 MT CO_2e/kWh, the energy savings from a 10% reduction in water consumption per capita by 2030 would equate to a reduction in approximately 59 MT CO_2e. Due to the requirements of SB 100, by 2045 SCE electricity will be 100% carbon neutral and the emission factor in 2045 will be 0 MT CO_2e/kWh. As such, no reduction in emissions due to energy savings is estimated for 2045.

In addition to a reduction in per service population water consumption, Play W.1f focuses on the replacement of energy used for local water pumping and treatment with 100% renewable sources.

[36] Department of Finance. E-5 Population and Housing Estimates for Cities, Counties, and the State, 2011-2019 with 2010 Census Benchmark. (http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-5/)

[37] Hanak, Ellen, and Davis, Matthew. "Lawns and Water Demand in California," *California Economic Policy*, Vol. 2, No 2, July 2006.

[38] See the Technical Appendix – GHG Inventory for complete description of energy intensities for water pumping, conveyance, and treatment by water provider and wastewater collection and treatment energy intensities specific to LACSD.

The City of South Pasadena supplied 99.57% of the total community water in 2016, which was all obtained from the San Gabriel Groundwater Basin.[39] It was assumed that the City of South Pasadena would continue to supply the community with 99.57% of their water needs. The average energy intensity for local groundwater pumping from the San Gabriel Groundwater Basin is 2,501.5 kWh/MG, while the energy intensity for chlorination treatment of local groundwater is 9 kWh/MG.[40,41] Emission reductions from the implementation of 100% renewable energy for local groundwater pumping and treatment were based on the forecasted community water consumption, the specific energy intensities listed above, and SCE electricity emission factors. It was assumed that Play W.1 would be implemented to reduce water consumption per service population by 10% in 2030 and 35% by 2045; therefore, the forecasted community water consumption incorporated the reduction described previously. SCE emission factors used in this analysis included the requirements of SB 100. As mentioned above, due to the requirements of SB 100, by 2045 SCE electricity will be 100% carbon neutral and the emission factor in 2045 will be 0 MT CO_2e/kWh. Therefore, a switch to 100% renewable energy for local groundwater pumping at treatment would equate to a reduction in approximately 355.4 MT CO_2e in 2030 and 0 MT CO_2e in 2045. The calculations and assumptions used to estimate emission reductions from Play W.1 are provided in Table 22.

[39] City of South Pasadena 2015 UWMP. Pg. 6-15. (https://www.southpasadenaca.gov/home/showdocument?id=2905)

[40] San Gabriel Valley Water Company (SGVWC) Energy Intensity values are used as a surrogate for local groundwater because the agency's supply is almost wholly pumped from San Gabriel Basin (CPUC 2010. Embedded Water Study 2. Appendix B, pg. 265. Water Agency and Function Component Study and Embedded Energy-Water Load Profiles). The energy intensities used are the averages of the lower and upper ranges: 2,501.5 kWh/MG for groundwater conveyance, and 93.5 kWh/MG for booster and raw water pumps.

[41] Treatment for City of South Pasadena water is chlorination. According to *Energy requirements of water production, treatment, end use, reclamation and disposal* published in Renewable and Sustainable Energy Review 2012, energy intensity of chlorination treatment is 0.0024 kWh per cubic meter, which equates to 9.0. kWh per Million Gallons.

Table 22 Play W.1 GHG Emission Reduction Calculations

Calculation Factor	2030	2045
Target Reduction in per capita water consumption	10%	35%
Per Capita Water Consumption Growth Beyond 2025 (gallons/year)[1]	28,370	20,490
Per Capita Wastewater Generation Growth Beyond 2025 (gallons/year)[1]	19,724	14,245
Forecasted service population[2]	36,720	38,040
Reduced Water Consumption (MG)[3]	116	420
Reduced Wastewater Generation (MG)[3]	80	292
Energy intensity for water cycle (kWh/MG)[4]	2,604	2,604
Energy intensity for wastewater treatment (kWh/MG)[5]	1,577	1,577
Resulting Decrease in Electricity Consumption (kWh) [6]	428,326	1,553,006
SB 100 Adjusted Electricity Emission Factor (MT CO_2e/MWh)[7]	0.136	0
Total Move W.1 a-e GHG Emissions Reductions (MT CO_2e)	**58.5**	**0**
Forecasted Water Consumption from Local Sources (MG)[8,9]	1,037	776
Energy intensity for Local Water Pumping and Treatment (kWh/MG)[10]	2,510.5	2,510.5
Resulting Decrease in Electricity Consumption (kWh) [6]	2,604,133	1,948,339
Total Move W.1 f GHG Emissions Reductions (MT CO_2e)	**355.4**	**0**
Total Play W.1 GHG Emissions Reductions (MT CO_2e)	**414**	**0**

Notes: MT CO_2e = metric tons of carbon dioxide; kWh =-kilowatt-hour; MG = million gallons

1. Per capita water consumption and wastewater generation annually is based on the 2016 per capita water consumption of 31,523 gallons/capita/year and wastewater generation of 21,915 gallons/capita/year.

2. Forecasted service population is equivalent to the population plus number of jobs. Population and job numbers were obtained from the Department of Finance. E-5 Population and Housing Estimates for Cities, Counties, and the State, 2011-2019 with 2010 Census Benchmark. (http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-5/)

3. Reduced water consumption and wastewater generation is based on the difference between the baseline per capita water consumption and baseline per capita wastewater generation rates listed in note and the adjusted per capita rates given the reduction targets, multiplied by the current service population.

4. Energy intensity factors for water consumption are based on the combined intensities needed for groundwater pumping, treatment and distribution as described in the inventory analysis in Appendix C – Community Technical Appendix and in the above written section. The energy intensities obtained from the CPUC Embedded Water Study 2 (2010) are used a proxy.

5. Agency specific (LACSD) energy intensities for wastewater generation were obtained from CPUC 2010. Embedded Energy Water Studies Study 2: Water Agency and Function Component Study and Embedded Energy-Water Load Profiles; Table 4.2 Appendix B-Agency Profiles (pg. 134); average of low and high value were applied.

6. Total electricity saved through reduction in water consumption and wastewater generation is estimated by multiplying the amount of reduced water or wastewater by the corresponding energy intensity factor.

7. SCE emission factors used in this analysis included the requirements of SB 100.

8. Play W.1 f focuses on the use of 100% renewable power for all pumping and treatment of local water sources which currently make up 99.57% of all water supplied to the City of South Pasadena; it is assumed that this will be the same in the future.

9. To avoid double counting potential reductions, forecasted water consumption assumes that Play W.1 a-e have been implemented.

10. Energy intensity for local water pumping and treatment is based on the average values for the San Gabriel Basin presented in CPUC 2010. Embedded Energy Water Studies Study 2: Water Agency and Function Component Study and Embedded Energy-Water Load Profiles.

Results

As shown in Table 23, Moves W.1.a through W.1.e associated with Play W.1 would result in a reduction of 59 MT CO2e in 2030 and 0 MT CO2e in 2045 through energy savings due to reduction in water consumption. Additional reductions of 355 MT CO2e in 2030 and 0 MT CO2e in 2045 would be achieved with the implementation of Move W.1.f with the use of 100% renewable energy for local water groundwater pumping and treatment, for a total of 414 MT CO_2e.

Table 23 GHG Emission Reductions Associated with Play W.1

Moves	Emission Reductions ($MT CO_2e$) 2030	2045	Source
W.1.a Continue to enforce the Model Water Efficient Landscapes Ordinance.			CPUC 2010. Embedded Energy Water Studies Study 2: Water Agency and Function Component Study and Embedded Energy-Water Load Profiles; Appendix B-Agency Profiles
W.1.b Work with the Los Angeles County Sanitation District (LACSD) to bring recycled water lines and infrastructure to the City.			
W.1.c In conjunction with the Downtown Specific Plan and City General Plan, adopt an ordinance restricting the use of potable water for non-potable uses and requiring greywater capture for land uses that are excess water users (e.g. golf courses, car washes, large fields, etc.).			
W.1.d Implement Plays 1 through 4 under Goal II of the Green Action Plan on the provided implementation timeline, aiming to provide education and promotion of greywater systems. (See the City's Green Action Plan for more information).	59	0	Hanak, Ellen, and Davis, Matthew. "Lawns and Water Demand in California," *California Economic Policy*, Vol. 2, No 2, July 2006.
W.1.e In conjunction with Move II.1.1 of the City Green Action Plan, develop an Integrated Water Resourced Management Plan that identifies access to recycled water and quantity of recycled water available to the City, as well as establishes an implementation plan. The implementation plan shall identify land use types (i.e., landscaping, gold courses, fields) and specific projects that will switch from potable to recycled water use allowing for a goal of 20% of City's potable water use to be replaced with recycled water.			City of South Pasadena 2015 UWMP
W.1.f Implement 100% renewable power for all pumping and treatment of water.	355	0	LACSD 2015 UWMP

2.5 Waste Sector

Play SW.1 Implement and enforce SB 1383 organics and recycling requirements to reduce landfilled organics waste emissions 50% by 2022 and 75% by 2025.

Background

Organic materials are the focus of the recent landmark legislation SB 1383 (Short-Lived Climate Pollutants: Organic Waste Reductions). Now in the final rulemaking stage, this new state law has the immediate goal of reducing organic waste sent to landfill and the ultimate objective of reaching statewide methane emissions reduction goals. Specifically, it sets a statewide goal for the reduction in organic waste to landfills – 50% by 2020 and 75% by 2025 – in addition to the recovery of 20% of edible food waste for human consumption. SB 1383 will require local governments to provide organics collection to all generators and require all generators to subscribe. It also has specific mandates for container systems, education and outreach programs, monitoring and contamination reporting, and enforcement of regulations. Full SB 1383 implementation will begin in 2022, allowing some time for jurisdictions to plan and prepare for achieving compliance.[42]

[42] California Air Resources Board. (2017). Short-Lived Climate Pollution Reduction Strategy.

The City of South Pasadena has already started the development of a Zero Waste Plan through their updated City General Plan and through their City Green Action Plan has begun to build out the infrastructure to reduce landfilled organics and increase recycling from local businesses. The adoption of ordinances requiring compliance with SB 1383 and actively working with the City's waste hauler will help to achieve the goals of SB 1383.

Methodology and Assumptions

The requirements and actions associated with SB 1383 have been developed to produce a 75% reduction in organics by the State of California.[43] Therefore, by taking the actions required, City of South Pasadena can expect to achieve a similar reduction level. The emissions reductions associated with a 75% reduction in organics was calculated using the 2014 Waste Characterization Study for the County of Los Angeles pursuant to the SB 1383 guidelines.[44] The City of South Pasadena did not have City-specific waste characterization data; therefore, it was assumed that 41% of the waste landfilled from the City was made up of organics as reported in the CalRecycle Waste Characterization Study for the County of Los Angeles. A 50% reduction was applied in 2022 and 75% reduction was applied in 2025 and continued through 2030. The reduced amount of organic waste was multiplied by the weighted average of the USEPA's emission factors for various organics from the Waste Reduction Model (WARM) based on the organic waste characterization (Emission Factor = 0.289 MT CO_2e/short ton of waste).[45] The calculations and assumptions used to estimate emission reductions from Play SW.1 are provided in Table 24.

Table 24 Play SW.1 GHG Emission Reduction Calculations

Calculation Factor	2030	2045
Target Reduction in Landfilled Organics	75%	75%
Forecasted service population[1]	36,720	38,040
Forecasted Waste Generation (tons)[2]	19,125	19,813
Forecasted Organic Waste Generation (tons)[3]	7,841	8,123
Diverted Organic Waste (tons)[4]	5,881	6,092
Organics Waste Emission Factor (MT CO_2e/ton)[5]	0.2895	0.2895
Total Play SW.1 GHG Emissions Reductions (MT CO_2e)	**1,702**	**1,764**

Notes: MT CO_2e = metric tons of carbon dioxide; kWh =-kilowatt-hour

1. Forecasted service population is equivalent to the population plus number of jobs. Population and job numbers were obtained from the Department of Finance. E-5 Population and Housing Estimates for Cities, Counties, and the State, 2011-2019 with 2010 Census Benchmark. (http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-5/)

2. Forecasted waste generation is estimated as the forecasted service population multiplied by the per capita waste generation factor obtained from the 2016 inventory (0.5208 tons/service population)

3. Data on the composition of the waste stream by waste type was not available for the City of South Pasadena, therefore the Cal Recycle statewide average composition was used where ~59% of the waste stream is mixed municipal solid waste (MSW) and ~41% is organics.

