Workbook Guide

INSTRUCTIONS: Use this spreadsheet to identify data needs, record data sources, collect key metrics,

Legend for data entry
Do not edit
Requires manual entry

It should be noted that even cells shown in white should be verified annually. Basic assumptions may c

Inventory Year
2017

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Inventory N	
Source/Activity	**Worksheet**
Background	
All	Visual Summary
All	Emission Summary
All	Benchmarking
All	Year-to-Year Comparison
Data Sources	Inventory Data Checklist
Data Inputs: Supporting Data	
All	Emission Factors
Community Indicators	Community Indicators
Data Inputs: Stationary Energy	
Energy Use	Stationary Energy Data
Energy Use	Fugitive Emissions Data
Data Inputs: Transportation	
On-Road Vehicles	On-Road Data
Transit	Transit Data

Railways	Railways Data
Aviation	Aviation Data
Off-Road	Off-Road Data
Data Inputs: Waste	
Solid Waste Generation	Waste Recycling Data
Wastewater Treatment Facilities	Wastewater Data
Data Inputs: Fugitive Emissions - BASIC+	
Refrigerants	IPPU Data
Data Inputs: Consumption-Based Sources	
Consumption-Based Sources	Consumption-Based Data
Reporting: GPC Outputs	
Community Indicators	GPC Table 4.1
GPC Table 4.3	GPC Table 4.2
Activity data tabs	GPC Table 4.3
Activity data tabs	GPC Table 4.4

and calculate emission outputs.

change over time and the City may receive updated studies. Only the main activity data is highlighted in blue.

Management Spreadsheet Contents
Description
Provides summary information, including charts and graphs, for the inventory.
Provides all summary information for the inventory, including emissions by scope, sector, and source.
Provides comparison data for similar cities.
Provides comparisons of activity data and emissions from all previous inventories against current inventory.
Identifies required data and provides a place to store contact information for relevant community inventory sources and sectors.
Provides information on emissions factors used for calculating emissions totals, as well as emission factor sources.
Includes general community characteristics used to complete GPC Table 4.1 and to calculate GHG emission metrics.
Input raw energy data for stationary fuels and electricity to calculate the total emissions for each source.
Input key metrics regarding fugitive emission activities, including the number of oil wells and natural gas consumption, to calculate total fugitive emissions.
Input raw data, including data on VMT and electrical vehicles, to estimate mobile fuel consumption and emissions.
Input raw transit data to estimate transit fuel consumption and emissions.

Input raw railways data to estimate railways consumption and emissions.
Input raw aviation data used to estimate emissions from airline travel.
Input raw off-road data used to estimate emissions from off-road vehicles and equipment.
Input raw community generated waste data sent to landfill or composting facility and recycling data to calculate the total emissions for waste disposal.
Input raw data for wastewater treatment to calculate the total emissions from wastewater treatment processes.
Links with commercial square footage data to calculate the total emissions from refrigerants. Includes additional chemicals as appropriate.
Input data to calculate emissions from food, water delivery, and cement.
Data is linked from Community Indicators tab. Required for GPC compliance.
Data is linked from GPC Table 4.3. Required for GPC compliance.
Data is linked from activity data tabs into GPC Table 4.3. Required for GPC compliance.
Data is linked from activity data tabs to calculate information-only emissions reductions. Not required for GPC compliance.

Visual Summary of Data

INSTRUCTIONS: Use this tab to review visual summaries of emission data. Data is lumped together in commonly re

Notes:

(1) Chart types may be changed by right-clicking on the chart and selecting "Change Chart Type". If the chart type

All Emissions by Scope		
Scope	**Emissions (mt CO_2e)**	**Percentage of Total**
Scope 1	4,532,549	39%
Scope 2	4,086,448	36%
Scope 3	741,969	6%
Consumption-based	2,144,725	19%
Total Emissions	**11,505,692**	**100%**
Total BASIC Emissions	**8,727,295**	**161%**
Total BASIC Emissions with Consumption-Based	**10,872,020**	**286%**

All Emissions by Sector		
Sector	**Emissions (mt CO_2e)**	**Percentage of Total**
Commercial and Industrial Buildings	3,826,910	36%
Residential Buildings	1,147,876	11%
Transportation	3,309,748	31%
Solid Waste	24,793	0%
Wastewater Treatment	133,200	1%
Industrial Processes and Products Use	2,124	0%
Consumption-Based	2,144,725	20%
Total Emissions	**10,589,375**	**100%**

