CITY OF BOULDER'S 2019 GREENHOUSE GAS EMISSIONS INVENTORY & SUMMARY REPORT

SEPTEMBER 2020

CITY OF BOULDER

lotus
engineering & sustainability

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Photo from Taylor Brandon / Unsplash
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INTRODUCTION

The City of Boulder aims to reduce greenhouse gas (GHG) emissions at least 15% below 2005 levels by 2020 and at least 80% by 2050. Additionally, Boulder has committed to powering the city with 100% renewable electricity by 2030, with at least 50% of that electricity being produced locally.[1] Since Boulder started conducting an annual greenhouse gas inventory, the city has experienced year over year reductions in emissions. As of 2019, the community had reduced emissions by 21% since 2005 – surpassing its 2020 goal by 6%. This reduction has happened even though between 2005 and 2019, Boulder's population, gross domestic product (GDP), and square footage have increased by 9%, 71%, and 11%, respectively.

The reduction in emissions have been driven by:

- ***Cleaner Electricity:*** Since 2005, the electricity emission factor for carbon dioxide (CO_2) has decreased by 38% due to additional renewable energy resources and the reduction of coal and natural gas on the grid. In 2019, the electricity emission factor for CO_2 decreased by 7% from 2018.
- ***Reduction in electricity consumption:*** Specifically, the commercial and industrial sector decreased electricity consumption, and correspondingly GHG emissions, by 5% in 2019, while total electricity consumption also decreased by 3%.
- ***Reduced emissions from on-road transportation:*** Since 2005, on-road transportation emissions have decreased by 15% due to more efficient vehicles and the increase in the number of electric vehicles.
- ***Reduced emissions from solid waste:*** Since 2005, solid waste emissions have decreased by 59% due to an increase in waste diversion from composting and recycling.

While many emission sources have decreased, some sources of emissions have increased since 2005 including:

- ***Natural gas usage:*** Since 2005, natural gas usage has increased by more than 11%.
- ***Aviation emissions:*** Since 2005, emissions from the Boulder Municipal Airport have increased by 36% due to increased demand.

However, there is more work to do, and Boulder remains committed to striving toward further community emission reductions. To quantify the community's 2019 GHG emissions, the city contracted Lotus Engineering and Sustainability, LLC (Lotus) to complete a 2019 community GHG emissions inventory. This report describes the results of the 2019 inventory and compares results against the city's 2005 baseline year and the subsequent 2012, 2015, 2016, 2017, and 2018 inventories.

1 For more information see https://bouldercolorado.gov/climate/climate-commitment.

The 2019 GHG inventory was completed using the same approach as was used for previous community inventories -- the Global Protocol for Community-Scale Greenhouse Emission Inventories (GPC).[2] The GPC protocol provides a robust framework for accounting and reporting city-wide greenhouse gas emissions. This protocol is also the required protocol for cities committed to the Global Covenant of Mayors for Climate & Energy that Boulder committed to in 2015.[3] By completing a GPC-compliant inventory, Boulder can report emissions to the Carbon Disclosure Project (CDP),[4] which outwardly demonstrates Boulder's climate change commitments to a global audience. Tracking annual emissions also allows the city to regularly update the community on progress toward goals on their "Boulder Measures" city-wide dashboard.[5]

The following report reviews how the 2019 inventory was completed, 2019 greenhouse gas emissions sources, and trends in emissions between 2005 and 2019 and 2018 and 2019.

2 For more information see: https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities.
3 For more information see: https://www.globalcovenantofmayors.org/.
4 For more information see: https://www.cdp.net/en/info/about-us.
5 For more information see: https://bouldercolorado.gov/boulder-measures.

KEY FINDINGS FROM 2019 INVENTORY

The 2019 City of Boulder greenhouse gas inventory showed an emission value of 1,466,276 metric tons of carbon dioxide equivalent (MT CO_2e,). The 2019 emissions sector and source results are relatively consistent with previous inventories.

As shown in Figure 1, the largest portion of community emissions (52% at 760,201 MT CO_2e) were attributed to the commercial and industrial (C&I) buildings sector. Residential buildings comprised 18% of total emissions (257,050 MT CO_2e when residential fugitive emissions are included) and, when combined with the C&I buildings sector, emissions from all community buildings comprised 70% (1,017,251 MT CO_2e) of total emissions. The transportation sector accounted for 29% (426,264 MT CO_2e). While the majority of these emissions are from on-road travel and transit (over 99.7%, or 425,167 MT CO_2e), this category also includes emissions attributed to railways (317 MT CO_2e) and Boulder Municipal Airport (780 MT CO_2e). Emissions from buildings and transportation comprised nearly 98% of all emissions. The remaining emissions come from the solid waste and wastewater treatment sectors (22,118 MT CO_2e and 642 MT CO_2e, respectively).

Within each of the sectors, there are several sources of emissions, and some sources are attributed to multiple sectors. For example, electricity is a source of emissions that is captured within the C&I building sector, the residential sector, and the transportation sector. The largest source of emissions is electricity (44% or 649,703 MT CO_2e). Transportation (including on-road vehicles, transit, and railways and local aviation) is the second largest source (29% or 425,185 MT CO_2e). Stationary fuels (e.g. natural gas, propane, and stationary diesel), such as those used in buildings, was the third largest source (25% or 367,548 MT CO_2e). The remaining emission