4. Diverted organics is based on the total forecasted organics generation multiplied by the targeted reduction.

5. The emission factor for organics waste is the weighted average of emission factors for all organic materials listed in the U.S. EPA's WARM model Version 15 using the Cal Recycle 2014 Waste Characterization study prepared for California Regions (https://www2.calrecycle.ca.gov/WasteCharacterization/ResidentialStreams?lg=443&cy=19) for tonnage by waste type.

*Values may not add up due to rounding

[43] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1383

[44] https://www2.calrecycle.ca.gov/WasteCharacterization/ResidentialStreams%3fcy%3d19%26lg%3d443

[45] https://www.epa.gov/sites/production/files/2019-06/documents/warm_v15_organics.pdf

Results

The Plays associated with Play SW.1 would result in a reduction of 1,702 MT CO_2e in 2030 and 1,764 MT CO_2e in 2045, as shown in Table 25.

Table 25 GHG Emission Reductions Associated with Play SW.1

Moves	Emission Reductions (MT CO_2e) 2030	2045	Source
SW.1.a Adopt procurement policies to comply with SB 1383 requirements for jurisdictions to purchase recovered organic waste products.	1,702	1,764	CalRecycle Waste Stream Characterization (https://www2.calrecycle.ca.gov/WasteCharacterization/) EPA. Waste Reduction Model (WARM) Version 15. May 2019. (https://www.epa.gov/warm/documentation-chapters-greenhouse-gas-emission-energy-and-economic-factors-used-waste-reduction) SB 1383
SW.1.b Adopt an ordinance requiring compliance with SB 1383. Ensure ordinances established through the City General Plan and the Zero Waste Plan are consistent with SB 1383 requirements; and revise ordinances if necessary.			
SW.1.c Adopt an Edible Food Recovery Ordinance for edible food generators, food recovery services, or organization that are required to comply with SB 1383.			
SW.1.d Partner with the City's waste hauler, to provide organic waste collection and recycling services to all commercial and residential generators of organic waste.			
SW.1.e Adopt an ordinance requiring all residential and commercial customers to subscribe to an organic waste collection program and/or report self-hauling or backhauling of organics.			
SW.1.f Conduct a Feasibility Study and prepare an action plan to ensure edible food reuse infrastructure is sufficient to accept capacity needed to recover 20% of edible food disposed or identify proposed new or expanded food recovery capacity.			
SW.1.g Support an education and outreach program for school children and adults around food waste prevention, nutrition education, and the importance of edible food recovery. Support City Green Action Plan Play III identified educational goals (Move III.1.3., Move III.1.4., Move III1.6., Move III.2.1, Move III. 3.3, and Move III.4.2).			
SW.1.h Establish an edible food recovery program supporting City General Plan and the City Green Action Plan Move III.1.2 to minimize food waste.			
SW.1.i Adopt an ordinance or enforceable mechanism to regulate haulers collecting organic waste, including collection program requirements and identification of organic waste receiving facilities.			
SW.1.j Partner with City Waste Services to: ▪ Ensure organic waste collection from mixed waste containers are transported to a high diversion organic waste processing facility; ▪ Provide quarterly route reviews to identify prohibited contaminants potentially found in containers that are collected along route; ▪ Clearly label all new containers indicating which materials are accepted in each container, and by January 1, 2025, place or replace labels on all containers.			

Play SW.2 Reduce residential and commercial waste sent to landfills by 50% by 2030 and 100% by 2045.

Background

Play SW.2 aims to reduce residential and commercial waste landfilled through the implementation of a Zero Waste Plan which primarily focuses on increased organics diversion through composting, reduction of construction and demolition (C&D) waste through a C&D recycling ordinance in

compliance with 2019 CALGreen building codes, and ordinances banning single use food ware and hospitality items (i.e. single use toiletry bottles).

Methodology and Assumptions

The 2014 waste characterization study for the County of Los Angeles pursuant to the SB 1383 guidelines indicated that approximately 41% of landfilled waste is organics while the remaining 59% of the waste landfilled is a mixture of various types of material.[46] As the City of South Pasadena does not characterize its waste stream, it is assumed that the County of Los Angeles waste characterization data is representative. To avoid double counting of emission reductions generated from Play SW.1, the organic diversion from the landfill due to SB 1383 was incorporated into quantification of SW.2 such that additional reduction in waste to the landfill was evaluated based on the altered waste stream post Play SW.1 implementation. With the compliance to SB 1383 requirements, the City of South Pasadena's organic waste contribution to landfills would be reduced to approximately 10.25% of the total waste stream by 2030.

No case studies have been conducted on the waste reduction impacts of single use foodware and single-use individual toiletry items in the hospitality industry. However, several cities including Richmond, Oakland, Berkeley, and Palo Alto have passed ordinances banning them and California recently enacted a law, effective 2023, that bans most single-use toiletry items at hotels.[47] [48] [49] [50] [51] Of these cities, Palo Alto has published numbers estimating a 1% (290 ton reduction of 27,000 tons total) reduction in total City waste due to the banning of plastic straws, utensils, stirrer sticks, drink plugs, produce bags, and other disposable plastic items.[52] These numbers do not account for other foodware which was banned in previous ordinances. Marriot estimates that approximately 500 million plastic bottles or 1.7 million pounds of plastic are landfilled each year and that by eliminating single-use plastic toiletry bottles in hotels, that this will reduce amenity plastic usage by 30%.[53] It is estimated that in the County of Los Angeles that about 12% of commercial waste and 10% of residential waste is plastic, according to CalRecycle's waste characterization tool.[54] Of that, approximately 3% is "Remainder/Composite" plastic that cannot be recycled, including Styrofoam. Depending on the food serviceware ban enacted by the City of South Pasadena, a waste reduction between 1% and 2.5% could be expected conservatively. An additional 2.1% could be expected from the reduction in single-use hotel bottles (30% reduction from 12% commercial plastic waste landfilled). Therefore, it is conservatively estimated that through ordinances targeting single-use plastic items would reduce landfilled waste by approximately 5%.

[46] https://www2.calrecycle.ca.gov/WasteCharacterization/ResidentialStreams%3fcy%3d19%26lg%3d443

[47] http://www2.oaklandnet.com/Government/o/PWA/o/FE/s/GAR/OAK024416

[48] https://www.waste360.com/legislation-regulation/berkeley-calif-disposable-foodware-ordinance-clamps-down-plastics

[49] https://www.ci.richmond.ca.us/1824/Food-Ware-Ordinance

[50] https://www.cityofpaloalto.org/gov/depts/pwd/zerowaste/projects/foodware.asp

[51] https://leginfo.legislature.ca.gov/faces/billCompareClient.xhtml?bill_id=201920200AB1162

[52] https://www.cityofpaloalto.org/civicax/filebank/blobdload.aspx?t=53734.77&BlobID=71714

[53] https://news.marriott.com/2019/08/marriott-international-to-eliminate-single-use-shower-toiletry-bottles-from-properties-worldwide-expanding-successful-2018-initiative/

[54] https://www2.calrecycle.ca.gov/WasteCharacterization/

The 2019 CALGreen Building code requires that 65% of C&D waste be recycled or used, diverting it from being landfilled.[55] It is estimated that in the County of Los Angeles about 10% of commercial waste and 12% of residential waste is from C&D materials, according to CalRecycle's Waste Characterization Tool. The adoption of 2019 CALGreen building code standards and an ordinance requiring compliance, the City of South Pasadena can expect an approximate 4% reduction in total waste that is landfilled.

The reduction in plastic and C&D waste through the ordinances, policies, and actions of the City were conservatively estimated to reduce landfilled waste by 9% in 2030 in addition to the 75% reduction from SB 1383. The reduced amount was multiplied by a weighted average of the USEPA's emission factors from the WARM v15 model taking into account the change in waste stream characterization with the implementation of SB 1383. After the implementation of SB 1383, the waste stream would be made up of approximately 10% organics and 90% mixed municipal solid waste (MSW) such that the emission factor would be 0.35 MT CO_2e per short ton of waste landfilled. It was conservatively assumed that the reduction in waste to landfill would be doubled to 18% by 2045 with continued efforts by the City and implementation of the Zero Waste Plan. To reach zero waste by 2045, policies and current efforts by the City may need to be more aggressive. The calculations and assumptions used to estimate emission reductions from Play *S*W.2 are provided in Table 26.

Table 26 Play SW.2 GHG Emission Reduction Calculations

Calculation Factor	2030	2045
Reduction in Landfilled Waste post SW.1[1]	9%	18%
Forecasted Waste Generation after SW. 1 (tons)[2]	13,244	13,720
Diverted Landfilled Waste (tons)[3]	1,192	2,470
Waste Emission Factor (MT CO_2e/ton)[4]	0.3480	0.3480
Total Play SW.2 GHG Emissions Reductions (MT CO_2e)	**414.8**	**859.4**

Notes: MT CO_2e = metric tons of carbon dioxide; kWh =-kilowatt-hour

1. Although the targets of this measure are for a 50% reduction in landfilled waste by 2030 and 100% by 2045, the measure proposed City-wide ordinances and 2019 Cal Green Code relied upon to achieve the measure will not meet those targets. The percent reduction used to calculate GHG reductions is based on substantial evidence as described in the preceding section.

2. Forecasted waste generation is estimated as the forecasted service population multiplied by the per capita waste generation factor obtained from the 2016 inventory (0.5208 tons/service population). To avoid double counting of emission reductions, the additional reduction in landfilled waste is based on the remaining waste after implementation of SW.1.

3. Diverted landfilled waste is based on forecasted waste generation post implementation of SW.1 multiplied by the estimated reduction.

4. The emission factor is the weighted average of the U.S. EPA's WARM model Version 15 emission factors for organics - food waste & yard trimmings (0.32 MT CO_2e/ton), mixed organics - includes textiles (0.21 MT CO_2e/ton), and mixed MSW (0.36 MT CO_2e/ton), where the waste stream post implementation of SW.1 is 15% organics – food waste & yard trimmings, 4% mixed organics – including textiles, and 81% mixed MSW.

*Values may not add up due to rounding

Results

The Moves associated with Play SW.2 would result in a reduction of 415 MT CO_2e in 2030 and 859 MT CO_2e in 2045, as shown in Table 27.

[55] https://www.contracosta.ca.gov/DocumentCenter/View/44118/CalGreen-Project-Recycling-Requirements-as-Amended-eff-1-1-2020?bidId=

Table 27 GHG Emission Reductions Associated with Play SW.2

Moves	Emission Reductions (MT CO_2e) 2030	2045	Source
SW.2.a Develop and implement a Zero Waste Plan, consistent with the General Plan, in order to reach South Pasadena's goal of zero waste by 2040.			
SW.2.b Provide ongoing education to residents, business owners, and South Pasadena School District regarding waste reduction, composting, and recycling.			CalRecycle Waste Stream Characterization (https://www2.calrecycle.ca.gov/WasteCharacterization/)
SW.2.c Increase reuse, recycling, and composting at temporary public events by mandating the installation of public recycling and composting containers and collection service; and encouraging reusable food ware, when relevant, according to the California State Retail Food Code.			
SW.2.d Develop a waste department or working group to enhance recycling and composting outreach and provide technical assistance or information in support of City Green Action Plan Move III. Additionally, implement and share a Recycle and Reuse Directory through City platforms, in support of Green Action Plan Move I.2.5.			EPA. Waste Reduction Model (WARM) Version 15. May 2019. (https://www.epa.gov/warm/documentation-chapters-greenhouse-gas-emission-energy-and-economic-factors-used-waste-reduction)
SW.2.e Adopt an ordinance requiring compliance with Sections 4.410.2, 5.410.1, 4.408.1, and 5.408.1 of the California Green Building Standards Code related to construction of buildings with adequate space for recycling containers and construction and demolition (C&D) recycling.	415	859	
SW.2.f Implement the City General Plan, requiring construction sites to separate waste for proper diversion and reuse or recycling.			
SW.2.g Develop and implement a Waste Stream Education Program targeting property managers of multi-family residences and the commercial sector, in support of Goal III of the City Green Action Plan.			
SW.2.h Develop policies to mandate/encourage reduction of waste and reuse in the food industry (e.g. facilities serving prepared food and prepackaged food; home meal delivery services), hospitality industry, and other commercial industries. Efforts may include developing ordinances for food service ware and a ban on single-use individual toiletry bottles in hotels/motels, grant/discount programs for switching to reusables, fast food champion pilot project, and working with home meal delivery services (e.g., Blue Apron), etc. to explore opportunities to reduce single-use packaging and encourage reuse.			2019 CALGreen Building Code AB-1162 Section 1. Chapter 6.1
SW.2.i Encourage reusable foodware; or if reusable foodware is not a feasible option, explore opportunities to mandate/encourage a switch to more environmentally friendly alternatives for various products in the commercial industry, when relevant.			