All Emissions by Source		
Emission Source	**Emissions (mt CO_2e)**	**Percentage of Total**
Building Electricity	4,049,713	35%
Natural Gas (including fugitive emissions)	1,822,670	16%
Propane	2,586	0%
Stationary Diesel	16,134	0%
On-Road Transportation and Transit (Buses)	2,618,125	23%
On-Road Transportation from Electric Vehicles & Light Rail	36,735	0%
Railways	19,564	0%
Transboundary Aviation	608,878	5%
In-Boundary Aviation	143	0%
Off-Road Vehicles and Equipment	26,302	0%
Solid Waste	133,200	1%
Wastewater	2,124	0%
Refrigerants	24,793	0%
Food	1,303,185	11%
Cement	823,142	7%

Water Delivery	18,398	0%
Total	**11,505,692**	**100%**

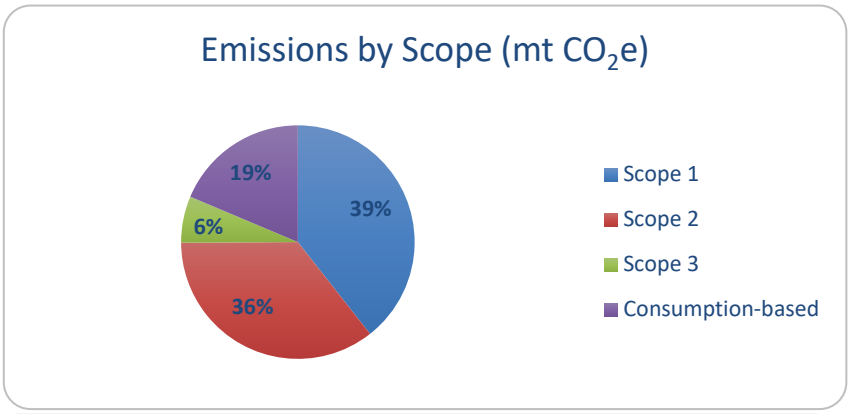
Stationary Energy Emissions Detail		
Emission Source	**Emissions (mt CO_2e)**	**Percentage of Total**
Residential Electricity	498,468	10%
Residential Natural Gas	619,909	12%
Residential Propane	5	0%
Commercial Electricity	2,919,178	59%
Commercial Natural Gas	818,593	16%
Commercial Propane	2,580	0%
Commercial Diesel	16,134	0%
Fugitive Emissions	99,919	2%
Total	**4,974,786**	**100%**

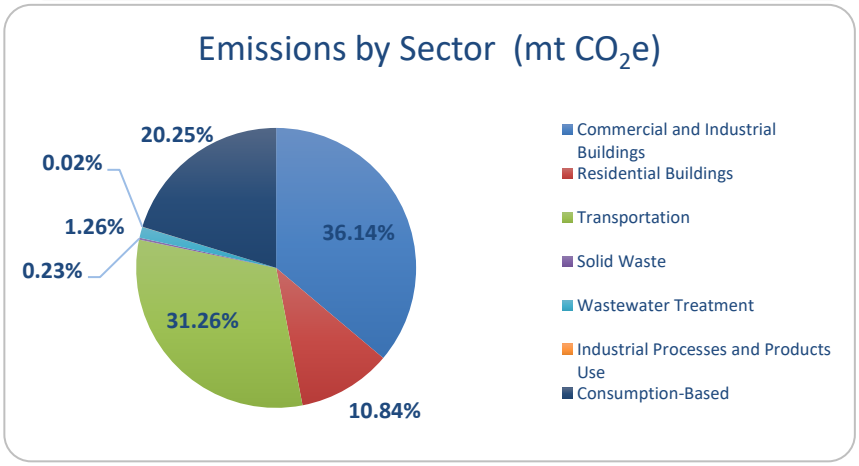
Transportation Emissions Detail		
Emission Source	**Emissions (mt CO_2e)**	**Percentage of Total**
Gasoline (includes gasoline and ethanol) Vehicles	2,209,852	67%
Diesel Vehicles	408,273	12%
Transit	0	0%
Railways	19,564	1%
Electric Vehicles	2,140	0%
Transboundary Aviation	608,878	19%
In-Boundary Aviation	143	0%
Off-Road Vehicles	26,302	1%
Total	**3,275,152**	**100%**

