

Office of the City Manager

INFORMATION CALENDAR

November 30, 2021

To: Honorable Mayor and Members of the City Council
 From: Dee Williams-Ridley, City Manager
 Submitted by: Jordan Klein, Director, Department of Planning and Development
 Subject: Berkeley's 2019 Community-Wide Greenhouse Gas Emissions Inventory

SUMMARY

City staff conducts an annual greenhouse gas (GHG) emissions inventory to understand the sources of community-wide GHG emissions, to measure progress towards meeting the City's Climate Action Plan (CAP) goals, and to move toward becoming a Fossil Fuel-Free city. Like previous annual inventories, Berkeley's 2019 community-wide GHG inventory focuses on emissions specifically occurring within the City and includes the following sources: transportation (on-road vehicles and public transit), building electricity usage, building natural gas consumption, landfill solid waste, and emissions from water consumption and wastewater treatment.

Total community-wide GHG emissions in 2019 decreased 26% from the 2000 baseline, and decreased 4% from 2018. The GHG emissions inventory for 2019 was the last inventory before the COVID-19 pandemic, which will impact the data found in future inventories, particularly in the transportation and building sectors.

CURRENT SITUATION AND ITS EFFECTS

Berkeley's community-wide GHG emissions inventory is a Strategic Plan Priority Project, advancing our goal to be a global leader in addressing climate change, advancing environmental justice, and protecting the environment.

2019 Community-Wide Greenhouse Gas Emissions Inventory

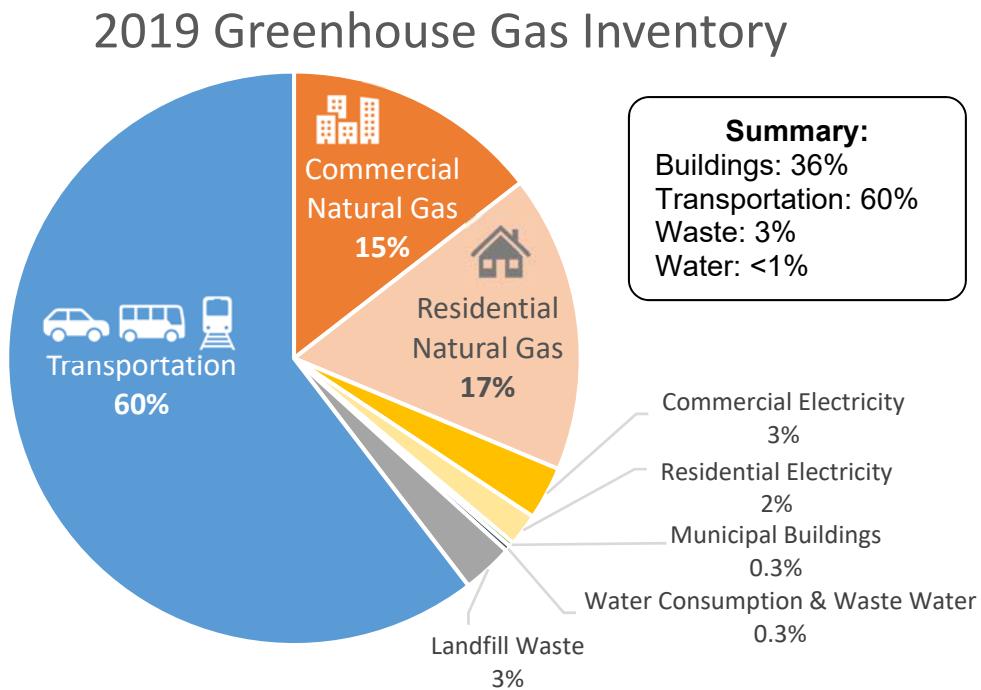
In 2019, Berkeley's community-wide greenhouse gas emissions totaled 540,569 metric tons of carbon dioxide equivalent (mtCO₂e).

The distribution of Berkeley's emissions seen below in **Figure 1** is similar to previous years, with the majority of emissions coming from Berkeley's transportation sector and the natural gas consumed within buildings. Emissions from the transportation sector, which includes on-road vehicles, BART, AC Transit, Amtrak and maritime vessels, accounted for 60% (326,568 mtCO₂e) of the overall emissions.