2.6 Carbon Sequestration Sector

Play CS.1 Increase carbon sequestration through increased tree planting and green space.

Background

The City of South Pasadena is considered a built-out city where a majority of new development or growth will involve the redevelopment of underutilized parcels or renovation of existing structures.

However, about 4% of the existing land use in the City of South Pasadena is devoted to parks and open space that are considered "urban green-space" within California's Natural and Working Lands Sector. There are approximately 36.6 acres devoted to parks and 44 acres of open space that includes natural open space, recreational trails and linkages, utility easements, and flood control channels.[56] Although built-out, the City has the opportunity to engage in carbon sequestration activities through enhancing open space, urban greening, and protecting and increasing the City's urban forest or tree stock. At this time only the carbon benefits of urban forestry can be assessed as additional research is needed to assess the benefits of vegetation and soil management.

Methodology and Assumptions

The current urban forest stock consists of approximately 11,000 trees.[57] A rough estimate of total amount of greenhouse gases that are captured in the urban forest is 389.4 MT CO_2e. This amount is in the City's current stock and cannot be counted as a GHG reduction measures. The goal is to maintain the amount and health of the current tree stock and then add trees to increase the carbon storage capacity of the urban forest. Assuming that the urban forest is not 100% stocked, which is typical even of communities that have well-managed forests such as South Pasadena, there is likely the ability to increase the size of the urban forest by 15% - 25%.[58,59] It was conservatively assumed that the City of South Pasadena has the capacity to increase the City's tree inventory by 5% in 2030 and 10% in 2045, or by 550 trees in 2030 and 1,100 trees in 2045. Annual CO_2e emissions reductions were estimated based on the number of trees to be added to the inventory and the average CO_2e accumulation factor per tree (0.0354 MT CO_2e/tree/year).[60] The calculations and assumptions used to estimate emission reductions from Play CS.1 are provided in Table 28.

Although not quantified herein, urban greening can further reduce building carbon emissions by reducing the heat island effect in cities.[61] Additionally, the application of suitable composted organic material to existing opens spaces can be used to enhance the sequestration of CO_2e. The application of compost allows for carbon to be stored in the soil and, over time, to be captured in the stems, leaves, and roots of grasses, woody plants, and trees.

[56] City of South Pasadena General Plan, Chapter 2: Land use (https://www.southpasadenaca.gov/government/departments/planning-and-building/general-plan)

[57] https://www.southpasadenaca.gov/government/departments/public-works/parks-division

[58] https://www.americanforests.org/blog/no-longer-recommend-40-percent-urban-tree-canopy-goal/

[59] https://sfgov.org/sfplanningarchive/urban-forest-plan

[60] CAPCOA Quantifying Greenhouse Gas Mitigation Measures

[61] The Trust for Public Land (TPL). Quantifying the greenhouse gas benefits of urban parks. August 2008.

Table 28 Play CS.1 GHG Emission Reduction Calculations

Calculation Factor	2030	2045
Target Increase in Tree Inventory	5%	10%
Newly Planted Trees[1]	550	1,100
Tree Sequestration Factor (MT CO_2e/tree/year)[2]	0.0354	0.0354
Total Play CS.1 GHG Emissions Reductions (MT CO_2e/year)	**19.5**	**38.9**

Notes: MT CO_2e = metric tons of carbon dioxide; kWh =-kilowatt-hour

1. The number of trees to be planted are based on the target increase in tree inventory multiplied by the existing tree inventory of about 11,000.

2. Default annual CO_2e sequestration per tree per year with a maximum lifespan of 20 years per tree is 0.0354 MT CO_2e/tree/year was obtained from CAPCOA. 2010. Quantifying Greenhouse Gas Mitigation Measures.

*Values may not add up due to rounding

Results

There is no single Move under Play CS.1 that will reduce GHG emission on its own. Instead, all of the Moves are collectively supportive towards increasing carbon sequestration. The Moves associated with Play CS.1 would result in a reduction of 19 MT CO_2e in 2030 and 39 MT CO_2e in 2045, as shown in Table 29.

Table 29 GHG Emission Reductions Associated with Play CS.1

	Emission Reductions (MT CO_2e)		
Moves	**2030**	**2045**	**Source**
CS.1.a Identify and map public spaces that can be converted to green space, including public parking that can be converted to parklets, freeway airspace that can be made into green space, vertical walls that can be planted with vines, and rooftops of public buildings that can be developed into gardens.	19	39	CAPCOA. Quantifying Greenhouse Gas Mitigation Measures. August 2010
CS.1.b Adopt a Greenscaping Ordinance that has a street tree requirement for all zoning districts, has a shade tree requirement for new development, requires greening of parking lots, and increases permeable surfaces in new development.			City of South Pasadena. Public Works Department – Urban Forestry
CS.1.c Prepare and adopt an Urban Forest Management Plan for the City that includes an inventory of existing trees, identifies future tree planting opportunities, and a climate-ready tree palette, as well as ongoing operations and maintenance needs.			The Trust for Public Land (TPL). Quantifying the greenhouse gas benefits of urban parks. August 2008.
CS.1.d Adopt a standard policy and set of practices for expanding urban tree canopy and placing vegetative barriers between busy roadways and developments to reduce exposure to air pollutants from traffic.			

2.7 Municipal Operations Sector

Play M.1 Reduce Carbon Intensity of Operations

Background

In the baseline year of 2016, City of South Pasadena operations generated approximately 2,755 MT CO_2e. Nearly 60% of these emissions were a result of natural gas and electricity consumption. Under

Play M.1, South Pasadena will implement the recommendations of the 2016 *Renewable Energy Council Report*, which includes increasing the energy efficiency of City operations and reducing the reliance on fossil natural gas (Moves M.1.a through M.1.d). The Moves under Play M.1 also include development of a sustainable buildings Request for Proposals (RFP) policy (Move M.1.e) and creating a new revolving green fund, funded by the energy cost savings from efficiency projects (Move.1.f).

Methodology and Assumptions

Implementation of Moves M.1.a, M.1.c, M.1.d and M.1.e under Play M.1 will reduce the grid electricity and natural gas consumption of City facilities, with GHG reductions being attained from switching natural gas fueled equipment to electric. The installation of solar PV and increased efficiency at City facilities would not result in GHG emission reductions as energy purchased by the City is already 100% renewable under the "100% Green Power" option for the CPA.[62] Additional GHG reductions would be attained for Move M.1.b, with the use of renewable natural gas (RNG) in City fleet vehicles that currently are fueled by natural gas. Emissions reductions associated with conversion of fleet vehicles to EV are captured under Play M.2.

In 2016, the City of South Pasadena buildings and operations consumed 20,512 therms of pipeline natural gas, generating 109 MT CO_2e. With currently available technology, it is possible to electrify nearly 100% of commercial and residential buildings.[63] Considering the City of South Pasadena's operations are similar to that of the commercial sector, with facilities and offices that need to be heated and cooled, public works operations garages, as well as operation and maintenance yards, it is assumed that 100% of South Pasadena's operations can be similarly electrified. Under full implementation of Moves M.1.a and M.1.d by 2030, South Pasadena will have electrified its operations, eliminating the need for pipeline natural gas. This would result in an emissions reduction of 109 MT CO_2e by 2030 continuing through 2045. The increased electricity consumption needed to offset these energy needs would not generate additional GHG emissions as the City of South Pasadena purchases 100% renewable electricity for its municipal accounts. GHG emission reduction calculations for Move M.1.a are provided in Table 30.

[62] In an email from Arpy Kasparian on June 5th, 2020, it was indicated that the City of South Pasadena had upgraded all of its municipal accounts to the "100% Green Power" option of the Clean Power Alliance in March of 2020, meaning the City would receive 100% GHG emission free electricity for all of its accounts. The GHG emission reductions for this are accounted for under Play E.1.

[63] Deason, Jeff. et al.. 2018. Electrification of buildings and Industry in the United States. pp. 16. https://pdfs.semanticscholar.org/27f0/d125d5316ee10565560545c0fc17d6c447a8.pdf?_ga=2.3238896.1101123906.1590438648-1004765093.1590438648

Table 30 Move M.1.a GHG Emission Reduction Calculations

Calculation Factor	2030	2045
Baseline Municipal Natural Gas Consumption (therms)[1]	20,512	20,512
Baseline Municipal Natural Gas GHG Emissions (MT CO_2e)[1]	109	109
Additional GHG Emissions from Increased Electricity Consumption (MT CO_2e)[2]	0	0
Move M.1.a GHG Emissions Reductions from Fuel Switching (MT CO_2e)	**109**	**109**

Notes: MT CO_2e = metric tons of carbon dioxide

1. Baseline Municipal Natural Gas Consumption and Baseline Municipal Natural Gas GHG Emissions are obtained from the 2016 Municipal GHG Emission Inventory, provided in Appendix C.

2. Energy consumed in equipment and appliances by natural gas equipment would be replaced by electric powered equipment. The energy consumption that would be needed to fuel the replacement electric equipment would generate no additional GHG because the City of South Pasadena obtains carbon free electricity through the "100% Green Power" option through the Clean Power Alliance.

In 2016, South Pasadena had three operational natural gas fueled fleet vehicles, that consumed 13,395 therms of natural gas, generating 79 MT CO_2e. With full implementation of Move M.1.b by 2030, these vehicles would be transitioned to either RNG or electric, resulting in a 79 MT CO_2e emissions reduction. Combustion of replacement RNG is considered to be biogenic, and therefore would not generate CO_2 emissions; however, there would be CH_4 and N_2O emissions associated with this combustion that would offset emissions reductions by less than 1 MT CO_2e.[64,65] Any replacement of natural gas fueled vehicles with electric would also generate no additional emissions, as the City of South Pasadena purchases 100% renewable electricity for municipal accounts. GHG emission reduction calculations for Move M.1.b are provided in Table 31.

Table 31 Move M.1.b GHG Emission Reduction Calculations

Calculation Factor	2030	2045
Baseline Municipal Fleet CNG Consumption (therms)[1]	13,395	13,395
Baseline Municipal Natural Gas GHG Emissions (MT CO_2e)[1]	79	79
Additional GHG Emissions from RNG Combustion - CH_4 and N_2O (MT CO_2e)[2]	<1	<1
Move M.1.b GHG Emissions Reductions from Purchasing RNG for Fleet Vehicles (MT CO_2e)	**79**	**79**

Notes: MT CO_2e = metric tons of carbon dioxide; CNG = compressed natural gas; RNG = renewable natural gas; CH_4 = methane; N_2O = nitrous oxide

1. Baseline Municipal Fleet CNG Consumption and Baseline Municipal Fleet CNG GHG Emissions are obtained from the 2016 Municipal GHG Emission Inventory, provided in Appendix C.

2. CH_4 and N_2O emission factors for gaseous biomass fuels are 3.2 and 0.63 grams per mmBtu, respectively. By converting mmBtu to therm (10 therm = 1 mmBtu), these emission factors become 0.32 g CH_4 per them and 0.063 g N_2O per therm. Multiplying by 13,395 therms and using the appropriate Global Warming Potentials (1 g CH_4 = 28 g CO_2e equivalent and 1 g N_2O = 265 g CO_2e), this equates to an additional 0.3 MT CO_2e. https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Results

Move M.1.a associated with Play M.1 would result in a reduction of 109 MT CO_2e in 2030, which would be consistent through 2045. Additional reductions of 79 MT CO_2e in 2030, which would be consistent through 2045 would be achieved with the implementation of Move M.1.b. As provided in

[64] CARB. 2018. LCFS Basics. slide 21. https://ww2.arb.ca.gov/sites/default/files/2020-05/basics-notes.pdf. Accessed May 25th, 2020.