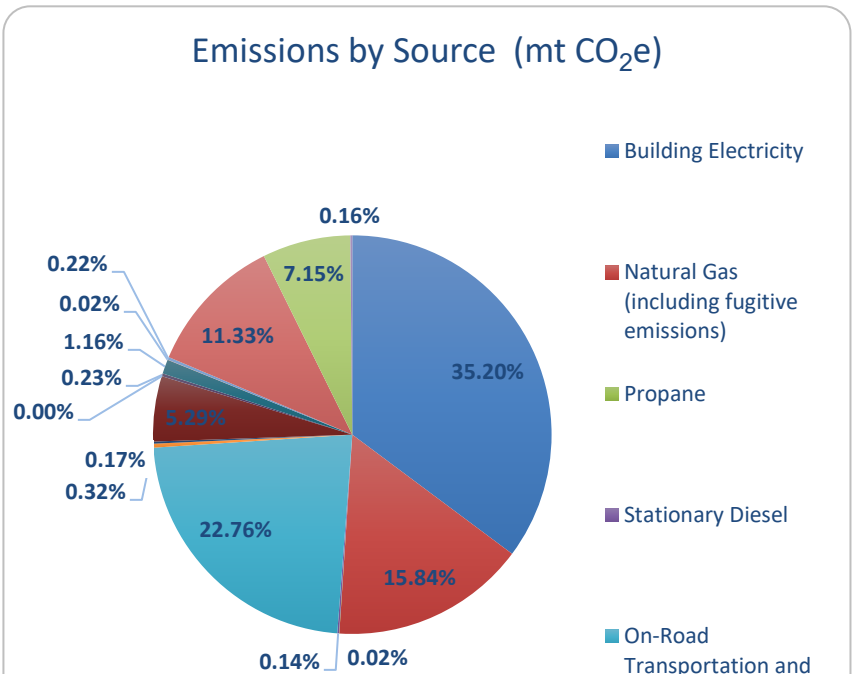
Waste Emissions Detail		
Emission Source	**Emissions (mt CO_2e)**	**Percentage of Total**
Solid Waste	133,200	98%
Wastewater	2,124	2%
Total	**135,324**	**100%**

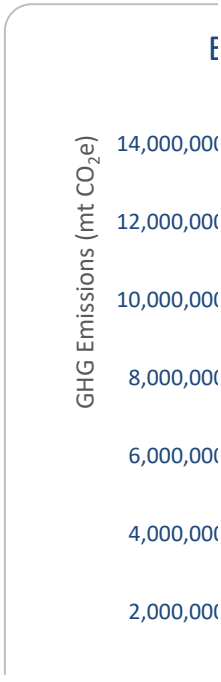
eferenced tables.

is changed, additional formatting may be required.