Energy usage data for Berkeley buildings, provided by East Bay Community Energy (EBCE) and PG&E, is broken down into residential, municipal, and commercial (including industrial) buildings—for both electricity use and natural gas combustion. The

built environment is the second largest source of emissions at 36% (196,819 mtCO₂e). As the electricity grid becomes cleaner, the combustion of fossil fuels (i.e., natural gas) within Berkeley's buildings becomes the primary source of the building sector's emissions, accounting for 32% of Berkeley's overall greenhouse emissions.

Figure 1: Pie chart of 2019 community-wide GHG emissions inventory, broken down by sector and fuel.



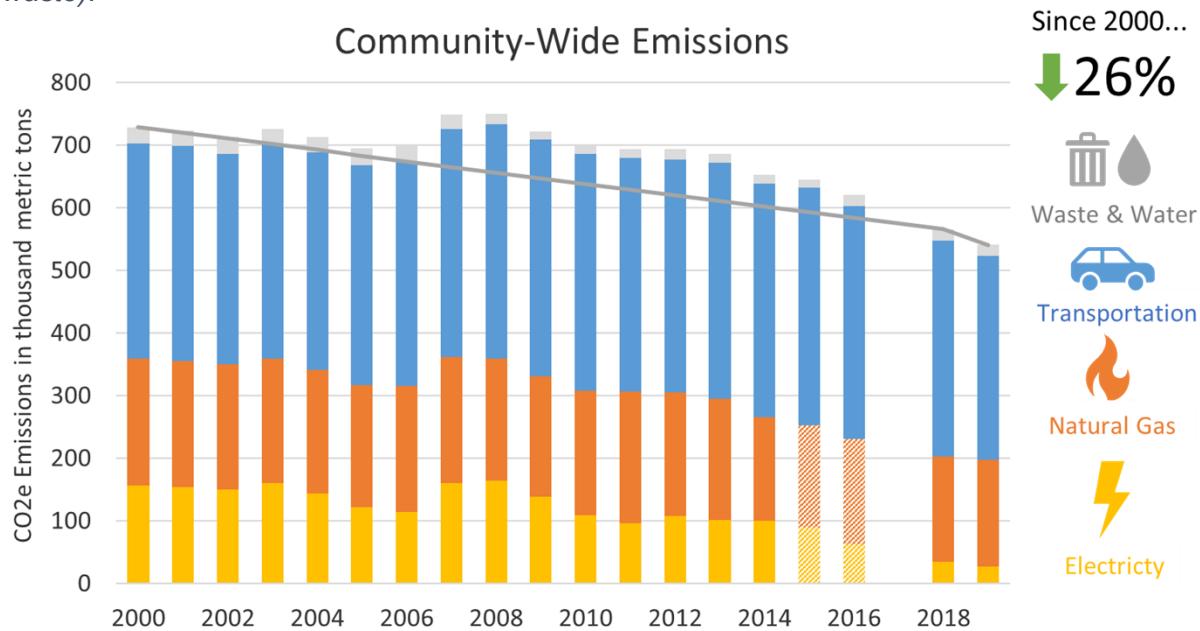
Emissions from Berkeley's municipal buildings account for 0.3% (1,442 mtCO₂e) of the 2019 community-wide emissions. See **Attachment 1** for additional information on Berkeley's municipal building energy efficiency and electrification projects.

The remaining 4% (17,182 mtCO₂e) of Berkeley's community-wide emissions come from landfill solid waste, water consumption, and waste water treatment.

Current Community-Wide Sector-Based GHG Emission Trends

The most current community emissions from 2019 are compared to the Climate Action Plan (CAP) baseline year of 2000, to identify reductions achieved thus far. A historic summary of Berkeley's annual emissions inventories from 2000 to 2019 is provided in **Figure 2**. Please note that due to data access issues, building energy use data for 2015 and 2016 was developed with assumptions and is represented with shaded coloring. No inventory was calculated for 2017, so that year of data is omitted.

Figure 1: Historic Berkeley emissions inventories back to 2000, broken out into building natural gas and electricity, transportation, and other (water, wastewater treatment and landfill solid waste).