[65] CH_4 and N_2O emission factors for gaseous biomass fuels are 3.2 and 0.63 grams per mmBtu, respectively. By converting mmBtu to therm (10 therm = 1 mmBtu), these emission factors become 0.32 g CH_4 per them and 0.063 g N_2O per therm. Multiplying by 13,395 therms and using the appropriate Global Warming Potentials (1 g CH_4 = 28 g CO_2e equivalent and 1 g N_2O = 265 g CO_2e), this equates to an additional 0.3 MT of CO_2e. https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Table 32, total GHG emission reductions of 188 MT CO_2e in 2030, through 2045 would be achieved through full implementation of Play M.1

Table 32 GHG Emission Reductions Associated with Play M.1

Play	Emission Reductions (MT CO_2e) 2030	2045	Source
M.1.a As recommended in the 2016 Renewable Energy Council Report, complete energy audits for all City facilities and implement all feasible recommendations for fuel switching and efficiency upgrades.	109		Deason, Jeff. et al.. 2018. Electrification of buildings and Industry in the United States
M.1.b As recommended in the 2016 Renewable Energy Council Report, purchase renewable natural gas (RNG) for applicable City fleet vehicles.	79		USEPA. 2018. Emission Factors for GHG Inventories CARB. 2018. LCFS Basics
M.1.c As recommended in the 2016 Renewable Energy Council Report, install PV solar systems at the City Hall and at Wilson Reservoir.	Supportive		N/A
M.1.d Adopt retrofitting policy for City owned buildings such that energy efficient and electrification retrofits are incorporated into City buildings as they become available.	Supportive		N/A
M.1.e Develop a policy for the City which would require all new building RFP's to include life cycle costing over 30 years and tie this directly to energy consumption and building electrification. This would include the buildings operational and maintenance costs and ensure that the City has the most cost effective (and sustainable) building possible.	Supportive		N/A
M.1.f As recommended in the 2016 Renewable Energy Council Report, invest all savings from City energy efficiency projects into a new revolving green fund that can be used to fund additional energy efficiency and GHG reduction projects.	Supportive		N/A

Play M.2 Electrify the municipal vehicle fleet and mobile equipment.

Background

Municipal transportation emissions for the City of South Pasadena come from two distinct sources, City-owned vehicles and equipment and employee commutes. In order to reduce these emission sources, the City will implement policies for purchasing electric vehicles where possible and utilize a lifecycle assessment for other vehicles and equipment (Moves M.2.c and M.2.d). The City will also incentivize employees to reduce the amount single occupancy vehicles (SOVs) and encourage them to adopt EVs, through transportation demand management tools (Move M.2.a), providing bicycles at City facilities for short trips (Move M.2.b), and installing EV charging stations at municipal buildings (Move M.2.e).

Methodology and Assumptions

Electrification of South Pasadena's vehicle fleet will consist of the future replacement of gasoline- and diesel-powered light-duty passenger vehicles and light-duty trucks with vehicles having electric drivetrains. South Pasadena has a baseline vehicle fleet consisting of 32 vehicles including heavy-duty trucks, light-duty trucks, and passenger vehicles. Full electric options for heavy-duty trucks are

currently limited; therefore, electrification of the vehicle fleet assumes that these trucks will remain on some type of fuel combustion through 2030, and only light-duty trucks and passenger vehicles will be converted to electric.

The GHG emission reductions from electrification of South Pasadena's vehicle fleet through implementation of Move M.2.d would reduce the emissions of the three light-duty passenger cars and eight light duty trucks in the baseline fleet to zero by 2030, through 2045. It is likely that these vehicles will have reached their end of life and be replaced by 2030, as the typical lifespan of modern vehicles is 15.6 years, and these vehicles were manufactured prior to 2014.[66] Collectively, these vehicles generated 24 MT CO_2e in the baseline inventory year; therefore, replacing them with electric vehicles will result in an equivalent emissions reduction. Any replacement vehicles with electric would also generate no additional emissions, as the City of South Pasadena purchases 100% renewable electricity. The technologies that would replace heavy-duty vehicles is uncertain; therefore, emission reductions are not calculated for the remaining vehicles in the fleet. GHG emission reduction calculations for Move M.2.d are provided in Table 33.

Table 33 Move M.2.d GHG Emission Reduction Calculations

Calculation Factor	2030	2045
Baseline Municipal Fleet Passenger and Light Duty Fuel Consumption (Gallons)[1]	2,209	2,209
Unleaded Gasoline Combustion Emission Factor (MT CO_2e/Gallon)[2]	0.0103	0.0103
Baseline GHG Emissions Fleet Passenger and Light Duty Vehicles (MT CO_2e)	23	23
Additional GHG Emissions from Increased Electricity Consumption (MT CO_2e)[3]	0	0
Move M.2.d GHG Emissions Reductions from Electrification of Fleet Vehicles (MT CO_2e)	**24**	**24**

Notes: MT CO_2e = metric tons of carbon dioxide

1. Baseline Municipal Fleet Passenger and Light Duty Vehicle Fuel Consumption was provided by the City of South Pasadena on September 11, 2019.

2. Unleaded Gasoline Combustion Emission Factor obtained from EPA Emission Factors for Greenhouse Gas Inventories, updated 3/9/2018. CO_2 emission factors from Table 2 and CH_4 and N_2O emission factors from Table 5. Emission factors were converted to CO_2e using the respective Global Warming Potentials (1 g CH_4 = 28 g CO_2e equivalent and 1 g N_2O = 265 g CO_2e) https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

3. The energy consumption that would be needed to fuel the replacement electric vehicles would generate no additional GHG because the City of South Pasadena obtains carbon free electricity through the "100% Green Power" option through the Clean Power Alliance.

GHG reductions from implementation of transportation demand management (TDM) measures to reduce commute by single occupancy vehicles for municipal employees are not quantified due to the uncertainty of voluntary actions associated with Move M.2.a. Although it is likely that measure to promote telecommuting and vanpooling will be adopted by some commuters, there is a large range of commute distances for City employee's and it is unclear how these will affect the commute patterns of individuals.[67] Therefore, even though there will likely be GHG emissions reductions associated with the program, the uncertainty of individual actions does not warrant an accurate analysis of expected reductions.

[66] Bento, Antonio, et. al.. 2016. Vehicle Lifetime Trends and Scrappage Behavior in the U.S. Used Car Market. https://faculty.sites.uci.edu/kevinroth/files/2011/03/Scrappage_18Jan2016.pdf

[67] Southern California Association of Governments (SCAG). Transportation Demand Management Strategic Plan and Final Report. http://www.scag.ca.gov/Documents/TDMStrategicPlanFinalReportwAppendicesweb.pdf.

Results

Move M.2.d associated with Play M.2 would result in a reduction of 23 MT CO_2e in 2030, which would be consistent through 2045, as shown in Table 34. The additional Moves under this Play are considered supportive towards effectively implementing Move M.2.d and reaching the overall goal of Play M.2.

Table 34 GHG Emission Reductions Associated with Play M.2

Play	Emission Reductions (MT CO_2e) 2030	2045	Source
M.2.a Develop a suite of transportation demand management tools to incentivize alternative transportation methods for employees, including telecommute options.	Not Quantified		N/A
M.2.b Provide bicycles and bicycle storage for employees to use during work hours for short business or personal trips.	Supportive		N/A
M.2.c Develop and adopt a policy to apply lifecycle assessment to all new vehicle and equipment purchases.	Supportive		N/A
M.2.d Implement the City Fleet Alternative Fuel Conversion Policy developed under the City General Plan, electrifying the City vehicle fleet and using it to encourage residents to convert as well.	23		Bento, Antonio, et. al.. 2016. Vehicle Lifetime Trends and Scrappage Behavior in the U.S. Used Car Market.
M.2.e Install EV charging stations at municipal buildings.	Supportive		N/A

Play M.3 Increase the City's renewable energy production and energy resilience.

Background

Similar to Play E.4, the City of South Pasadena will take action to improve the resilience and energy independence of operations. The City will:

- Conduct a feasibility study to determine which City buildings would be ideal resilience centers with solar and battery installations (Move M.3.a)
- Convert all streetlights to LED bulbs (Move M.3.b)
- Work with utility providers to develop grid connected local solar projects (Move M.3.c)
- Install solar arrays at all municipal buildings, working with emergency services to add solar and battery storage at priority locations (Move M.3.d)
- Review options for microgrid systems in existing municipal buildings (Move M.3.d)

While these measures will reduce the City's reliance on grid supplied electricity, they will not achieve GHG reductions, as the City of South Pasadena already purchases 100% renewable electricity for all municipal accounts. The Moves associated with Play M.3 are provided in Table 35.

Table 35 GHG Emission Reductions Associated with Play M.3

Play	Emission Reductions (MT CO_2e) 2030	2045	Source
M.3.a Conduct a Feasibility Study to determine which City buildings would serve as ideal resilience centers including solar and battery installations.	Supportive		N/A
M.3.b Convert all streetlights to light emitting diode (LED) bulbs.	Supportive		N/A
M.3.c Work with SCE to identify and develop local solar projects to connect to the grid.	Supportive		N/A
M.3.d Install solar arrays at facilities that currently do not have solar arrays and work with emergency services to add solar and battery storage at priority locations. Review options for potential to combine multiple buildings into micro-grid systems.	Supportive		N/A
M.3.e Explore opportunities and partnerships to develop renewable-powered fuel cell micro-grids to provide back-up or primary power for critical facilities such as hospitals and schools as a clean alternative to diesel generators	Supportive		N/A

3 Conclusion

The Plays and Moves identified in this CAP will lead to a significant reduction in GHG emissions and provide a foundation for achieving net carbon neutrality. However, achieving carbon neutrality will require significant additional changes to the technology and systems currently in place that will require further policies and programs that build on this plan including full electrification of building and transportation systems, an increased shift to shared and active mobility, and increased waste reduction and diversion. The Moves and Plays developed to meet the 2030 goals established in SB 32 provide the foundation and establishes the trajectory for this long-term transformation. However, the 2045 GHG emissions reductions quantified in this CAP are not yet enough to meet the long term 2045 goal of carbon neutrality. As the current Moves and Plays are implemented, the City will gain more information, new technologies will emerge, and current pilot projects and programs are anticipated to scale to the size needed to reach carbon neutrality. Furthermore, the state is expected to continue providing updated regulations and support once the 2030 target is achieved. Future CAP updates will outline new measures needed to reach the ultimate goal of carbon neutrality.

Appendix E:
Funding Strategy

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Funding Strategy

Full implementation of the Climate Action Plan (CAP) will require investments on the part of the City of South Pasadena, local households and businesses, and property owners. In many cases, the expenditures will not only help to reduce greenhouse gas (GHG) emissions, but will also bring other valuable co-benefits such as cleaner air, water conservation, off-setting savings on energy and utility expenditures, more robust and flexible transportation systems, improved public health, and enhanced local quality of life.

Some expenditures will not represent net-cost increases, but instead will involve substituting investments on climate-friendly equipment, materials, and technologies for expenditures that would otherwise have been made on less climate-friendly options. For example, residents and businesses are encouraged to make investments in water and energy conservation improvements; the initial expenditure on the improvements will be offset by long-term savings from reduced water or energy usage. Further, the City and local partners such as Southern California Edison (SCE), Southern California Gas (SoCalGas), and/or water providers can help households and businesses make these transitions by promoting available low-cost financing programs.

In some cases, expenditures may represent net-cost increases compared to a "status quo" approach to climate change. As such, these costs represent an accounting for the costs to address the negative externalities[1] associated with current practices that are now recognized as not sustainable.

Below are general descriptions of principles that will guide the City's approach to funding the CAP and descriptions of key funding sources that the City may use. A more detailed matching of specific CAP actions with potential funding sources and tools is included in the Climate Action Plan and Table 1 below (The Funding Matrix).

Funding Strategy Principles

The CAP will be implemented over time. Funding sources for some actions can be identified at the outset, while the best means to fund other actions will be determined at the time the City is ready to implement them, depending on the resources available at the time. Several principles will help the City to determine the best approach to funding various actions, as follows:

Equity

The costs of implementing the CAP should be spread as equitably as possible, taking care to limit the imposition of new costs on the segments of the community that have the least ability to shoulder increased costs. Where certain segments of the community will benefit disproportionately from an action, the costs should be spread accordingly. Where possible, funding options and resources have been included which target assistance to low- and moderate-income households.

1 "A negative externality is a cost that is suffered by a third party as a result of an economic transaction. In a transaction, the producer and consumer are the first and second parties, and third parties include any individual, organization, property owner, or resource that is indirectly affected." Accessed August 12, 2020 at: https://www.economicsonline.co.uk/Market_failures/Externalities.html

Cost-Effectiveness

The CAP prioritizes cost-effective Plays and Moves which can generate cost savings that will offset the costs to those who are required to pay for implementation. While some Plays and Moves may require some initial capital outlay, whenever possible these actions should generate long-term cost savings that will repay and even generate a return on investment (ROI). The City will prioritize the use of available local resources to implement those Moves that have the highest GHG reduction potential.