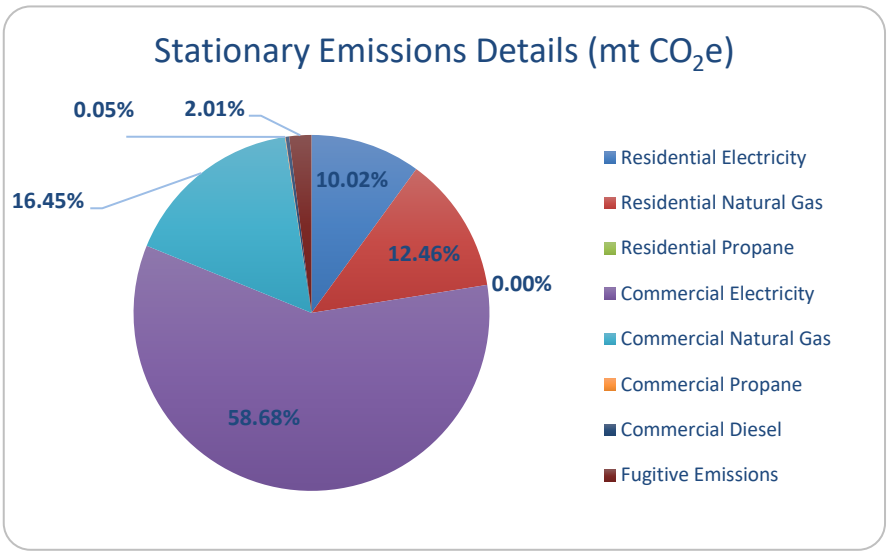


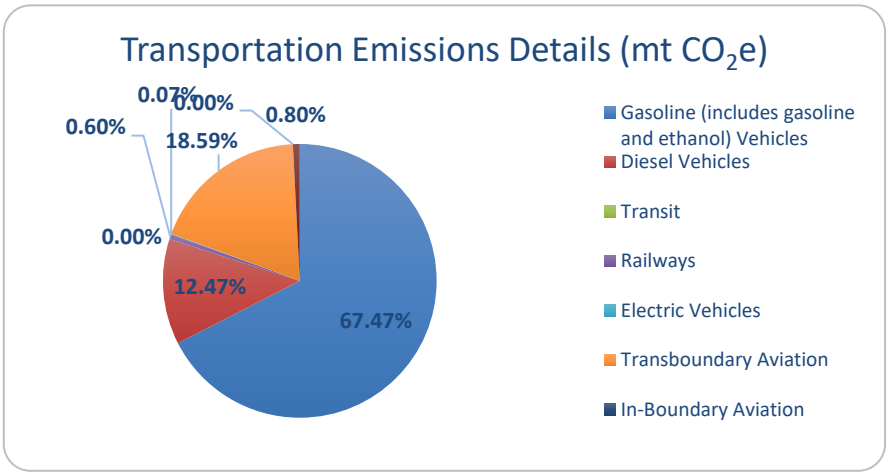


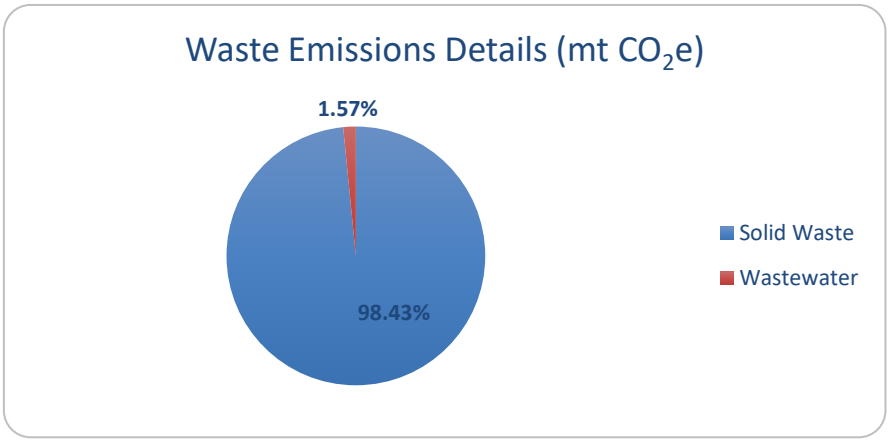


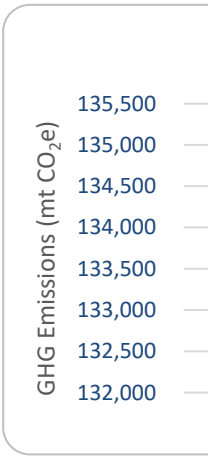


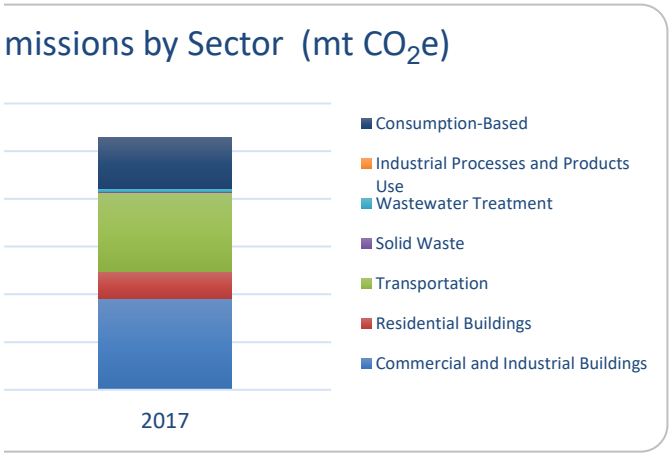
Transit (Buses)