Community-wide emissions in 2019 decreased 26% from the 2000 baseline and decreased 4% from 2018. Berkeley has moved beyond its initial emissions reduction goal, 80% GHG emissions reduction by 2050, established by the CAP. On May 11, 2021, Berkeley City Council committed to become zero net emissions by 2045 or sooner¹, requiring an additional 74% reduction of GHG emissions over the next 24 years.

Buildings

Overall greenhouse gas emissions from Berkeley's building sector decreased by 3% from 2018 to 2019, placing our current building sector emissions 45% below our 2000 baseline. Total community-wide electricity usage decreased 4% while total community-wide natural gas usage increased by 1% from 2018 to 2019.

Impacts to Berkeley's Building sector emissions:

- PG&E Electricity Emission Factor - While the majority of the community-wide electricity is provided by EBCE, 7% was provided by PG&E in 2019. PG&E's default electricity product for 2019 was initially calculated to be nearly emissions-free through a new calculation methodology, but is currently being re-evaluated

¹Commit to Race to Zero Council Report and Resolution, May 11, 2021:
https://www.cityofberkeley.info/Clerk/City_Council/2021/05_May/Documents/2021-05-11_Item_19_Commit_to_C40_Race_to_Zero_Campaign.aspx

by the Climate Registry². Until the 2019 emission factor is published, the Climate Registry has specified that PG&E's 2018 emission factor should be used for 2019 calculations.

- Continual Roll-out of East Bay Community Energy – In 2018, 31% of our community-wide electricity usage was provided by EBCE, with 1% of that usage provided by one of EBCE's emissions-free products, Renewable 100 and Brilliant 100. The automatic roll-out, switching both residential and commercial accounts from electricity purchased through PG&E to EBCE, continued into 2019. Due to this rollout, electricity provided by EBCE increased to 93% of community-wide electricity usage for 2019 and the usage provided by one of EBCE's emissions free products increased to 3%.
- EBCE Bright Choice Electricity Emission Factor – The emission factor for EBCE's default electricity product, Bright Choice, increased by 34% in 2019. The Bright Choice product accounts for 90% of our 2019 community-wide electricity consumption. Even with the emission factor increasing from 2018 to 2019 it still remains significantly lower than PG&E's emission factor for 2018. The increase is related to the changing procurement costs and loss of nuclear allocation in the 2019 electricity mix. EBCE is committed to providing 100% emission-free Bright Choice by 2030. Additionally, during 2022, all Berkeley Customers will be automatically opted-up into EBCE's Renewable 100³.

Transportation

A new data source and methodology was used to calculate community-wide emissions from the transportation sector. Using the new methodology, total community-wide transportation emissions decreased 5% from 2018 to 2019 due in part to more sustainable modes of commuting.

The City has historically used the Bay Area's Metropolitan Transportation Commission (MTC), Travel Model One, to calculate emissions for the transportation sector. Travel Model One is based on a simulation model of typical weekday travel, created to assist in regional planning activities. The model's projections use historic data, and estimate total vehicle miles on 5-year increments. As a result, using this model makes it difficult to track the impact of new transportation policies, yearly changes to commuting patterns, or impacts from events like the COVID-19 pandemic.

² Emission factors for both PG&E and EBCE electricity are verified by a third-party and publicly reported through the Climate Registry: <https://www.theclimateregistry.org/our-members/cris-public-reports/>

³ Energy Commission Report to Council: Adopt a Resolution to Upgrade Residential and Commercial Customers to East Bay Community Energy (EBCE) Renewable 100 Plan, June 29, 2021: https://www.cityofberkeley.info/Clerk/City_Council/2021/06_June/Documents/2021-06-29_Item_24_Adopt_a_Resolution_to_Upgrade_Residential.aspx

In December 2018, Google launched the Environmental Insights Explorer (EIE). Google EIE is a free tool that helps cities measure emissions from both building energy usage and on-road transportation. Google EIE estimates vehicle miles based on aggregated and anonymized location history data⁴. Since the data is based on continuous observation, Google EIE data is a more accurate indicator of year-to-year changes to local transportation activity and the commuting impacts from COVID-19.