Leveraging Local Resources

Leveraging local resources will involve using outside sources of funding to augment local resources to fund implementation of the CAP. The City will leverage General Fund resources and in-kind staff time to aggressively seek grants, matching funds, in-kind contributions, and other resources from state, federal, and philanthropic sources to help pay for actions and limit the cost to the City, residents, and local businesses. The CAP also includes actions through which City staff will monitor and publicize grants and incentives that will help households and businesses make the necessary climate-friendly investments.

Types of Funding Sources

The CAP will rely on a variety of funding sources for implementation. Below are general descriptions of some key funding sources identified that can be used to pay for climate-friendly actions:

Grants

From time to time, the City is able to secure funds for specific projects through grant programs provided by state and federal agencies. This includes various grant programs funded through the State of California's Cap and Trade program, which generates money for the State's Greenhouse Gas Reduction Fund, some of which is granted to local governments. State and federal grants may be a useful source of funding to pay for the portion of mitigation programs or actions that is attributable to the City's existing residential and non-residential development, which cannot be funded through impact fees collected on new development. State and federal grants can also be used to fund climate-friendly actions and programs that have broad community benefits, or to help defray costs that might otherwise have been too burdensome for lower-income households or small businesses. Additionally, utility companies may also provide grants within their service areas through various programs designed to incentivize energy conservation.

Pros and Cons

Grants are beneficial because they represent an opportunity to reduce the cost burden for implementation programs and projects on the City itself and the burden on local residents and businesses. Grants are one funding source that the City can use to pay existing development's share of project costs when the costs must be split between new development and existing development.

The primary disadvantages of grants are that the availability of funds is not certain due to competition for limited funds, timing of funding availability may not match with necessary implementation timelines, and grants are not always available for the types of projects which need funding. Exceptions to this include the Transportation Development Act (TDA) Article 3 Bicycle and Pedestrian Funds from Metro and upcoming Senate Bill (SB) 2 allocations from the state that are allocated to cities in a formulaic manner. The City will need to prioritize the funds for CAP implementation projects from these sources along with other eligible uses that may be of community interest.

General City Funds

The City's General Fund receives the revenues over which the City Council exercises discretionary funding authority. The General Fund receives major funding sources including sales tax revenues, property tax revenues, property tax in-lieu of vehicle license fees, and many other smaller revenue streams. The City Council spends these monies on public services that broadly benefit the community at large. While balancing all of its budgetary needs, the City Council may elect to spend some General Fund money on CAP implementation, such as providing staff support for climate-friendly programs or actions.

The CAP contains numerous Moves that are likely to be implemented through in-kind City staff efforts; however, it is not likely that existing City staff will have adequate capacity to take on all the responsibilities of CAP implementation that are identified as "Staff in-kind." To leverage the available staff resources, the City will seek to partner with other agencies and/or contract out certain services (e.g. using consultants for specialized studies), when that is more cost-effective. One such potential opportunity that is not tied to any single CAP Move is to apply to host a Civic Spark fellow who could work under the direction of the City's Sustainability Staff to help with CAP implementation activities. Civic Spark Fellows are provided through an AmeriCorps program that places fellows with local governments and other entities that are engaged in sustainability projects. The Civic Spark program covers most of the cost to host a Fellow so the City's General Fund can leverage this opportunity to acquire more staff than the City could otherwise afford to support.

Pros and Cons

A benefit of using General Fund monies to fund climate-friendly actions is that the City Council already has authority to allocate General Fund monies to implement climate-friendly actions. Therefore, reallocation of General Fund dollars to such actions is not restricted by governmental approval or outside agencies. However, it must also be recognized that the General Fund supports many other critical public services, such as law enforcement and fire protection, as well as parks and roadway maintenance. The City likely has little ability to allocate General Fund monies to new programs without impacting existing programs. The COVID-19 pandemic has significantly reduced the General Fund through decreases in revenue sources such as sales tax, property tax, and increases in health-related expenses. These reductions to the City's General funds will make it more difficult to directly fund implementation of some CAP Plays and Moves.

Restricted Funds

Restricted funds are monies that the City receives, but which can only be used for specified purposes. This is often the case with funds that are passed through to the City from other governmental entities, such as state or federal agencies. Relevant examples of such restricted funds include money allocated to the City from regional funding sources such as: transportation development funds received from the Local Return Program which is administered by Los Angeles Metro from Los Angeles County sales tax Measures A, C, R, and M; the local subvention funds that the City receives from the Southern California Air Quality Management District (SCAQMD)[2] and from Assembly Bill (AB) 2766[3] vehicle license fees for air quality improvement projects; and the TDA Article 3 funds which are distributed by Metro.[4] For these revenue examples, the City receives

2 https://www.metro.net/projects/local_return_pgm/

3 http://www.aqmd.gov/docs/default-source/transportation/ab2766-motor-vehicle-subvention-fund-program/ab2766-resource-guide.pdf?sfvrsn=8

4 https://www.metro.net/projects/tda/

annual allocations of funds on a per-capita basis and the City can use those funds consistent with the relevant program guidelines, which include many purposes that align with the overall CAP goals as well as the objectives of specific transportation-related Moves.

Pros and Cons

A benefit of the Local Return Program and Local Subvention funds is that they are existing funding sources which will continue to accrue annually at fairly predictable levels. Given the alignment of these two programs' goals with the goals of the CAP, many of the Moves included in the CAP could be eligible for the use of these monies. The challenge with using these funds is that they are typically fully allocated and directing funds towards CAP projects will require prioritizing CAP projects over other potentially worthy uses of the funds.

Fees for Service/User Fees

The City operates some services on a cost recovery basis. The City collects funds in the form of user fees to provide specific services to various user groups and the fees charged are designed to offset the cost of the services provided. An example of user fees that support services provided to a specific segment of the community includes building permit fees, which are charged to cover the cost of reviewing plans and conducting inspections to verify that buildings are constructed properly. To the extent that these types of services incorporate climate-friendly actions, the costs of these actions can be recovered through user fees. User fees and ratepayer charges can also be applicable to utilities such as SCE, SoCalGas, water providers, and other businesses that provide goods and services that come under the auspices of the CAP.

Pros and Cons

Implementation projects and actions that are funded via fees for service, user fees, or ratepayer charges are similar to actions that are funded directly via household or business income, in that they uphold the "user pays" principle. They are also similar in that a disadvantage is that they could disproportionately burden lower income households or small and disadvantaged businesses that have more limited resources. The City will want to be particularly careful where users of affected services have limited ability to change their behavior to limit their exposure to increased costs. For example, some utility incentive programs can be structured to provide relatively low rates for "baseline" consumption then charging higher rates for consumption above established baseline levels to incentivize the minimization of consumption.

Financing Tools

Financing tools are not funding sources per se; however, while many climate-friendly actions may generate long-term cost savings, they may also require significant up-front expenditures which could be a challenge for the City, households, or businesses to finance. There are various financing tools that can be used to essentially borrow the funds needed "up front" for CAP implementation, to be paid back over time using one or more funding sources that will generate money over time. Examples of such tools include home mortgages and equity lines, Property Assessed Clean Energy (PACE) programs, on-bill financing programs sponsored by utilities, various state or federal financing programs, "green bond" programs used in places such as San Francisco, and private financing innovations such as the Metered Energy Efficiency Transaction Structure (MEETS) pioneered in Seattle. Another option to be considered for municipal expenditures is "interfund borrowing" whereby the City could self-finance certain improvements by using money from idle fund balances, and then repay those funds over time with other revenue streams. In particular, the City should consider using financing mechanisms to pay for up-front costs of large capital projects that will yield

long-term annual budget savings that can offset the annual debt service from the financings. In this way, the City can benefit from long-term costs savings of investments such as solar power generation facilities on City property and water and energy conservation improvements. The City should consider the possibility of undertaking a "green bond" issuance to finance a package of such investments, to be repaid using annual budget expenditures that otherwise would have been spent in the absence of the cost savings created by the investments. Additionally, if the City identifies the use of Los Angeles County Measure A, C, R, and M funds (Local Return Program) to help pay for transportation-related CAP projects, the City can consider utilizing borrowing options outlined in Metro's program guidelines[5] to obtain up-front funds for investments, to be repaid using the City's future Local Return Program formulaic allocations.

Pros and Cons

As described above, various financing tools can be beneficial because they can help make large expenditures achievable by providing funds up-front and then allowing the cost to be repaid over an extended period of time. The disadvantage of most financing programs is that the cost of financing (e.g., interest charged on the outstanding balance while the financing is being repaid) adds to overall project costs. It will be beneficial for the City to fund its CAP implementation activities on a pay-as-you-go basis whenever practical and to reserve financing techniques for those situations where funds are needed up-front but are not available without using financing tools, or where long-term annual operational cost savings are sufficient to offset the necessary debt service payments.

5 http://media.metro.net.s3.amazonaws.com/projects_studies/local_return/images/borrowing_guidelines_prop_a_c_measure_r_m.pdf

Table 1 Detailed Funding Matrix

Move	Cost	City Lead Department	Potential Funding Source	Notes
Play C.1 Engage South Pasadena youth in climate change action and provide education on ways to live a sustainable lifestyle.				
C.1.a Support South Pasadena Unified School District by providing students with information on climate change and the beneficial role of trees.	Low	Public Works and Community Services	U.S. EPA - Environmental Education Grants (Need to Partner with a qualified education agency)	Grants support environmental education projects that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques.
C.1.b Utilize South Pasadena's historic neighborhoods to demonstrate to students the importance of mature urban trees in providing shade and reducing the urban heat island effect.	Low	Public Works and Community Services		
C.1.c Identify grant funding opportunities and engage with local nurseries to identify appropriate and cost-effective California native plants/trees that can be both planted in the ground or remain potted for students living in rental/multi-family homes.	Low	Public Works and Community Services	General Fund	Staff in-kind
Play E.1. Maximize the usage of renewable power within the community, by continuing to achieve an opt-out rate lower than 4% for the Clean Power Alliance.				
E.1.a Monitor progress and perform public outreach and education campaigns highlighting the benefits of 100% renewable energy, including: ✓ Monitoring opt-out rates on an annual basis ✓ Tabling at community events ✓ Establishing an informational resource page on the City website ✓ Regular social media posts ✓ Energy bill inserts	Low	Public Works	General Fund	Staff in-kind

Move	Cost	City Lead Department	Potential Funding Source	Notes
Play E.2 Require electrification of 100% of newly constructed buildings.				
E.2.a Develop a webpage and materials for display at City Hall promoting the benefits of electrification and resources that can assist with the fuel-switching process.	Low	Public Works and Building and Planning	General Fund	Staff in-kind or contractor
E.2.b Provide financial and technical resources, including hosting workforce development trainings for installers and building owners/operators to discuss benefits and technical requirements of electrification.	Med	Building and Planning	Foothill Workforce Development Board – job training	Possibility to recruit vendors to assist with training and provide sponsorships and seek to partner with Foothill Workforce Development Board to arrange training – Workforce Development Board partners with businesses to provide job training to upgrade employee skills.
E.2.c Perform regular internal trainings with planners and building officials on current state decarbonization goals and incentives available for electric homes.	Low	Building and Planning	General Fund	Staff in-kind or contractor
E.2.d Provide education around cooking with electric appliances, including demonstrations from chefs and/or local restaurants, as available.	Low	Building and Planning	General Fund	Staff in-kind or contractor; could charge registration fees to off-set costs
E.2.e Adopt an Electrification Readiness reach code for all new buildings and accessory dwelling units which bans the piping of natural gas. In doing so the City will: ✓ Engage with stakeholders, both internal stakeholders, such as City staff and officials, and external stakeholders, such as local developers regarding the purpose and impact of the reach code ✓ Conduct a cost effectiveness study ✓ Develop and draft an ordinance ✓ Conduct public hearings, public notices, and formally adopt the ordinance ✓ Submit the adopted ordinance to the California Energy Commission (CEC)	Low/ Med	Building and Planning	General Fund	Staff in-kind