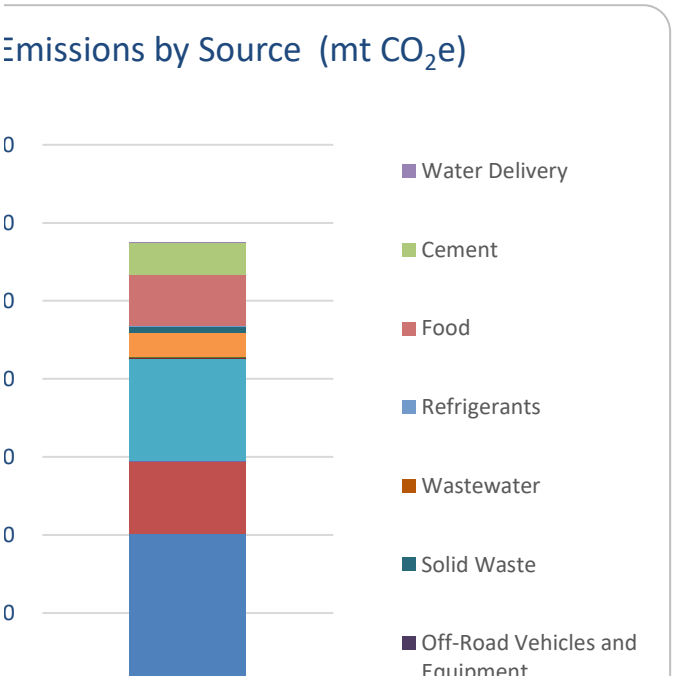




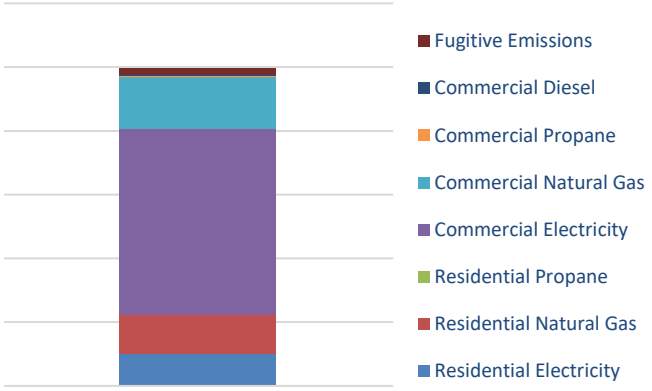




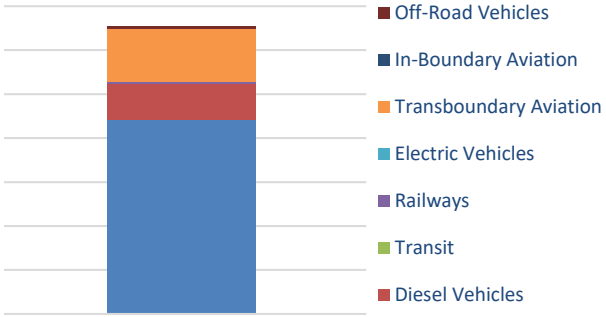

missions by Sector (mt CO_2e)
Consumption-Based
Industrial Processes and Products Use
Wastewater Treatment
Solid Waste
Transportation
Residential Buildings
Commercial and Industrial Buildings
2017


Emissions by Source (mt CO_2e)
Water Delivery
Cement
Food
Refrigerants
Wastewater
Solid Waste
Off-Road Vehicles and Equipment

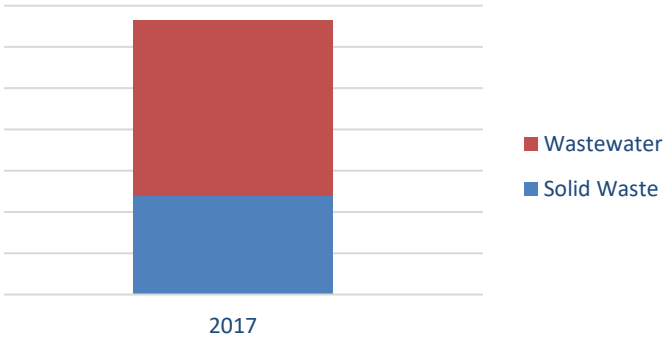
tionary Emissions Details (mt CO_2e)



ɔortation Emissions Details (mt CO_2e)