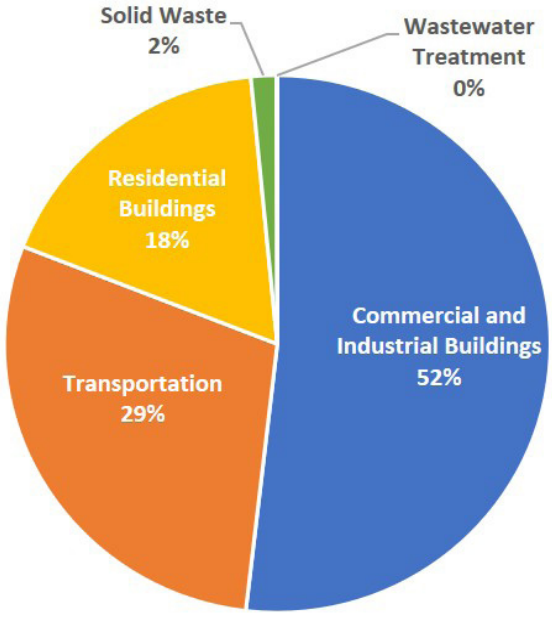

Figure 1. Emissions by sector (mt CO2e).

sources include solid waste (2% or 22,118 MT CO_2e) and wastewater (0.04% or 642 MT CO_2e). Figure 2 shows emissions by source, while Figure 3 provides additional information regarding sector and sources.

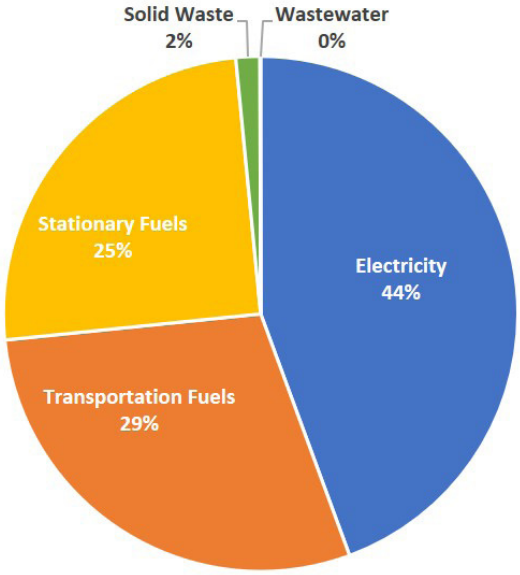

Figure 2. Emissions by source (mt CO_2e).

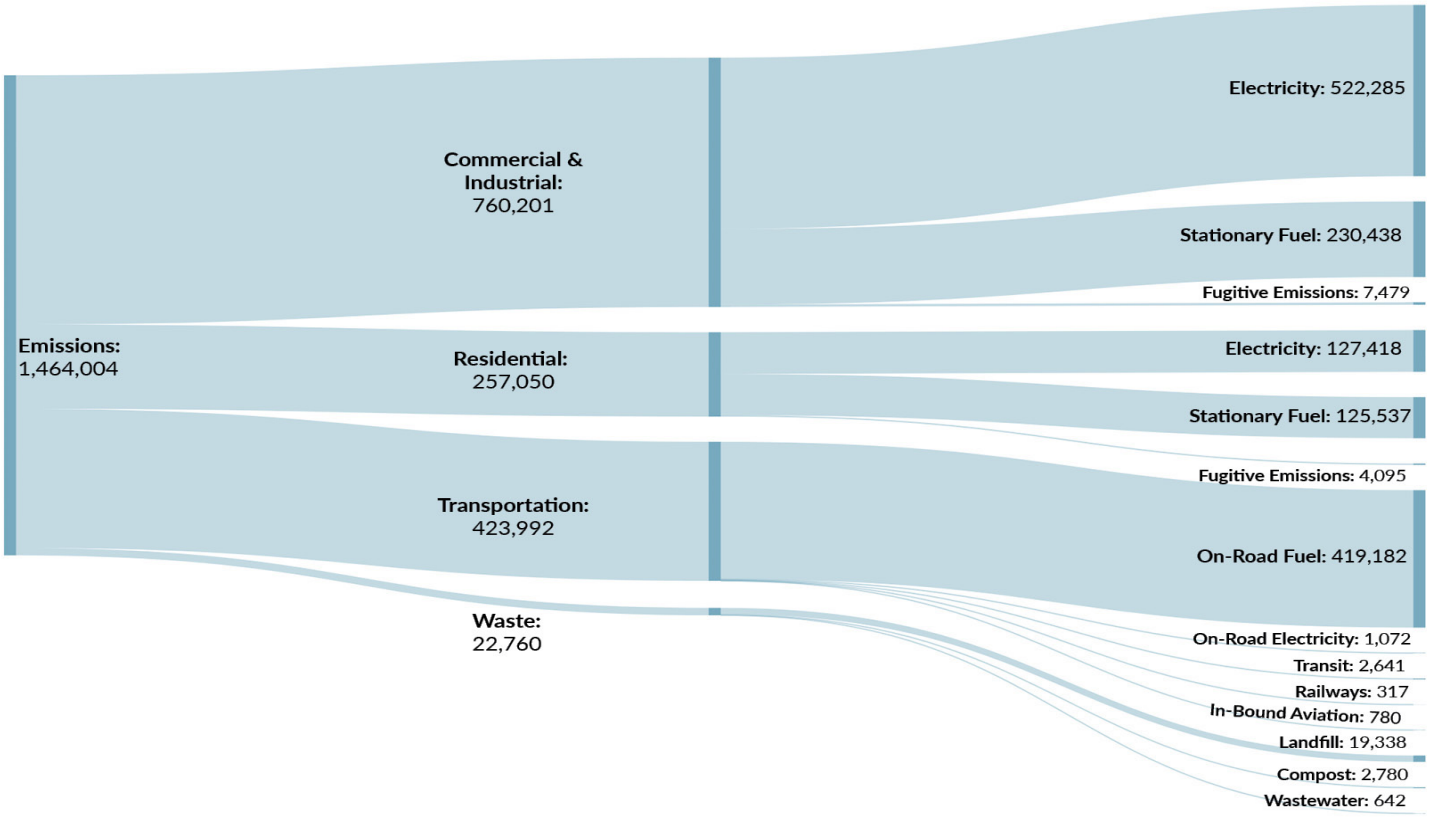

Figure 3. City of Boulder's greenhouse gas emissions inventory (mt CO_2e).