Move	Cost	City Lead Department	Potential Funding Source	Notes
E.2.f Adopt an ordinance that allows granting of minor allowances for certain site development standards when there is no practical ways to design a project to be all electric.	Low/ Med	Building and Planning	General Fund	Staff in-kind
Play E.3 Electrify 5% of existing buildings by 2030 and 80% by 2045.				
E.3.a Develop an existing building electrification permit tracking program to track annual progress in achieving the targeted electrification goal.	Low	Building and Planning	General Fund	Staff in-kind; potentially include costs of tracking in building permit fees.
E.3.b Keep an updated list of rebates and incentives available to residents who would like to convert their buildings to electric power.	Low	Public Works and Building and Planning	General Fund	Staff in-kind; partner with SCE
E.3.c Provide education on the potential energy savings and benefits of electric heat pumps for water heating and space heating when permits for replacement are obtained.	Low	Public Works and Building and Planning	General Fund	Staff in-kind; partner with SCE
E.3.d Work with Southern California Edison (SCE) and/or the Clean Power Alliance to provide rebates for residential replacement of natural gas-powered air and water heating appliances with electric-powered.	Low	Public Works	1. General Fund 2. SCE 3. Clean Power Alliance for rebate funding	Partner with SCE and/or Clean Power Alliance
E.3.e Promote water heater, space heating, and appliance (electric stoves/dryers) replacement programs and incentives (residential) at time of construction permit.	Low	Public Works and Building and Planning	General Fund	Staff in-kind - Could partner with local contractors, retailers, and building supply companies to host a building electrification expo to educate consumers. Vendors could also provide sponsorships to defray costs.
E.3.f Perform an existing buildings analysis in order to understand the potential for electrification retrofitting in South Pasadena and establish a roadmap for eliminating natural gas from existing buildings.	Med/ High	Building and Planning	California Energy Commission – Energy Partnership Program	This would likely require consultant contract and would also likely need General Fund support. Depending on level of detail of retrofit analysis, study cost could be significantly above $50,000. This program offers services to help identify the most cost-effective, energy-

Move	Cost	City Lead Department	Potential Funding Source	Notes
				saving opportunities for buildings and new construction. The Energy Partnership Program can be used to conduct energy audits and prepare feasibility studies. The Energy Commission provides technical assistance services up to $20,000 of a consultant's costs. The program is a continuously open with no final filing date.
E.3.g Establish a comprehensive, coordinated education campaign focused towards property owners, landlords, property management companies, and occupants for reducing the use of natural gas in homes and businesses. Establish a shared understanding of existing incentives for electric appliances and upgrades, and how to access them, including SCE incentive programs and rebates.	Med	Public Works and Building and Planning	1. Southern California Edison, SoCalGas – rebates, incentives, and financing programs or 2. U.S. EPA - Environmental Education Grants (Need to Partner with a qualified education agency)	Staff in-kind and/or consultant contract – would likely need General Fund support SCE and SoCalGas offer a range of incentives, rebates, and financing programs for residential and non-residential customers. Grants support environmental education projects that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques.
E.3.h Perform a cost-effectiveness study for electrification retrofitting, including requirements for newly permitted HVAC/hot water heaters and other appliances to be electric.	Low	Building and Planning	California Energy Commission	This program offers services to help identify the most cost-effective, energy-saving opportunities for buildings and new construction. The Energy Partnership Program can be used to conduct energy audits and prepare feasibility studies. The Energy Commission provides technical assistance services up to $20,000 of a

Move	Cost	City Lead Department	Potential Funding Source	Notes
				consultant's costs. The program is a continuously open with no final filing date. See studies completed by Sacramento Municipal Utility District and other utilities on the same topic.
E.3.i Develop a best practices model based on the progress electrifying existing buildings in South Pasadena and outside of South Pasadena to significantly increase electrification post-2030.	Low	Building and Planning	General Fund	Staff in-kind
Play E.4 Develop and promote reduced reliance on natural gas through increased clean energy systems that build off of renewable energy development, production, and storage.				
E.4.a Conduct a Feasibility Study to assess cost and applicable locations for installation of battery back-up systems or generators throughout the City in support of the General Plan.	Med	Public Works	California Energy Commission - Energy Partnership Program	The Feasibility Study would likely require a consultant contract, which may need General Fund support. This program offers services to help identify the most cost-effective, energy-saving opportunities for buildings and new construction. The Energy Partnership Program can be used to conduct energy audits and prepare feasibility studies. The Energy Commission provides technical assistance services up to $20,000 of a consultant's costs. The program is a continuously open with no final filing date.
E.4.b Promote installation of storage technology in concert with renewable energy infrastructure through educational programs, outreach, and information provided via City platforms.	Low	Public Works	General Fund	Staff in-kind

Move	Cost	City Lead Department	Potential Funding Source	Notes
E.4.c Conduct "micro-grid" Feasibility/Pilot Study in support of the General Plan.	Med	Public Works	California Energy Commission - Energy Partnership Program	The Feasibility Study/Pilot Study would likely require a consultant contract, which may need General Fund support. This program offers services to help identify the most cost-effective, energy-saving opportunities for buildings and new construction. The Energy Partnership Program can be used to conduct energy audits and prepare feasibility studies. The Energy Commission provides technical assistance services up to $20,000 of a consultant's costs. The program is a continuously open with no final filing date.
E.4.d In support of the General Plan, develop and implement a Solar Action Plan with a goal of meeting 50% of South Pasadena's power demand through solar by 2040.	Med/ High	Public Works and Building and Planning	Private Solar Dealers/Installers - End-users buy or lease systems with costs offset by long-term energy savings. Solar developers construct and manage new solar systems to supply end-users pursuant to a power purchase agreement.	The Move would likely require a consultant contract, which may need General Fund support. Implementation of the Solar Action Plan would cost many millions of dollars; however, costs would be mostly absorbed by end users who would benefit from the renewable energy savings. Private companies offer their customers financing programs for purchasing and installing systems, lease programs, and power purchase agreements to convert to solar energy.
E.4.e In support of the 2018-2019 City Strategic Plan, develop a strategy and implementation schedule for the Renewable Energy Plan, after feasibility study.	Med	Public Works and Building and Planning	General Fund	The Move would likely require a consultant contract, which may need General Fund support.
E.4.f Adopt a PV (Solar) Ordinance requiring newly constructed and majorly renovated multi-family and	Low/ Med	Building and Planning	General Fund	Staff in-kind

Move	Cost	City Lead Department	Potential Funding Source	Notes
commercial buildings to install PV systems with an annual output greater or equal to 25% of buildings electricity demand. Ensure consistency of ordinance with the City General Plan.				
E.4.g Require all new structures or major retrofits to be pre-wired for solar panels, consistent with the General Plan.	Low	Building and Planning	General Fund	Staff in-kind
E.4.h Work with various City departments to establish and streamline battery storage requirements to allow for easier implementation of these technologies throughout the City.	Low	Public Works and Building and Planning	General Fund	Staff in-kind
E.4.i Work with home and business owners, including those in the historic districts, to identify and promote renewable energy demonstration projects to showcase the benefits.	Low	Public Works and Building and Planning	General Fund	Staff in-kind
E.4.j Work with SCE and the CPA to develop a program and timeline for increasing resilience to power losses, including Public Safety Power Shutoffs (PSPS), and climate-driven extreme weather events for low-income, medically dependent, and elderly populations through installation of renewable energy and onsite energy storage with islanding capabilities, following appropriate project-level environmental review.	High	Public Works	1. SCE 2. CPA	Staff in-kind; work with SCE and CPA to determine if there is potential to create a program similar to Search Results Web results Low Income Home Energy Assistance Program (LIHEAP) that utilizes funds collected from ratepayers at large to fund assistance for vulnerable populations. Implementation costs could be substantially over $50,000, depending on the number of sites served.
Play T.1 Increase use of zero-emission vehicle and equipment 13% by 2030 and 25% by 2045.				
T.1.a Develop an EV Readiness Plan to establish a path forward to increase EV infrastructure within the City and promote mode shift to EVs, that is consistent with the City General Plan. In conjunction with an EV Readiness Plan, conduct a community EV Feasibility Study to assess infrastructure needs and challenges.	Med	Public Works	1. Moving California, California Climate Investments - Sustainable Transportation Equity Project (STEP) 2. California Air Resources Board -	The EV Readiness Plan would likely require a consultant contract, which may need General Fund support. STEP is a new pilot with $2 million for Clean Transportation Planning & Capacity Building Grants, and $20 million for Implementation Grants. Eligible Planning projects include mobility plans and needs assessments. Eligible implementation

Move	Cost	City Lead Department	Potential Funding Source	Notes
			Clean Vehicle Rebate Program	projects include infrastructure, capital, operations, planning, policy-making, and outreach projects. The Clean Vehicle Rebate Program provides rebates for income eligible-consumers. Enhanced rebates for lower-income consumers.
T.1.b Adopt an EV Charging Retrofits in Existing Commercial and Multifamily Buildings reach code requiring major retrofits, with either a permit value over $200,000 or including modification of parking surfaces or electric panels, to meet CalGreen requirements for "EV Ready" charging spaces and infrastructure.	Low/ Med	Public Works and Building and Planning	1. Moving California, California Climate Investments - Sustainable Transportation Equity Project (STEP) 2. CAL eVIP - Southern California Incentive Project (SCIP)	The Southern California Incentive Project (SCIP) offers rebates for the purchase and installation of eligible public electric vehicle (EV) chargers in Los Angeles, Orange, Riverside and San Bernardino counties – with a total of $29 million in available funds. Eligible rebates include up to $70,000 per DC fast charger (DCFC) for installations at new sites and sites with stub-outs and up to $40,000 per DC fast charger for installations at replacement and make-ready sites. Installations in designated disadvantaged communities (DACs) are eligible for rebates up to $80,000 per DC fast charger regardless of installation site type"
T.1.c Streamline permit processes (city, county, state, utility) for electric vehicle charging infrastructure and alternative fuel stations.	Low	Building and Planning	General Fund	Staff in-kind
T.1.d Enhance promotion of public and private conversion to zero-emission vehicles through implementation of the City General Plan; including use of City events, social media, and the City website to educate on benefits of zero-emission vehicles and available incentives.	Low	Public Works	General Fund	Staff in-kind

Move	Cost	City Lead Department	Potential Funding Source	Notes
T.1.e Establish an ordinance that restricts use of gas-powered lawn equipment, including leaf blowers, and provide information on the City website outlining available incentives.	Low/ Med	Public Works	General Fund	Staff in-kind
T.1.f Adopt an EV Readiness Reach Code requiring new commercial construction to provide the minimum number of EV capable spaces to meet Tier 2 requirements (20% of total). In doing so the City will: ✓ Engage with stakeholders, both internal stakeholders, such as local government staff and officials, and external stakeholders, such as local developers regarding the purpose and impact of the reach code ✓ Conduct a cost effectiveness study ✓ Develop and draft an ordinance ✓ Conduct public hearings, public notices, and formally adopt the ordinance ✓ Submit the adopted ordinance to the California Energy Commission (CEC)	Low/ Med	Public Works and Building and Planning	1. General Fund 2. AB 2766 funds	The EV Readiness Reach Code would likely require a consultant contract, which may need General Fund support. Staff in-kind support would be provided and implementation of this Move would build on model ordinances and studies conducted by others. Funding from the South Coast Air Quality Management District (SCAQMD) to support air pollution reduction projects.
T.1.g Earmark and identify additional funding for implementation of the EV Readiness Plan to include public charging infrastructure in key locations.	Low	Public Works	1. General Fund 2. AB 2766 – local subventions 3. Funding from EV charging station companies	Staff in-kind; potential partnership with commercial EV charging station companies. Funding from the South Coast Air Quality Management District (SCAQMD) to support air pollution reduction projects.
T.2 Implement programs for public and shared transit that decrease passenger car VMT 3% by 2030 and 6% by 2045.				
T.2.a Conduct a Feasibility and Community Interest Study on the four transit improvement options of the City's General Plan.	Med	Building and Planning	1. Southern California Association of Governments (SCAG) - Sustainable Communities Program	The Move would likely require a consultant contract, which may need General Fund support. SCAG - Non-infrastructure funding for projects that help to implement the regional SCS

Move	Cost	City Lead Department	Potential Funding Source	Notes
			2. AB 2766 - Local Subventions 3. Los Angeles County Measures A, C, R, M - Local Return Program	AB 2766 - Annual allocations of funds can be used on projects that reduce air pollution. LA Metro - Annual formulaic grants to local jurisdictions from LA County voter-approved sales tax measures. Can fund numerous transportation improvement projects, including planning, capital investments, and services.
T.2.b Pursue a community car, bike, or e-scooter "micro-transit" share pilot consistent with the City General Plan.	Low	Building and Planning	AB2766 - Local Subventions	Staff in-kind; potential partnership with commercial shared mobility provider, San Gabriel Valley Council of Governments (SVGCOG) Annual allocations of funds can be used on projects that reduce air pollution.
T.2.c Conduct local transportation surveys to better understand the community's needs and motivation for travelling by car versus other alternatives such as bus or Metro Gold Line light rail. Use survey results to inform transit expansion and improvement projects.	Low/ Med	Public Works and Building and Planning	General Fund	The Move would likely require staff in-kind time or a consultant contract, which may need General Fund support.
T.2.d Adopt a Transportation Demand Management (TDM) Plan for the City that includes a transit system focus. Provide incentives for implementation of TDM measures at local businesses and new developments.	Med/ High	Building and Planning	Los Angeles County Measures A, C, R, M – Local Return Program	Form local Transportation Management Association (TMA); potential funding from TMA dues/assessments and grant funding to offset eligible services. The Move may also require staff in-kind time Annual formulaic grants to local jurisdictions from LA County voter-approved sales tax measures. Can fund numerous transportation improvement projects, including planning, capital investments, and services.