In addition to providing vehicle miles, Google EIE data provides the share of miles traveled through sustainable modes of transportation (see **Figure 3**). The total number of miles traveled through sustainable modes of transportation, which includes public transit, cycling, and walking, increased by 13% from 2018 to 2019, with the majority of these miles being taken on BART and/or on foot (see **Figure 4**). During that same time period, the total number of miles driven by people in automotive vehicles decreased by 4%. This is the first year Berkeley has been able to track these modes at this level of detail.

Impacts to Berkeley's Transportation sector emissions:

- Switching from MTC to Google EIE model - 2018 is the first available year for Google's EIE data and Berkeley's 2018 emissions inventory was updated with the new methodology. Inventories prior to 2018 will remain on the MTC modeled transportation emissions. Switching to the Google EIE data has slightly increased the transportation sector emissions for both 2018 and 2019. The 2018 transportation sector emissions calculated with Google EIE data was 7% higher than the MTC modeled emissions, and the 2019 transportation emissions with Google EIE data was only 2% higher than the MTC modeled emissions.
- Using National Defaults – The 2019 transportation emissions were calculated using total vehicle miles traveled from Google EIE and national default values for determining vehicle categories and their average fuel economy. Over the next year, staff will work to develop and vet a

Figure 2: Total miles traveled via automotive and sustainable modes of transportation.

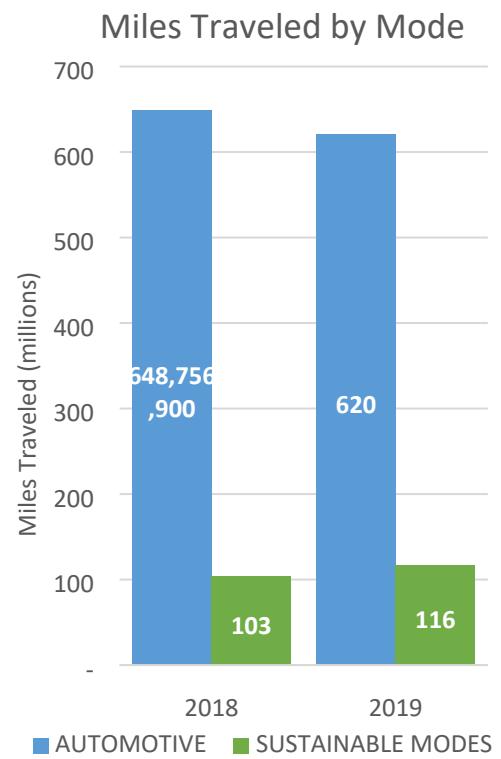
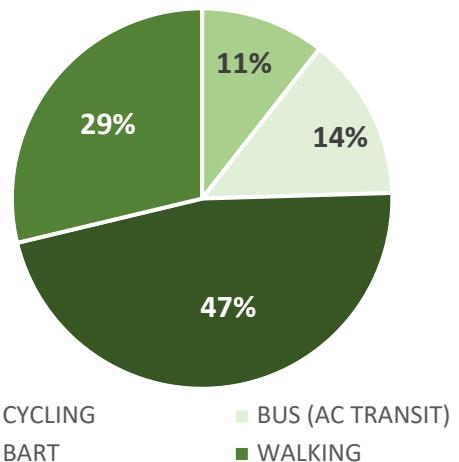


Figure 3: Proportion of miles traveled on sustainable modes of transportation by type for 2019.

2019 Sustainable Modes



⁴ [Technical Review of Google Environmental Insights Explorer](#)

new methodology to replace the national defaults with local values.

Landfill Solid Waste

Total community-wide landfill solid waste and overall emissions from the waste sector decreased by 3.6% in 2019 compared to 2018, placing our current waste sector emissions 35% below our 2000 baseline.