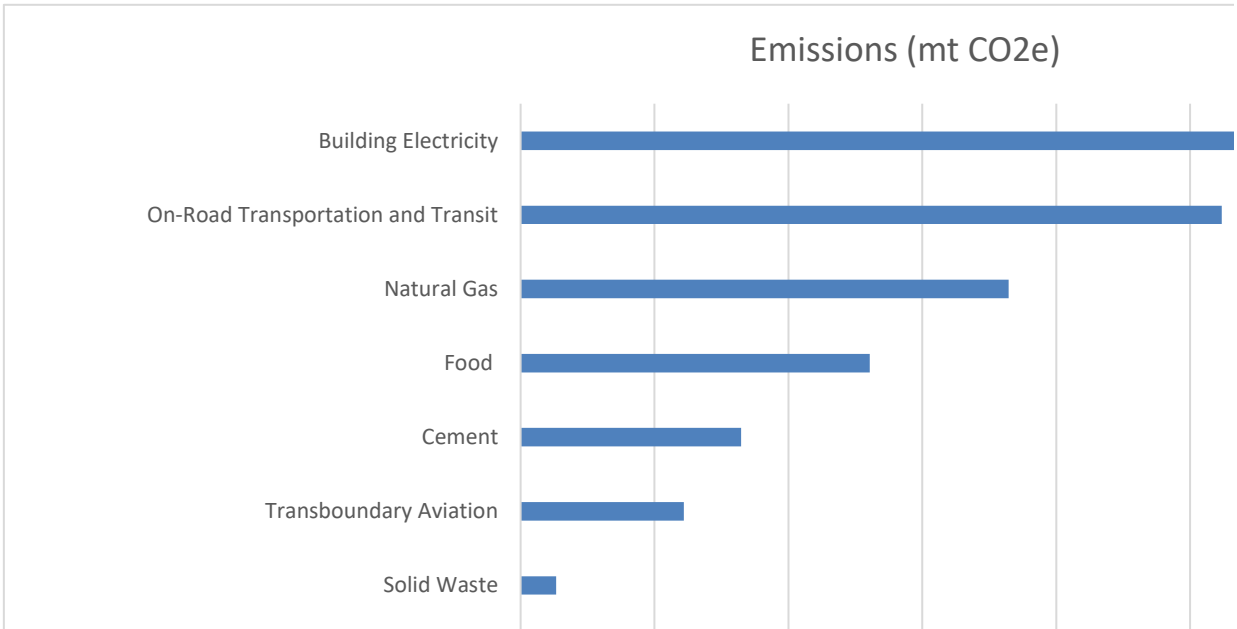


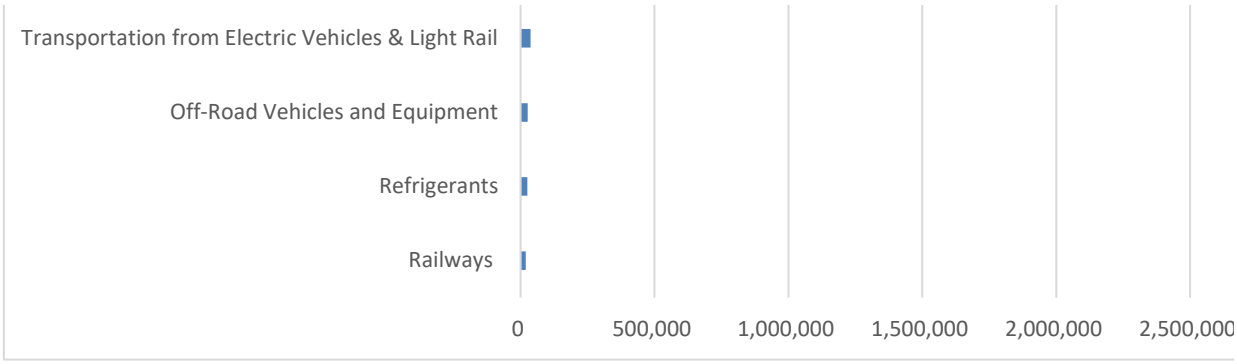
Waste Emissions Details (mt CO_2e)