COMPARISON BETWEEN INVENTORIES

Total community emissions have decreased by 21% (see Table 1) since the 2005 baseline.

Table 1. Sector and source emission comparison over time (mt CO_2e).

Sector	2005 (Baseline)	2012	2015	2016	2017	2018	2019	% Change Between Baseline and 2019
Residential Electric	201,710	174,506	164,759	145,565	141,210	134,347	127,418	-37%
Residential Natural Gas	109,717	99,457	109,554	105,685	104,369	112,972	125,536	14%
C&I Electric	812,849	790,966	748,651	657,351	632,470	587,601	522,285	-36%
C&I Natural Gas	164,371	196,634	198,786	204,493	206,699	215,510	230,438	41%
Fugitive Emissions	-	9,237	9,619	10,012	10,086	10,678	11,574	NA
Total Buildings	**1,288,647**	**1,270,800**	**1,231,369**	**1,123,106**	**1,094,834**	**1,061,108**	**1,017,251**	**-21%**
Vehicle Travel	501,358	423,892	446,797	448,994	430,168	429,443	425,167	-15%
Railways	-	-	-	40	40	97	317	NA
Air Travel (BMA)	572	626	653	630	701	852	780	36%
Total Transportation	**501,930**	**424,528**	**447,450**	**449,664**	**430,909**	**430,392**	**425,484**	**-15%**
Landfill	53,840	14,920	19,932	22,838	18,663	18,233	19,338	-64%
Composting	-	1,257	2,129	2,446	2,267	3,083	2,781	NA
Wastewater Treatment	1,800	697	671	809	722	704	642	-64%
Total Waste	**55,640**	**16,874**	**22,732**	**26,093**	**21,652**	**22,020**	**22,760**	**-59%**
Total BASIC	**1,846,217**	**1,712,192**	**1,701,551**	**1,598,863**	**1,547,395**	**1,513,520**	**1,466,276**	**-21%**

Electricity represents the single largest source of emissions savings, which is attributable to the significant improvements in the electricity grid combined with increased adoption of local renewable generation and energy efficiency. The increase in natural gas emissions is driven by an increase in consumption and the addition of including fugitive emissions from natural gas. The increase in air travel emissions is attributable to a significant increase in air travel at Boulder Municipal Airport beginning in 2017. These increases, as well as a detailed comparison of normalized emission data (e.g., emissions per capita) and activity data (e.g., energy consumption, vehicle miles traveled, etc.), are further discussed in the section Factors Influencing Emissions.

Figure 4 shows trends by source. Most sources have declined each year, apart from stationary fuel.[6]

6 Railway emissions were not accounted for in the 2005, 2012, and 2015 inventories.

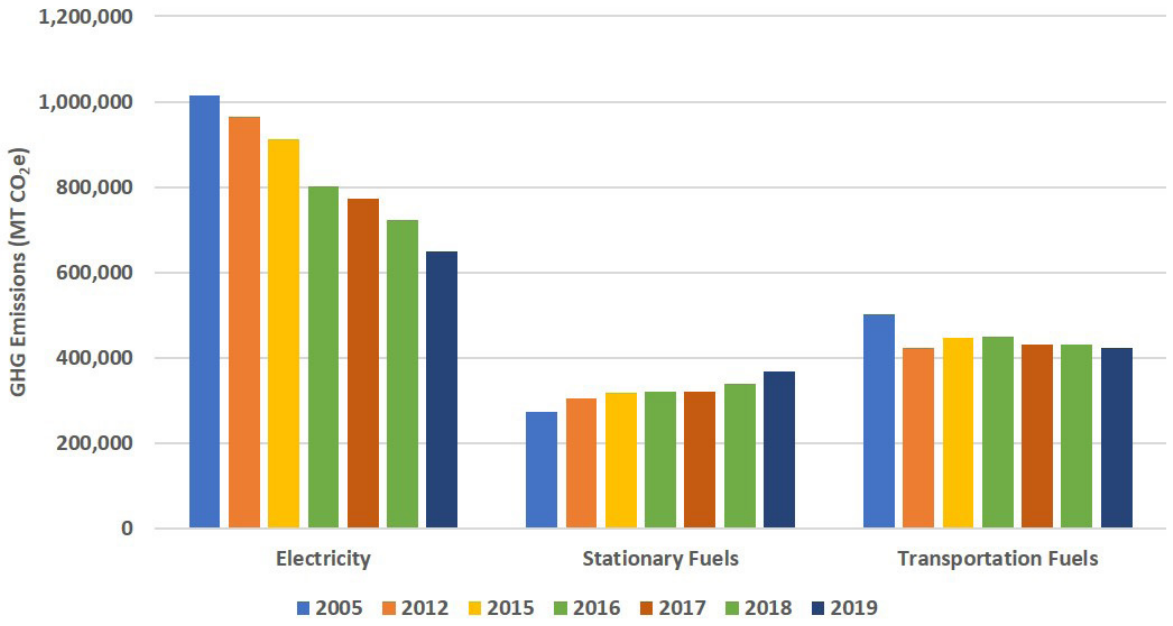

Figure 4. Primary emission sources 2005 to 2019.

The relative contributions from each emission category have remained consistent over the years, as shown in Figure 5. Emissions from C&I buildings comprise the majority of total emissions, while on-road transportation emissions are second, and residential building emissions are third.