Additional Context

- Race to Zero – The Race to Zero is global campaign run by the COP26 Presidency and High-Level Climate Champions to rally non-state entities, including companies, cities and regions, to take immediate action to halve global emissions by 2030 and be net zero emissions by 2050. The City of Berkeley joined⁵ the Race to Zero initiative on May 11, 2021, committing to reach net zero emissions by 2045 and to set an interim 2030 target consistent with a fair share of 50% global emission reductions.
- Consumption-Based GHG Emissions Inventory - Although the more traditional emission inventory that Berkeley uses—known as a “production-based” or “sector-based” inventory—lays a foundation for key climate policy and program planning, taking a look at the emissions beyond Berkeley’s borders is necessary to address the climate crisis as a regional or global issue. Consumption-based inventories consider the entire life cycle of a specific product to calculate its GHG emissions. Included are goods and services such as air travel (even if, as for Berkeley, the airport is located outside of a jurisdictional boundary), food, appliances, and construction of buildings. An inventory of all Alameda County cities was created by the CoolClimate Network in 2018⁶ and was reported in Berkeley’s Community-wide Greenhouse Gas Emissions Inventory that year. Capturing this data accurately has been proven very complex and there is currently no standardized methodology to account and report across cities.
- Embodied Carbon – Embodied carbon is the carbon dioxide equivalent (CO₂e) emissions associated with the materials and construction process for buildings or infrastructure. Only operational carbon, from building energy consumption, is captured through Berkeley’s building sector emissions and emissions related to a building’s embodied carbon are not included in Berkeley’s annual emissions inventory.
- Interest in Regional/State inventories – There is increasing interest in transitioning annual local greenhouse gas inventories to a regional or state entity, such as the California Air Resources Board (CARB). These inventories would continue to provide sector-based emissions at the city-level jurisdictional

⁵ Commit to Race to Zero Council Report and Resolution, May 11, 2021:
https://www.cityofberkeley.info/Clerk/City_Council/2021/05_May/Documents/2021-05-11_Item_19_Commit_to_C40_Race_to_Zero_Campaign.aspx

⁶ Bay Area Air Quality Management District, Consumption-Based GHG Emissions Inventory:
<https://www.baaqmd.gov/about-air-quality/research-and-data/emission-inventory/consumption-based-ghg-emissions-inventory>

boundary but the data collection, processing, and reporting would be completed by a regional or state entity. These groups have better access to the data needed for this work and it would increase standardization of the varying inventory methodologies across local jurisdictions, allowing for meaningful cross-jurisdictional comparisons.

Staff will continue to work with regional and other partners, such as StopWaste, the Local Government Commission, and the Urban Sustainability Director's Network, to monitor advances in greenhouse inventory models, tools, and frameworks that would improve Berkeley's understanding and efforts to capture community-wide emissions.

BACKGROUND

Since Berkeley's adoption of its historic Climate Action Plan in 2009, city staff has conducted an annual GHG emissions inventory in order to understand the sources of community-wide GHG emissions, and the impacts of local, regional, and larger efforts to reduce emissions. Data is gathered from regional entities on sector-specific activities, and is then converted to metric tons of carbon dioxide equivalent (mtCO₂e). The inventory utilizes the best available data and follows the Global Covenant of Mayors for Climate & Energy protocol which allows the City to report consistently to the community and to other agencies.

Although this inventory does not include UC Berkeley and The Berkeley Lab, as they are outside the City's jurisdiction, they continue to be valued partners in efforts working to improve Berkeley's shared community emissions and combat climate change.

ENVIRONMENTAL SUSTAINABILITY AND CLIMATE IMPACTS

Berkeley's community-wide annual greenhouse gas inventory allows the city to measure and track its progress for implementing Berkeley's Climate Action Plan and reaching zero net emissions by 2045.

POSSIBLE FUTURE ACTION

The Race to Zero initiative requires Cities to establish an interim science-based 2030 target that is consistent with a fair share of 50% global emission reductions. Staff is working with ICLEI, a global network of local governments, to create the required science-based 2030 target. Accompanying the 2019 GHG inventory report, staff will bring the 2030 emission reduction target to Council for consideration.

FISCAL IMPACTS OF POSSIBLE FUTURE ACTION

There are no direct fiscal impacts to establishing the science-based 2030 target.