Move	Cost	City Lead Department	Potential Funding Source	Notes
T.2.e Facilitate transportation equity through targeted provision of programs that encourage minority, low-income, disabled, and senior populations to take transit, walk, bike, use rideshare or car share.	Low	Public Works and Community Services	Los Angeles County Measures A, C, R, M – Local Return Program	Staff in-kind; incorporate equity considerations into other actions. Annual formulaic grants to local jurisdictions from LA County voter-approved sales tax measures. Can fund numerous transportation improvement projects, including planning, capital investments, and services.
Play T.3 Develop and implement an Active Transportation Plan to shift 3% of passenger car VMT to active transportation by 2030, and 5% by 2045.				
Play T.3.a Develop and adopt an Active Transportation Plan consistent with SCAG 2016 RTP/SCS that will identify funding strategies and policies for development of pedestrian, bicycle, and other alternative modes of transportation projects. Establish citywide events, outreach, educational programs, and platforms to promote active transportation in the community in support of the General Plan.	High	Public Works and Building and Planning	1. California Transportation Commission (CTC) - Active Transportation Program (ATP) 2. LA Metro - TDA Article 3	Staff in-kind or contractor; cost may be well over $50,000 CTC ATP - The goals of the ATP include increasing the proportion of trips accomplished by biking and walking and increasing the safety and mobility for nonmotorized users. Each ATP programming cycle will include four years of funding. New programming capacity for the 2021 ATP will be for state fiscal years 2021-22, 2022-23, 2023-24 and 2024-25 Funding from the ATP may be used to fund the development of community-wide active transportation plans within or, for area-wide plans, encompassing disadvantaged communities, including bicycle, pedestrian, safe routes to schools, or comprehensive active transportation plans LA Metro - Metro Administers Transportation Development Act Article 3 funds for cities within LA County. Funds are allocated annually on a per capita

Move	Cost	City Lead Department	Potential Funding Source	Notes
				basis and can be used for bicycle and pedestrian improvement projects.
Play T.3.b Conduct a Street/Intersection Study to identify streets and intersections that can be improved for pedestrians and bicyclists through traffic calming measures and/or where multi-use pathway opportunities exist to increase active transportation.	Low/ Med	Public Works	1. California Transportation Commission (CTC) - Local Partnership Program (LPP) 2. Mitigation fees paid by new development projects that contribute to VMT - Local VMT-based transportation impact fee or local/regional VMT bank/exchange program 3. LA Metro - TDA Article 3	Staff in-kind or contractor; potential grant funding CTC LPP - The primary objective of this program is to provide funding to counties, cities, districts, and regional transportation agencies in which voters have approved fees or taxes dedicated solely to transportation improvements or that have imposed fees, including uniform developer fees, dedicated solely to transportation improvements. The Local Partnership Program provides funding to local and regional agencies to improve Aging Infrastructure, Road Conditions, Active Transportation, Transit and rail, Health and Safety Benefits. The Local Partnership Program funds are distributed through a 40% statewide competitive component and a 60% formulaic component. FY20 Funding deadline for 2020 applications was June 30, 2020. Development projects would pay impact fees to offset VMT impacts or pay into a VMT bank or exchange program to offset their contributions to VMT. Funds collected in this manner would be spent on VMT-reducing projects. This can be implemented in tandem with the switch from LOS-based to VMT-based mitigations for CEQA traffic impacts.

Move	Cost	City Lead Department	Potential Funding Source	Notes
				Metro TDA Article 3 - Metro Administers Transportation Development Act Article 3 funds for cities within LA County. Funds are allocated annually on a per capita basis and can be used for bicycle and pedestrian improvement projects.
Play T.3.c Annually review and update the City's Bicycle and Pedestrian Network Map and post throughout City.	Low	Building and Planning	General Fund	Staff in-kind; additionally, potential sponsorships from local bike shops and other businesses may be pursued
Play T.3.d Work with the Community Service Department or South Pasadena Police Department to develop programs and classes to teach and promote bicycle riding education and safety to residents of all ages and skill levels.	Low	Public Works	General Fund	Staff in-kind
Play T.3.e Conduct a nexus study and develop an ordinance requiring payment of fees from development projects to implement safe active transportation routes and infrastructure citywide.	Low/ Med	Public Works	Mitigation fees paid by new development projects that contribute to VMT	Local VMT-based transportation impact fee or local/regional VMT bank/exchange program. Development projects would pay impact fees to offset VMT impacts or pay into a VMT bank or exchange program to offset their contributions to VMT. Funds collected in this manner would be spent on VMT-reducing projects. This can be implemented in tandem with the switch from LOS-based to VMT-based mitigations for CEQA traffic impacts.
Play T.3.f Amend zoning code to require installation of bike stalls or lockers at new developments, "mobility hubs", and during change of use of existing buildings, consistent with the General Plan.	Low	Public Works and Building and Planning	General Fund, combine with Play T.3.g	Staff in-kind New developments would incorporate costs; costs could be offset by reducing vehicle parking requirements commensurately.

Move	Cost	City Lead Department	Potential Funding Source	Notes
Play T.3.g Adopt a Trip Reduction Ordinance that incudes requirements in the Zoning Code to require end-of-trip facilities for cyclists (e.g., showers, bike repair kiosks, and lockers) in new, non-residential building projects of a specified size.	Low/ Med	Public Works and Building and Planning	General Fund	Staff in-kind New developments would incorporate costs; costs could be offset by reducing vehicle parking requirements commensurately.
W.1 Reduce per capita water consumption by 10% by 2030 and 35% by 2045.				
W.1.a Continue to enforce the Model Water Efficient Landscapes Ordinance.	Low	Public Works and Building and Planning	General Fund	Staff in-kind (existing program)
W.1.b Work with the Los Angeles County Sanitation District (LACSD) to bring recycled water lines and infrastructure to the City.	High	Public Works	1. User Fees 2. Water Resources Control Board-Water Recycling Funding Program - Construction Grant	Staff in-kind; implementation costs could be in the multiple millions of dollars. User fees could potentially reimburse costs; partner with Upper San Gabriel Valley Municipal Water District to conduct the study. Integrated Water & Wastewater Resources Management Plan (currently being studied) will address recycled water feasibility. Water recycling construction projects must offset or augment state or local fresh water supplies. Eligible projects include construction of recycled water treatment facilities, storage facilities, pumping facilities, groundwater recharge facilities, and recycled water distribution systems, including onsite improvements.
W.1.c In conjunction with the Downtown Specific Plan Action and City General Plan Action, adopt an ordinance restricting the use of potable water for non-potable uses and requiring	Low/ Med	Public Works	Water Conservation Funds	Staff in-kind

Move	Cost	City Lead Department	Potential Funding Source	Notes
greywater capture for land uses that are excess water users (e.g. golf courses, car washes, large fields, etc.).				
W.1.d Implement Plays 1 through 4 under Goal II of the Green Action Plan on the provided implementation timeline, aiming to provide education and promotion of greywater systems. (See the City's Green Action Plan for more information).	Low	Public Works	Water Conservation Funds	Staff in-kind
W.1.e In conjunction with Move II.1.1 of the City Green Action Plan, develop a Recycled Water Use Master Plan that identifies access to recycled water and quantity of recycled water available to the City, as well as establishes an implementation plan. The implementation plan shall identify land use types (i.e., landscaping, gold courses, fields) and specific projects that will switch from potable to recycled water use allowing for a goal of 20% of City's potable water use to be replaced with recycled water.	High	Public Works	Water Resources Control Board - Water Recycling Funding Program - Planning Grant	Contractor; costs to implement could be in the multiple millions of dollars; combine with W.1.b; potentially reimburse up-front costs through user fees. WRFP Planning Grants encourage Local Public Agencies to investigate the feasibility of recycling wastewater and assist them with completing planning for water recycling projects by supplementing local funds. Applications are accepted continuously.
W.1.f Implement 100% renewable power for all pumping and treatment of water.	Low	Public Works	General Fund	Marginal cost increase above current costs; incorporate costs into rate structure
Play SW.1 Implement and enforce SB 1383 organics and recycling requirements to reduce landfilled organics waste emissions 50% by 2022 and 75% by 2025.				
SW.1.a Adopt procurement policies to comply with SB 1383 requirements for jurisdictions to purchase recovered organic waste products.	Low	Public Works	General Fund	Possible marginal cost increase above standard products that are already purchased
SW.1.b Adopt an ordinance requiring compliance with SB 1383. Ensure ordinances established through the City General Plan Action and the Zero Waste Plan are consistent with SB 1383 requirements; and revise ordinances if necessary.	Low/ Med	Public Works	User fees for solid waste services	Staff in-kind; partner with waste hauler Costs for implementation of organics recycling could be recovered through solid waste user fees.

Move	Cost	City Lead Department	Potential Funding Source	Notes
SW.1.c Adopt an Edible Food Recovery Ordinance for edible food generators, food recovery services, or organization that are required to comply with SB 1383.	Low/ Med	Public Works	User fees for solid waste services	Staff in-kind; partner with waste hauler Costs for implementation of organics recycling could be recovered through solid waste user fees.
SW.1.d Partner with the City's waste hauler, to provide organic waste collection and recycling services to all commercial and residential generators of organic waste.	Low	Public Works	User fees for solid waste services	Staff in-kind; partner with waste hauler Costs for implementation of organics recycling could be recovered through solid waste user fees.
SW.1.e Adopt an ordinance requiring all residential and commercial customers to subscribe to an organic waste collection program and/or report self-hauling or backhauling of organics.	Low/ Med	Public Works	User fees for solid waste services	Staff in-kind; partner with waste hauler Costs for implementation of organics recycling could be recovered through solid waste user fees.
SW.1.f Conduct a Feasibility Study and prepare an action plan to ensure edible food reuse infrastructure is sufficient to accept capacity needed to recover 20% of edible food disposed or identify proposed new or expanded food recovery capacity.	Low/ Med	Public Works	CalRecycle - Food Waste Prevention and Rescue Grant Program	Staff in-kind or contractor; potential grant funding The purpose of this competitive grant program is to lower overall greenhouse gas emissions by expanding existing or establishing new food waste prevention and/or rescue projects in California to reduce the amount of food being disposed in landfills. Eligible projects include food waste prevention projects that prevent food waste and from being generated Food rescue projects that result in edible food being rescued and distributed to people Availability of application materials for fiscal year (FY) 2019-20 is to be determined
SW.1.g Establish an education and outreach program for school children and adults around food waste prevention, nutrition education, and the importance of edible food	Low	Public Works	U.S. EPA - Environmental Education Grants	Staff in-kind Grants support environmental education projects that promote environmental

Move	Cost	City Lead Department	Potential Funding Source	Notes
recovery. Support City Green Action Plan Play III identified educational goals (Move III.1.3., Move III.1.4., Move III1.6., Move III.2.1, Move III. 3.3, and Move III.4.2) through an established educational program.				awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques. 2020 grant applications were announced in October 2019 and due January 6, 2020.
SW.1.h Establish an edible food recovery program supporting the City General Plan and the City Green Action Plan Move III.1.2 to minimize food waste.	Low	Public Works	CalRecycle - Food Waste Prevention and Rescue Grant Program	Staff in-kind; partner with local food bank or similar organization to implement The purpose of this competitive grant program is to lower overall greenhouse gas emissions by expanding existing or establishing new food waste prevention and/or rescue projects in California to reduce the amount of food being disposed in landfills. Eligible projects include food waste prevention projects that prevent food waste and from being generated Food rescue projects that result in edible food being rescued and distributed to people Availability of application materials for fiscal year (FY) 2019-20 is to be determined
SW.1.i Adopt an ordinance or enforceable mechanism to regulate haulers collecting organic waste, including collection program requirements and identification of organic waste receiving facilities.	Low/ Med	Public Works	General Fund, possibly incorporate costs into franchise agreement.	Staff in-kind
SW.1.j Partner with City waste services to:	Low	Public Works	User fees for solid waste services; incorporate into	Staff in-kind; incorporate costs in user fees for waste hauler