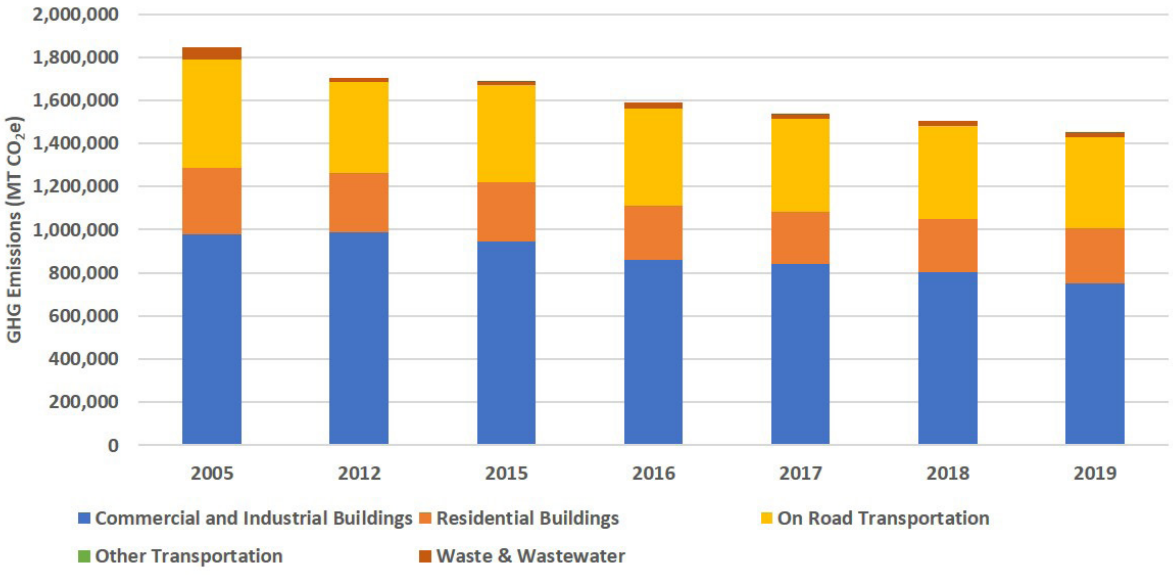

Figure 5. Emissions breakout over time by end use.

While Boulder has achieved an overall emissions reduction of 21% between 2005 and 2019, normalized metrics[7] indicate even greater emission reduction achievements, as shown in Table 2. After normalizing total emissions for indicating growth factors, significant savings are revealed.

Table 2. Normalized emissions metrics.

Emission Metrics	Units	2005 (Baseline)	2019	Change since 2005
Total emissions per capita	MT CO_2e/resident	18.7	13.7	-27%
Total emissions per Gross Domestic Product (GDP)	MT CO_2e / $	0.00011	0.00005	-55%
Residential electricity per person	kilowatt hour (kwh)/ person	2,483	2,298	-8%
C&I natural gas per building floor space	decatherm (dTh)/sq.ft.	0.093	0.092	-1%
VMT per capita	VMT/resident	9,699	8,486	-13%
Landfill tons per capita	tons/resident	0.85	0.85	0%

To understand how Boulder is performing relative to other communities, Boulder's 2019 per capita emissions were compared to other cities, with the results depicted in Table 3.[8]

Table 3. Per capita emissions city comparison.

City	Per Capita Emissions (MT CO_2e)
Boulder, CO (2019)	**13.7**
Colorado (2018)	21
Denver, CO (2019)	11.6
Westminster, CO (2018)	12.1
Fort Collins, CO (2018)	12
Boulder, CO (2050 Climate Goal)	**3 (Anticipated)**

Per capita emission trends allow Boulder residents to relate directly to the impact their local activity has on larger global issues like climate change. Understanding GHG emissions inventories and the per capita emissions trends provides a foundation from which Boulder can work from to encourage residents to reduce their footprint as a global citizen.

7 Normalized metrics are intensity ratios that can be used in GHG emissions accounting to scale the net generated emissions by business metrics or other financial or community indicators, such as emissions per person or emissions per job.
8 Methodologies for calculating per capita emissions may differ by city.

COMPARISON AGAINST GHG EMISSION REDUCTION TARGETS

Boulder has already met its 2020 emission target and continues to make progress against its 2050 GHG emission reduction targets. See Figure 6 for details.

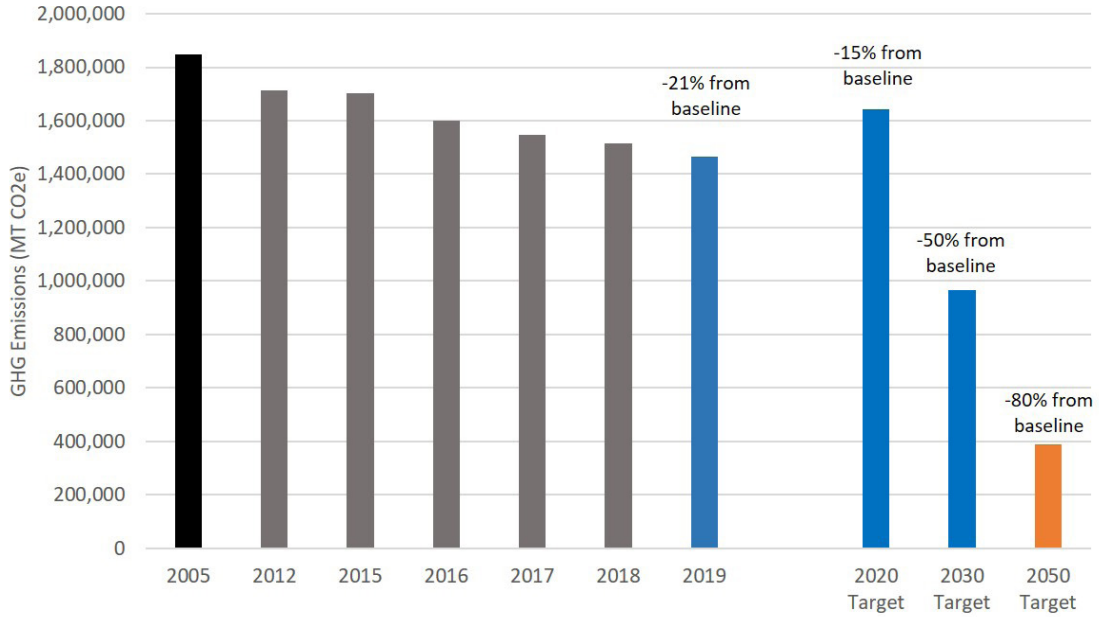

Figure 6. Overall community emission trends and goals.