CONTACT PERSON

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Attachments:

1: Municipal Facilities Emissions Savings Upgrades (2019)

Attachment 1: Municipal Facilities Emissions Savings Upgrades (2019)

The City continues to make improvements to its municipal facilities to increase energy efficiency, lower energy costs, reduce greenhouse gas (GHG) emissions, and transition buildings toward being all-electric powered by clean electricity. Municipal buildings use emissions-free electricity from East Bay Community Energy (EBCE), purchasing the Brilliant 100 product in 2019 and the Renewable 100 product as of 2021.

Energy upgrades, including efficiency and electrification, were integrated into building renovations and capital improvement projects during 2019. Those projects and others funded through incentives and grants, are highlighted below:

Mental Health Adult Services Clinic, 2640 Martin Luther King Jr. Way

Significant building renovation, with the intent of being an all-electric zero emissions building, was started in 2018. Older plumbing equipment was replaced with high efficiency products and inefficient natural gas systems were replaced with efficient electric heat pump technology. All of the natural gas end uses were eliminated and the gas meter was removed. Electric service was increased to accommodate new heating and cooling energy loads, and a solar electric system was installed that is intended to offset 100% of the electric energy used at this site. The building will have a formal case study done, as part of the Lawrence Berkeley National Labs grant, which also includes energy monitoring for several years.

Live Oak Recreation Center, 1301 Shattuck Avenue

Renovations during 2019 included energy upgrades and partial electrification of the heating systems to remove gas wall furnaces in the recreation center. Gas heat remains in the theater portion of the building, which is leased to various entities. Water heating has been electrified and a new roof with insulation was installed to reduce summer solar heat gain and preserve winter heat provided by the heat pump. Large ceiling-mounted fans were installed in the gymnasium area to increase occupant comfort and save on cooling loads. A full cost and energy analysis will be done for 2020.

North Berkeley Senior Center, 1901 Hearst Avenue

This Senior Center closed for renovations in 2019 and will be an all-electric building when completed by 2022. The gas boilers were replaced with high efficiency heat pumps and a solar PV system has been added to offset annual energy use. An EBCE grant of \$49,000 for Commercial Kitchen Electrification was awarded in 2021 for both North and South Berkeley Senior Centers. The grant provides funding to replace the gas range with a new six-burner electric induction cooktop. It will also replace the original kitchen steam table, which used natural gas-heated hot water and electric resistance heaters to keep food warm, with a new dry well induction food warming table, thereby reducing electric load and eliminating this need for hot water, saving both gas and water costs.

South Berkeley Senior Center, 2939 Ellis Street

The South Berkeley Senior Center is also a recipient of the same Commercial Kitchen Electrification grant to the City from EBCE. This grant will cover some of the costs of new induction cooktop, a new drywell food warmer to replace the original steam table, the costs of all electrical induction cooking equipment, and labor to rewire circuits to these appliances.

Public Safety Building, 2100 Martin Luther King Jr Way

Beginning in 2018, the Public Safety Building (PSB) started participating in an Automated Demand Response (ADR) project that resulted in cost savings of about \$11,000 that year, plus a one-time incentive of \$1,400. A lighting upgrade to LEDs and better lighting controls was completed in the PSB in 2019, resulting in total cost savings of \$13,600 in 2019. The lighting upgrade was the City's first On Bill Financing (OBF) project. The total cost was \$250,000, with zero up-front costs; the City is repaying the loan on its monthly utility bill. The loan payment is roughly equal to the energy cost savings, resulting in no cost increase for the City, while reducing energy use and GHG emissions. Additional OBF projects are being developed as energy efficiency and electrification assessments are completed for other City buildings.

Dona Spring Animal Shelter, 1 Bolivar Drive

A complete energy assessment was done in 2018-2019 of all systems at the Animal Shelter, including HVAC, lighting, and plug loads. This study delineated the energy used by the AT&T cell phone tower on top of the building from the Animal Shelter operations.

Municipal Street Light Retrofit to Lower Wattage LEDs, citywide

Municipal street lights were originally converted to LEDs in 2010-2012. In 2018-2020, approximately 7,000 cobra head street light fixtures were replaced due to a manufacturing defect. The new, lower wattage fixtures, provided by the vendor to the City at no cost, meet CalTrans standards and will result in considerably less energy consumed and lower utility bills. A full cost and energy analysis of this project is pending, as PG&E is still correcting the billing and providing updated energy consumption for 2019.