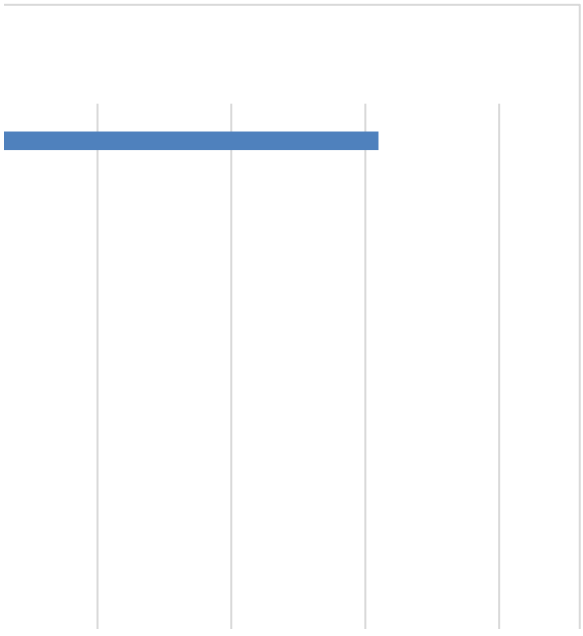


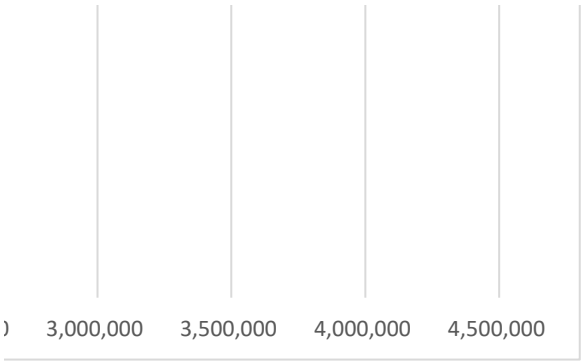
All Emissions by Source		
Emission Source	**Emissions (mt CO_2e)**	**Percentage of Total**
In-Boundary Aviation	143	0.00%
Wastewater	2,124	0.02%
Propane	2,586	0.02%
Stationary Diesel	16,134	0.14%
Water Delivery	18,398	0.16%
Railways	19,564	0.17%
Refrigerants	24,793	0.22%
Off-Road Vehicles and Equipment	26,302	0.23%
Transportation from Electric Vehicles & Light Rail	36,735	0.32%
Solid Waste	133,200	1.16%
Transboundary Aviation	608,878	5.29%
Cement	823,142	7.15%
Food	1,303,185	11.33%

Natural Gas	1,822,670	15.84%
On-Road Transportation and Transit	2,618,125	22.76%
Building Electricity	4,049,713	35.20%
Total	**11,505,692**	**100%**


Emissions (mt CO2e)
Building Electricity
On-Road Transportation and Transit
Natural Gas
Food
Cement
Transboundary Aviation
Solid Waste


Transportation from Electric Vehicles & Light Rail
Off-Road Vehicles and Equipment
Refrigerants
Railways
0
500,000
1,000,000
1,500,000
2,000,000
2,500,000




3,000,000
3,500,000
4,000,000
4,500,000

Emission Summary

Emission Inventory Summary		
Scope	**Emissions (mt CO_2e)**	**Percentage of Total**
Scope 1	4,532,549	39%
Scope 2	4,086,448	36%
Scope 3	741,969	6%
Consumption-Based	2,144,725	19%
Total	**11,505,692**	**100%**
Information only	(748,955)	N/A

Emission Inventory Summary BASIC		
Scope	**Emissions (mt CO_2e)**	**Percentage of Total**
Scope 1	4,507,756	52%
Scope 2	4,086,448	47%
Scope 3	133,091	2%
Consumption-Based	2,144,725	N/A
Total BASIC	**8,727,295**	**100%**
Total BASIC with Consumption-Based	**10,872,020**	**N/A**
Total	**11,505,692**	**N/A**
Information only	(748,955)	N/A

Note: BASIC emissions do not include emissions from itinerant aviation (608,878 mtCO $_2$ e), refrigerants (24,793 mtCO $_2$ e), or consumption-based sources (2,144,725 mtCO $_2$ e).