FACTORS INFLUENCING EMISSIONS

The city uses the annual GHG study to understand how programs, policies and education efforts may be influencing emission reductions and to identify opportunity areas for increased emphasis.

Emission Factor Trends

A significant contributor to Boulder's emission reductions since 2005 is a cleaner electricity grid supplying energy to the community. Colorado's Renewable Energy Standard[9] and the state's Clean Air Clean Jobs Act[10] require Xcel Energy, Boulder's electricity provider, to increase the efficiency of its operations and procure increasing amounts of energy from low- to zero-carbon sources (i.e., renewable energy, recycled energy, etc.). Further, House Bill 1261, passed in 2019, requires a reduction in greenhouse gas emissions within all sectors of the state's economy, including electricity generation.[11] The Public Utilities Commission has approved Xcel Energy's Colorado Energy Plan, which maps the utility's work to reduce emissions to meet its own goal of an 80% reduction in electricity generation emissions by 2030.[12] As a result of this work, the mix of energy sources that supply Xcel Energy's

9 For more information see: https://www.xcelenergy.com/staticfiles/xe/Corporate/CRR2013/environment/renewable-energy.html.
10 For more information see: https://www.xcelenergy.com/environment/system_improvements/colorado_clean_air_clean_jobs.
11 For more information see: https://leg.colorado.gov/bills/hb19-1261.
12 For more information see: https://www.xcelenergy.com/staticfiles/xe-responsive/Company/Rates%20&%20Regulations/Regulatory%20Filings/CO%20Recent%20Filings/Colorado%20Energy%20Plan%202020.pdf.

electric grid changes every year and the resulting electricity emission factor decreases every year. Based on data from Xcel Energy, in 2019 the electricity emission factor for carbon dioxide (CO_2) has decreased by 38% from 2005, and by 7% from 2018.[13] See Table 4.

Table 4. Changes in electricity emission factors.

Energy	Units	2005 (Baseline)	2018	2019	Change since 2005	Change since 2018
Electricity Emissions Factor	MT CO_2e / MWh	0.824	0.552	0.514	-38%	-7%

Community Indicator Trends

Between 2005 and 2019, Boulder experienced growth across most community indicators; the exception to this trend in 2019 is in regard to the number of cooling degree days, which indicates that 2019 was a marginally cooler year locally than in 2005. The city tax revenue has doubled from 2005, and most other indicators have grown by a factor of 10% or more. The change in key community indicators for 2005, 2018 and 2019 are shown in Table 5.[14]

Table 5. Changes in community indicators.

Community Indicators	2005 (Baseline)	2018	2019	Change since 2005
Population	98,526	108,507	107,100	9%
Number of Housing Units	41,482	46,189	46,217	11%
Taxes (dollars)	$111,701,000	$224,270,000	$224,270,000	100%
Nominal GDP (million dollars)	$16,120	$25,274	$27,533	71%
Number of Service Area Jobs	96,755	100,148	106,506	10%
C&I Building Floor Space (sq. ft.)	42,091,402	46,019,288	46,847,635	11%
C&I Floor Space Excluding CU Boulder (sq.ft)	33,442,674	33,524,956	33,868,245	1%
Heating Degree Days	5,227	5,251	6,116	17%
Cooling Degree Days	745	771	724	-3%

13 Xcel Energy does not report emission factors for methane and nitrous oxide. These values are sourced from U.S. Environmental Protection Agency's (EPA) eGRID and are not expected to change annually.
14 The nominal GDP value reported in this report does not include inflation.