Move	Cost	City Lead Department	Potential Funding Source	Notes
✓ Ensure organic waste collection from mixed waste containers are transported to a high diversion organic waste processing facility. ✓ Provide quarterly route reviews to identify prohibited contaminants potentially found in containers that are collected along route. ✓ Clearly label all new containers indicating which materials are accepted in each container, and by January 1, 2025, place or replace labels on all containers.			agreement with Athens Services	
Play SW.2 Reduce residential and commercial waste sent to landfills by 50% by 2030 and 100% by 2045.				
SW.2.a Develop and implement a Zero Waste Plan, consistent with the General Plan Action, in order to reach South Pasadena's goal of zero waste by 2040.	Low/ Med	Public Works	User fees	Contractor - Incorporate costs of study and implementation into solid waste user fees.
SW.2.b Provide ongoing education to residents, business owners, and South Pasadena School District regarding waste reduction, composting, and recycling.	Low	Public Works	U.S. EPA - Environmental Education Grants	Staff in-kind; partner with waste hauler Grants support environmental education projects that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques. 2020 grant applications were announced in October 2019 and due January 6, 2020.
SW.2.c Increase reuse, recycling, and composting at temporary public events by mandating the installation of public recycling and composting containers and collection service; and encouraging reusable food ware, when relevant, according to the California State Retail Food Code.	Low	Public Works	CalRecycle - Beverage Container Recycling Grants	Staff in-kind Provides funding to assist organizations with establishing convenient beverage container recycling and litter abatement

Move	Cost	City Lead Department	Potential Funding Source	Notes
				projects. The next application cycle is expected in Fall 2020.
SW.2.d Develop a waste department or working group to enhance recycling and composting outreach and provide technical assistance or information in support of City Green Action Plan Move III. Additionally, implement and share a Recycle and Reuse Directory through City platforms, in support of Green Action Plan Move I.2.5.	Low/ Med	Public Works	General Fund	Staff in-kind; costs would increase if new staff needed
SW.2.e Adopt an ordinance requiring compliance with Sections 4.410.2, 5.410.1, 4.408.1, and 5.408.1 of the California Green Building Standards Code related to construction of buildings with adequate space for recycling containers and construction and demolition (C&D) recycling.	Low/ Med	Building and Planning	General Fund, planning and building permit fees.	Staff in-kind Costs for implementation could be recovered through planning and building plan review fees charged to projects subject to requirements.
SW.2.f Implement the City General Plan, requiring construction sites to separate waste for proper diversion and reuse or recycling.	Low	Public Works and Building and Planning	General Fund, planning and building permit fees.	Staff in-kind; possible cost recovery through permit surcharge Costs for implementation could be recovered through planning and building plan review fees charged to projects subject to requirements.
SW.2.g Develop and implement a Waste Stream Education Program targeting property managers of multi-family residences and the commercial sector, in support of Goal III of the City Green Action Plan.	Low	Public Works	General Fund	Staff in-kind; partner with property owner organizations and/or Chamber of Commerce for outreach and education.
SW.2.h Develop policies to mandate/encourage reduction of waste and reuse in the food industry (e.g. facilities serving prepared food and prepackaged food; home meal delivery services), hospitality industry, and other commercial industries. Efforts may include developing ordinances for food service ware and a ban on single-use individual toiletry bottles in hotels/motels, grant/discount programs for switching to reusables, fast food champion pilot project, and working with home meal delivery services (e.g., Blue Apron),	Low/ Med	Public Works	General Fund, affected businesses	Staff in-kind; partner with Chamber of Commerce to gain business input on policy and to educate affected businesses. Possible regulatory fees charged to affected businesses.

Move	Cost	City Lead Department	Potential Funding Source	Notes
etc. to explore opportunities to reduce single-use packaging and encourage reuse.				
SW.2.i Encourage reusable foodware; or if reusable foodware is not a feasible option, explore opportunities to mandate/encourage a switch to more environmentally friendly alternatives for various products in the commercial industry, when relevant.	Low	Public Works	General Fund	Staff in-kind; partner with Chamber of Commerce to gain business input on policy and to educate affected businesses.
Play CS.1 Increase carbon sequestration through increased tree planting and green space.				
CS.1.a Identify and map public spaces that can be converted to green space, including public parking that can be converted to parklets, freeway airspace that can be made into green space, vertical walls that can be planted with vines, and rooftops of public buildings that can be developed into gardens.	Low	Public Works	CalFire - Urban and Community Forestry	Staff in-kind or contractor to identify and map; implementation could be funded with combination of grants and private property owner investments Funds projects to expand and manage urban forests. 2019-20 concept proposals were due 11-27-2019. The next round of funding has not yet been announced.
CS.1.b Adopt a Greenscaping Ordinance that has a street tree requirement for all zoning districts, has a shade tree requirement for new development, requires greening of parking lots, and increases permeable surfaces in new development.	Low/ Med	Public Works and Building and Planning	General Fund	Staff in-kind; property owners fund improvements Implementation costs would be covered by building permit fees charged to construction projects.
CS.1.c Prepare and adopt an Urban Forest Management Plan for the City that includes an inventory of existing trees, identifies future tree planting opportunities, and a climate-ready tree palette, as well as ongoing operations and maintenance needs.	High	Public Works	CalFire - Urban and Community Forestry	Staff in-kind or contractor; costs for implementation and long-term maintenance would likely be in the multiple millions of dollars; possible grant funding and funding from private property owners to plant trees; maintenance costs could potentially be incorporated into a lighting and landscaping assessment district.

Move	Cost	City Lead Department	Potential Funding Source	Notes
				Funds projects to expand and manage urban forests. 2019-20 concept proposals were due 11-27-2019. The next round of funding has not yet been announced.
CS.1.d Adopt a standard policy and set of practices for expanding urban tree canopy and placing vegetative barriers between busy roadways and developments to reduce exposure to air pollutants from traffic.	Low	Public Works	General Fund	Staff in-kind
M.1 Reduce carbon intensity of City operations.				
M.1.a As recommended in the 2016 Renewable Energy Council Report, complete energy audits for all City facilities and implement all feasible recommendations for fuel switching and efficiency upgrades.	High	Public Works	California Energy Commission Energy Partnership Program	Staff in-kind or contractor for study; costs for implementation could be substantially over $50,000; offset by potential long-term savings from improvements This program offers services to help identify the most cost-effective, energy-saving opportunities for buildings and new construction. The Energy Partnership Program can be used to conduct energy audits and prepare feasibility studies. The Energy Commission provides technical assistance services up to $20,000 of a consultant's costs. The program is continuously open with no final filing date.
M.1.b As recommended in the 2016 Renewable Energy Council Report, purchase renewable natural gas (RNG) for applicable City fleet vehicles.	Low	Public Works	General Fund	Marginal costs for substitution of fuels
M.1.c As recommended in the 2016 Renewable Energy Council Report, install PV solar systems at the City Hall and at Wilson Reservoir.	High	Public Works	General Fund	Up-front costs are likely substantially over $50,000, but offset by long-term electricity cost savings. Solar generation facilities would be a candidate for Green Bond financing, to be

Move	Cost	City Lead Department	Potential Funding Source	Notes
				repaid using General Fund monies that otherwise would have been spent on purchasing electricity.
M.1.d Adopt retrofitting policy for City owned buildings such that energy efficient and electrification retrofits are incorporated into City buildings as they become available.	Low	Public Works	General Fund	Staff in-kind Energy efficiency projects would be good candidates for Green Bond financing, to be repaid using General Fund monies that otherwise would have been spent on utility costs.
M.1.e Develop a policy for the City which would require all new building RFP's to include life cycle costing over 30 years and tie this directly to energy consumption and building electrification. This would include the buildings operational and maintenance costs and ensure that the City has the most cost effective (and sustainable) building possible.	Low	Public Works	General Fund	Staff in-kind to develop policy; City benefits from lifecycle savings Lifecycle costing will help the City to identify potential for long-term cost savings. Green Bond financing could be used to make the necessary up-front investment in efficient buildings.
M.1.f As recommended in the 2016 Renewable Energy Council Report, invest all savings from City energy efficiency projects into a new revolving green fund that can be used to fund additional energy efficiency and GHG reduction projects.	Low	Finance	General Fund	Calls for using energy efficiency dividends to fund new projects The Green Fund could help to repay Green Bond financings.
M.2 Electrify the municipal vehicle fleet and mobile equipment.				
M.2.a Develop a suite of transportation demand management tools to incentivize alternative transportation methods for employees, including telecommute options.	Low	Management Services	General Fund	Staff in-kind City is adapting to telecommuting for COVID-19. Develop continuing telecommuting policies for post-pandemic.
M.2.b Provide bicycles and bicycle storage for employees to use during work hours for short business or personal trips.	Low	Public Works	General Fund	Limited capital expenditure and maintenance costs

Move	Cost	City Lead Department	Potential Funding Source	Notes
M.2.c Develop and adopt a policy to apply lifecycle assessment to all new vehicle and equipment purchases.	Low	Public Works	General Fund	Staff in-kind to develop policy; City benefits from lifecycle savings Lifecycle costing will help the City to identify potential for long-term cost savings. Green Bond financing could be used to make the necessary up-front investment in efficient buildings.
M.2.d Implement the City Fleet Alternative Fuel Conversion Policy developed under the City General Plan, electrifying the City vehicle fleet and using it to encourage residents to convert as well.	Low	Public Works	Southern California Air Quality Management District (SCAQMD) - Carl Moyer Program	Long-term savings from reduced maintenance and fuel costs Replacement of older heavy duty diesel vehicles and equipment with clean technologies. Eligible equipment includes trucks, public agency utility vehicles, emergency vehicles.
M.2.e Install EV charging stations at municipal buildings.	Med	Public Works and Building and Planning	1. Moving California, California Climate Investments, CARB - Sustainable Transportation Equity Project (STEP) 2. CAL eVIP, CA Energy Commission - Southern California Incentive Project (SCIP)	Possible low to no-cost of partnered with commercial EV charging company STEP - is a new pilot with $2 million for Clean Transportation Planning & Capacity Building Grants, and $20 millions for Implementation Grants. Eligible Planning projects include mobility plans and needs assessments. Eligible implementation projects include infrastructure, capital, operations, planning, policy-making, and outreach projects. The Southern California Incentive Project (SCIP) offers rebates for the purchase and installation of eligible public electric vehicle (EV) chargers in Los Angeles, Orange, Riverside and San Bernardino counties – with a total of $29 million in available funds.

Move	Cost	City Lead Department	Potential Funding Source	Notes
				Eligible rebates include up to $70,000 per DC fast charger (DCFC) for installations at new sites and sites with stub-outs and up to $40,000 per DC fast charger for installations at replacement and make-ready sites. Installations in designated disadvantaged communities (DACs) are eligible for rebates up to $80,000 per DC fast charger regardless of installation site type. Applications accepted on an ongoing basis while funds available.
M.3 Increase City's renewable energy production and energy resilience.				
M.3.a Conduct a Feasibility Study to determine which City buildings would serve as ideal resilience centers including solar and battery installations.	Low	Public Works	General Fund	Staff in-kind/contractor
M.3.b Convert all streetlights to light emitting diode (LED) bulbs.	High	Public Works	General Fund	Up-front costs are potentially over $1 million, but offset by long-term electricity cost savings. Energy efficiency projects would be good candidates for Green Bond financing, to be repaid using General Fund monies that otherwise would have been spent on utility costs.
M.3.c Work with SCE to identify and develop local solar projects to connect to the grid.	Low	Public Works	General Fund, possibly incorporate costs into Lighting and Landscaping Assessment District	Staff in-kind; solar development funded by sale of power generated Solar projects would be good candidates for Green Bond financing, to be repaid using General Fund monies that otherwise would have been spent on utility costs.

Move	Cost	City Lead Department	Potential Funding Source	Notes
M.3.d Install solar arrays at facilities that currently do not have solar arrays and work with emergency services to add solar and battery storage at priority locations. Review options for potential to combine multiple buildings into micro-grid systems.	High	Public Works	General Fund	Up-front costs would be substantially over $50,000, but offset by long-term electricity cost savings. Solar projects would be good candidates for Green Bond financing, to be repaid using General Fund monies that otherwise would have been spent on utility costs. Coordinate with Move E.4.c.
M.3.e Explore opportunities and partnerships to develop renewable-powered fuel cell micro-grids to provide back-up or primary power for critical facilities such as hospitals and schools as a clean alternative to diesel generators.	Low	Public Works	General Fund	Staff in-kind Coordinate with Move E.4.c.

Appendix F:
CEQA Document

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