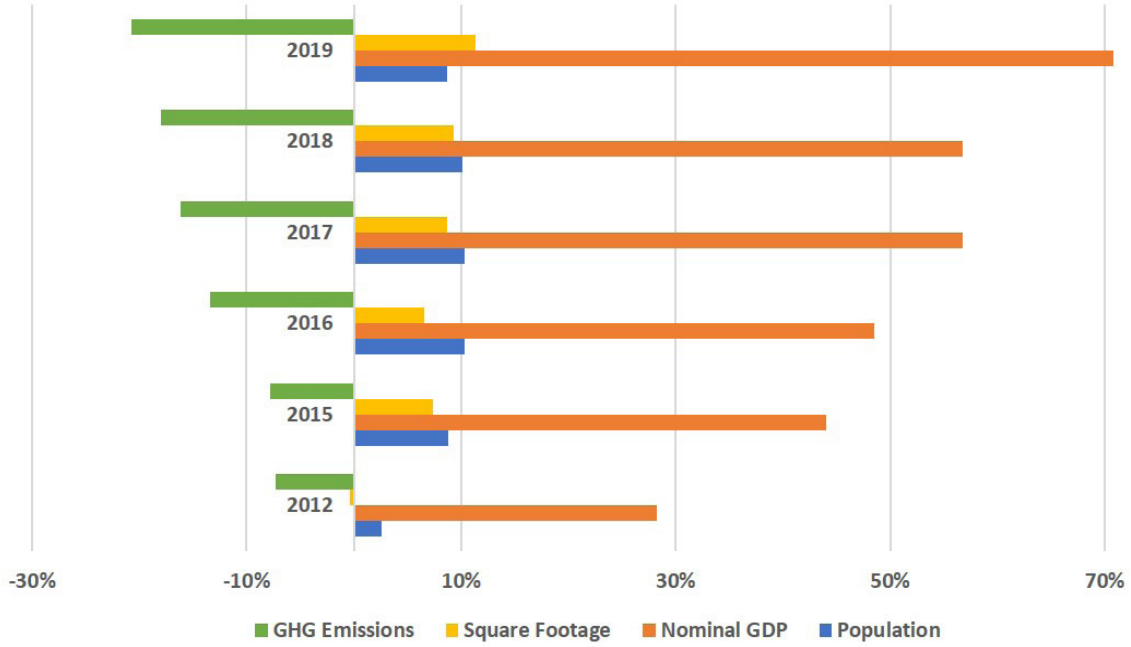

Figure 7. Changes in emissions compared to changes in key indicators.

In light of a growing community, GHG emissions have decreased every year since the baseline year (see Figure 7).

Energy Trends

Table 6 below provides the changes in energy activity data that ties directly to overall emissions. Total community electricity usage increased by almost 5% since the baseline year of 2005, and natural gas usage has increased by 11%. These increases can be largely attributed to population growth.

Table 6. Changes in energy activity data.

Energy Metrics	Units	2005 (Baseline)	2018	2019	Change Since 2005
Residential Electricity	kWh	244,648,421	241,569,146	241,111,116	1%
Residential Natural Gas	dTh	2,078,322	2,124,070	2,360,307	14%
C&I Electricity	kWh	946,243,999	1,056,561,724	1,008,805,751	7%
C&I Natural Gas	dTh	3,952,523	4,030,603	4,310,543	9%
Total Electricity Usage	**kWh**	**1,190,892,420**	**1,298,130,870**	**1,254,916,867**	**5%**
Total Natural Gas Usage	**dTh**	**6,030,845**	**6,154,673**	**6,670,850**	**11%**

Electricity Usage

Even though an increase in electricity and natural gas use is evident, when normalizing consumption for growth factors, residential electricity usage decreased since the baseline year (see Table 7). In comparison, C&I electricity slightly decreased per employee and square footage, and significantly decreased per GDP.

Table 7. Normalized activity data.

Electricity Metrics	Units	2005 (Baseline)	2018	2019	Change Since 2005
Residential electricity per housing unit (HU)	kWh/HU	5,898	5,230	5,325	-10%
Residential electricity per person	kWh/person	2,483	2,226	2,298	-8%
C&I electricity per employee (FTE)	kWh/FTE	9,780	10,550	9,715	-1%
C&I electricity per building floor space	kWh/sq. ft.	22.5	23.0	21.5	-4%
C&I electricity per GDP	kWh/$	0.059	0.042	0.037	-37%

The decrease in normalized residential electricity shows that Boulder residents are using less electricity to perform the same tasks, even while total electricity consumption remains relatively flat due to population increases. The reduction in normalized residential electricity usage is largely attributed to growing end-user awareness, aggressive building codes and demand side management programs from the city, the county and the energy utility, including Boulder's EnergySmart Program, SmartRegs, and solar incentive programs.

Increases in overall C&I electricity are a function of economic growth. Growth in some of the normalized C&I electricity metrics (such as electricity use per employee) may be primarily driven by the addition of high energy density buildings which consume significant amounts of energy within small footprints. Because of this, the most accurate metric for the C&I sector is electricity use per GDP, which has decreased by 37% since 2005. The other metrics for the C&I sector have decreased slightly between 2019 and the baseline year.

Natural Gas Usage

Natural gas consumption has increased 11% overall in the community since the baseline (see Table 6). Table 8 shows that natural gas usage has increased overall; on a normalized basis it has increased slightly in residential, stayed relatively flat for C&I, but decreased significantly in C&I when looking at productivity as represented by GDP.

Table 8. Normalized natural gas data.

Natural Gas Metrics	Units	2005 (Baseline)	2018	2019	Change Since 2005
Residential natural gas per housing unit	dTh/HU	50	46	51	2%
Residential natural gas per person	dTh/person	21	20	22	5%
C&I natural gas per employee	dTh/FTE	41	40	42	2%
C&I natural gas per floor space	dTh/sq.ft.	0.093	0.0876	0.092	-1%
C&I natural gas per GDP	dTh/$	0.00024	0.00016	0.00016	-33%

The number of heating degree days (HDD)[15] increased between 2005 and 2019 by 17% (see Table 9). Based on the increase in the number of days of colder weather, it is expected that residential natural gas use would increase. However, natural gas consumption per housing unit and per person, normalized for HDD, is nearly 13% and 11% lower than 2005, respectively.

Table 9. Comparison of residential natural gas use to HDD.

Weather Normalized Metrics	Units	2005 (Baseline)	2018	2019	Change Since 2005
Heating degree days	HDD	5,227	5,251	6,116	17%
Residential natural gas per housing unit	dTh/HU/HDD	0.00959	0.00876	0.00835	-13%
Residential natural gas per person	dTh/person/HDD	0.00404	0.00373	0.0036	-11%

The data suggests that the residential sector has seen a decrease in natural gas consumption despite the increased number of cold weather days since 2005. The current City efforts to address residential and C&I natural gas use are identified in the Action Plan section below.

Transportation Trends

Overall, emissions from the transportation sector decreased by 15% between 2005 and 2019. Vehicle travel emissions decreased by over 15% from the baseline year, while air travel emissions from Boulder Municipal Airport increased by 36%. Though activity data is limited for 2005, Table 10 shows vehicle miles traveled (VMT) decreased nearly 5% between 2005 and 2019. Note that the community VMT data was not updated between 2018 and 2019. Railway emissions were not accounted for in the 2005 inventory because data was not available. The increase in emissions seen between 2018 and 2019 reflects a more accurate approach to data collection and emissions calculations rather than a material change in this sector.

15 A heating degree day (HDD) is a measurement designed to quantify the demand for energy needed to heat a building. It is the number of sum of the degrees that each day's average temperature is below 65° Fahrenheit (18° Celsius), which is the temperature below which buildings need to be heated (https://www.investopedia.com/terms/h/heatingdegreeday.asp).

Table 10. Changes in transportation activity data.

Transportation Metrics	Units	2005 (Baseline)	2018	2019	Change Since 2005
On-road transportation	VMT x 1,000	955,570	908,850	908,850	-5%
Vehicle travel	MT CO_2e	501,358	429,443	422,895	-16%
Railways	MT CO_2e	-	97	317	-
BMA Travel	MT CO_2e	572	852	780	36%
Total Transportation	**MT CO_2e**	**501,930**	**430,392**	**423,992**	**-16%**
Emissions per resident	MT CO_2e/ resident	5.09	3.97	3.96	-22%
Emissions per job	MT CO_2e/job	5.19	4.30	4.08	-21%
VMT per resident	VMT/resident	9,699	8,376	8,486	-13%
VMT per job	VMT/job	9,876	9,075	8,753	-11%

In addition to the overall decrease in transportation emissions, normalizing for growth trends shows significant reductions in both emissions and VMT per resident and per job. Some of the reductions in VMT and vehicle emissions are attributable to Boulder's transportation efforts including GO Boulder, expansion and continued improvement of bike lanes, support and incentives for electric vehicles, and transition of city fleet to cleaner fuels. Efforts underway to continue to reduce emissions from the transportation sector are identified in the section below titled Action Plan.

Scope 3 Airline Emissions

Emissions due to activity at Denver International Airport are categorized as "Scope 3". Scope 3 emissions, provided in Table 11, are optionally reported under GPC and are not included in the city inventory boundary or goals. These emissions are being tracked as an information-only item. Denver International Airport emission are based on the population of Boulder compared to the service territory (as defined by the Airport).[16]

Table 11. Scope 3 aviation emissions.

Scope 3 Airline Emission Metrics	Units	2005 (Baseline)	2018	2019	Change Since 2005
Gallons of fuel consumed	gallons	-	19,000,054	20,110,723	-
Emissions generated	MT CO_2e	87,570	183,534	194,243	122%

The increase in emissions is primarily driven by an increase in airline activity at the Denver International Airport, as well as more accurate data reporting on the activity at the airport.

16 Gallons of fuel consumed by the Denver International Airport operations was not available for 2005.

Waste Trends

As seen in Table 12, overall emissions from total waste decreased by 59% between 2005 and 2019, despite an 8% increase in the tons of waste landfilled. Changes in emissions factors and methodology for calculating waste emissions are the primary reasons for this discrepancy.

Table 12. Changes in waste activity data.

Waste Metrics	Units	2005 (Baseline)	2018	2019	Change since 2005
Landfilled waste	Tons	83,983	85,406	90,578	8%
Composted waste	Tons	-	41,217	31,174	-
Wastewater (nitrogen effluent discharge)	kg/day	2,569	488	418	-84%
Landfilled waste	MT CO_2e	53,840	18,233	19,338	-64%
Composted waste	MT CO_2e	-	3,083	2,781	-
Wastewater	MT CO2e	1,800	704	642	-64%
Total Waste	**MT CO_2e**	**55,640**	**22,020**	**22,760**	**-59%**
Landfill tons per GDP	Tons/$	0.000005	0.000003	0.000003	-83%
Landfill tons per resident	Tons/resident	0.85	0.78	0.84	-1%
Total waste emissions per resident	MT CO_2e/ resident	0.56	0.203	0.21	-62%
Total waste emissions per job	MT CO_2e/job	0.575	0.220	0.21	-63%

Landfilled and Composted Waste

The city has realized an 8% increase in landfilled waste tonnage from 2005 which is likely correlated with Boulder's growing population, construction, and economy. Despite the increase in landfill tonnage, a large reduction in emissions is observable. This discrepancy is partly based on changes in the methodology and emission factors for waste between 2005 and 2019. Additionally, composting waste is now an option for residents and businesses in Boulder, and compost operations continue to grow annually.[17] Lastly, the city has implemented several sustainability initiatives to help guide the community toward zero waste and therefore reduce landfill emissions, as identified in the Action Plan section.

17 Compost tonnage and emissions were not calculated in the 2005 inventory.

Wastewater Treatment

Table 12 also shows a significant decrease (64%) in emissions from the city's wastewater treatment plant (WWTP) between 2005 and 2019. The emissions associated with the effluent discharge of the WWTP are impacted by the amount of nitrogen discharged by the community and by the management of the treatment processes associated with nitrogen removal. Prior to 2006, around 1,000 MT CO_2e per year were associated with effluent nitrogen discharge. The $45M Liquid Stream Upgrades Project that occurred between 2005 and 2008 incorporated an activated sludge biological nutrient removal (BNR) system capable of roughly 50% nitrogen removal. This upgrade was motivated by new discharge permit limits for ammonia and nitrate. In addition, the $5M Nitrogen Upgrades Project that began in 2015 is evident in 2019 effluent nitrogen performance.

ACTION PLAN

The city's current action plan to address emissions includes a set of aggressive, city-funded programs and services. The programs and services outlined below are designed to reduce local GHG emissions and mitigate climate change.

In July of 2019, city council declared a climate emergency in the face of increasing impacts of climate change. By adopting this resolution, the Boulder joined a global coalition of governments and leaders who officially acknowledge the existence of a global climate emergency and recognize the importance of local action to protect and enhance the well-being of current and future generations. This sparked the initiation of a Climate Mobilization Action Plan which will engage the public, non-profit, institutional, and business interests in a community process to develop strategies focused on systemic change.

Buildings

- **Building Performance Program**: Continue implementation and building owner support for energy reporting and energy efficiency requirements on C&I buildings (larger than 20,000 sf).
- **SmartRegs**: Implementation of strategies to achieve 100 percent compliance with the city's rental housing efficiency requirements by 2019.
- **Natural Gas Replacement**: Continue to work with city consortium to develop a national strategy and technical assistance platform to accelerate the retirement of natural gas appliances. Grow the Comfort 365 program providing support to homeowners adopting heat pumps as natural gas replacement alternatives.
- **Voluntary Energy Efficiency**: Continue to support Boulder County's Partners for a Clean Environment (PACE) advising services and program implementation, including EnergySmart.
- **Clean Energy Finance**: Work with Boulder County to expand utilization of the Colorado Commercial Property Assessed Clean Energy (C-PACE) financing program. For more information see: http://copace.com/.
- **Electricity Offset for Marijuana Facilities**: Achieve 100 percent compliance with the city's requirement for marijuana facilities to offset their electricity usage with renewable energy.
- **Net Zero Energy Codes**: Every three years, update energy codes to ensure the city is on the pathway to the goal of net zero energy codes for all new buildings by 2031.
- **City Facilities**: Continue to retrofit city buildings to reduce emissions, including major redevelopment efforts such as the Alpine-Balsam site, which will demonstrate accelerated energy efficiency and renewable energy adoption.

Electricity Source Change

- **Renewable Grid Electricity**: To achieve 100% of grid electricity from renewables by 2030, the city is exploring options including partnering with Xcel Energy, forming a municipal utility, and state level policy reforms.
- **Solar/Local Generation Strategy**: Contract technical assistance in the development of a community solar adoption strategy designed to achieve the new renewable energy targets adopted in the Climate Commitment (50 MW by 2020).
- **Energy Resilience**: Complete implementation of the Department of Energy's Energy Resilience grant and implementation of resilient energy systems at three critical community service centers.
- **City Facility Solar Energy Development**: Explore use of city facilities and lands to increase local generation assets.
- **Community Solar Adoption**: Work with both public and private sector partners to utilize the Boulder Solar Tool and other individual and group adoption strategies to foster increased adoption of local solar.

Mobility

- **Multi-Modal Transportation Options**: Continue work with Transportation Division/ GO Boulder to implement multimodal action items from Boulder's Transportation Master Plan (TMP) to achieve GHG reduction goals as well as broader community sustainability goals.
- **Electric Vehicle (EV) Strategy**: Carry out a strategy to achieve Climate Commitment emission reduction targets related to EVs.
  - **Electric Vehicle Adoption**: Continue to coordinate the multi-departmental working group on EV and alternative fuels strategy development with a community goal of 15% EV adoption by 2035. Continue to pursue funding opportunities for public charging infrastructure, develop low-income access opportunities and pair EV charging with solar strategy.
  - **Electrification of Transit**: Expand cross departmental collaboration and continue working with Via and RTD to explore the adoption of transit fleet vehicle electrification options.
  - **Emerging Transportation Technologies**: Work with Transportation Division/GO Boulder to research and evaluate emerging mobility options including expanded ride share systems, connected/automated vehicles and new heavy transport options (e.g. renewable natural gas or diesel fleet vehicles).
- **Employee Commute**: Demonstrate city leadership in continuing to advance additional low emission commute options for city employees (e.g. EV adoption, electric van pool, telework, etc.).

Waste

- **Zero Waste Resolution and Zero Waste Strategic Plan**: Continue implementation strategies to achieve 85 percent waste diversion by the year 2025.

- **Universal Zero Waste Ordinance**: Continue to refine the implementation systems and compliance support for the city's recycling and composting expansion requirements on homeowners, property managers, and businesses.
- **Public Place Recycling and Composting**: Continued transition of city-owned public space waste receptacles to include zero waste services.
- **Food Waste Reduction**: Increase awareness of food waste and encourage edible food recovery programs.
- **Circular Economy**: Explore ways to make systemic change that moves our community beyond the compost-recycle-landfill model, looking at material management from a more holistic perspective to prevent waste from the start.
- **Repair and Reuse**: Connect and develop relationships with thrift/donation centers/reuse/repair shops and services in order to support the viability of their business model while simultaneously moving the city into active circular economy principles.
- **Packaging**: Reduce use of plastic packaging being used in our community through providing more sustainable/reusable options.
- **Construction & Demolition Debris**: Implement the new construction and demolition waste deposit program and code requirement.

Cross Cutting Initiatives

- **Energy Impact Offset Fund**: Continue work with Boulder County to create a local energy/carbon offset fund initially funded through the required offsets for the marijuana industry for electricity use.
- **Program Tracking and Reporting**: Continue city organization and community wide emissions tracking and reporting, as well as program level tracking and reporting. Work to integrate into the city dashboard and centralized data management systems.
- **Boulder Energy Challenge**: Review the impact of the second Boulder Energy Challenge, which provided funding to support the development and commercialization of innovative GHG emission reducing technologies and strategies in Boulder.
- **Research Internal Carbon Valuation**: Conduct best practices research with other cities, public institutions and businesses to identify mechanisms to effectively internalize the cost of carbon in city operations.
- **City Organization Climate Preparation**: Support the implementation of priority actions to make the city organization (facilities, fleet, operations, procurement etc.) more sustainable and better prepared for climate change.