All Emissions by Sector		
Emission Source	**Emissions (mt CO_2e)**	**Percentage of Total**
Commercial and Industrial Buildings	3,826,910	33%
Residential Buildings	1,147,876	10%
Multifamily Buildings	916,317	8%
Transportation	3,309,748	29%
Industrial Processes and Product Use	24,793	0%
Solid Waste	133,200	1%
Wastewater Treatment	2,124	0%
Consumption-Based	2,144,725	19%
Total	**11,505,692**	**100%**

All Emissions by Source		
Emission Source	**Emissions (mt CO_2e)**	**Percentage of Total**
Building Electricity	4,049,713	35%
Natural Gas (including fugitive emissions)	1,822,670	16%
Propane	2,586	0%
Stationary Diesel	16,134	0%

On-Road Transportation and Transit (Buses)	2,618,125	23%
On-Road Transportation from Electric Vehicles & Light Rail	36,735	0%
Railways	19,564	0%
Transboundary Aviation	608,878	5%
In-Boundary Aviation	143	0%
Off-Road Vehicles and Equipment	26,302	0%
Solid Waste	133,200	1%
Wastewater	2,124	0%
Refrigerants	24,793	0%
Food	1,303,185	11%
Cement	823,142	7%
Water Delivery	18,398	0%
Total	**11,505,692**	**100%**

Detailed Emissions Breakdown by S		
Stationary Energy		
Energy	**Type**	**GHG Emissions (mt CO_2e)**
Fuel combustion within the city	Commercial and Industrial	818,593
	Commercial and Industrial	16,134
	Commercial and Industrial	2,580
	Multifamily	284,250
	Residential	619,909
	Residential	5
Grid-supplied energy (electricity)	Commercial and Industrial	2,919,178
	Multifamily	632,067
	Residential	498,468
Fugitive Emissions	**Type**	**GHG Emissions (mt CO_2e)**
Fugitive emissions from oil and natural gas systems within the city boundary	Commercial and Industrial	70,425
	Residential	29,494
Total Stationary Energy		**5,891,102**

Transportation		
On-Road Vehicles	**GHG Emissions (mt CO_2e)**	**Scope**
Emissions from fuel combustion on-road transportation occurring in the city	2,618,125	1
Emissions from grid-supplied energy consumed in the city for on-road transportation	2,140	2
Transit	**GHG Emissions (mt CO_2e)**	**Scope**
Transit activities within the city (Buses)		1

Railways	GHG Emissions (mt CO_2e)	Scope
Transit activities within the city (Commercial Rail)	34,595	2
Railway activities within the city	19,564	1
Aviation	**GHG Emissions (mt CO_2e)**	**Scope**
Itinerant	608,878	3
In-Boundary	143	1
Off-Road Vehicles and Equipment	**GHG Emissions (mt CO_2e)**	**Scope**
Vehicles that consume gasoline	6,890	1
Vehicles that consume diesel	9,871	1
Vehicles that consume CNG	9,507	1
Equipment that consumes propane	34	1
Total Transportation	**3,309,748**	

Waste		
Community Solid Waste	**GHG Emissions (mt CO_2e)**	**Scope**
Landfilled waste treated outside the City	130,162	3
Composted waste treated inside the City	108	1
Composted waste treated outside the City	2,929	3
Wastewater Treatment and Discharge	**GHG Emissions (mt CO_2e)**	**Scope**
Wastewater Generated and Treated in City	2,124	1
Total Waste	**135,324**	

Industrial Processes and Products Use		
Refrigerant Use	**GHG Emissions (mt CO_2e)**	**Scope**
R-134A	24,793	1
Total Industrial Processes and Products Use	**24,793**	

Consumption-Based Sources		
Consumption-Based Sources	**GHG Emissions (mt CO_2e)**	**Scope**
Food	1,303,185	N/A
Cement	823,142	N/A
Water delivery	18,398	N/A
Total Consumption-Based Sources	**2,144,725**	

TOTAL	**11,505,692**	

Information Only		
	GHG Emissions (mt CO_2e)	**Scope**
Recycling	(673,317)	N/A
Renewable energy	(75,639)	N/A
OTAL INFORMATION-ONLY AVOIDED EMISSIONS	**(748,955)**	

Percentage of Core Total
40.89%
12.27%
9.79%
35.36%
0.26%
1.42%
N/A
N/A
100%

ector

Scope	Value	Unit
1	153,909,899	therms
1	1,569,245	gallons diesel
1	457,165	gallons propane
1	53,444,021	therms
1	116,553,736	therms
1	940	gallons propane
2	4,888,565,213	kWh
2	1,058,482,546	kWh
2	834,753,747	kWh
Scope	Value	Unit
1	153,909,899	therms
1	169,997,757	therms

Value	Unit
5,615,074,551	VMT
3,584,000	kWh
Value	Unit
	gallons diesel

Value	Unit
57,934,405	kWh
842,943,342	ton-miles

Value	Unit
16,769	gallons aviation gasoline

Value	Unit
784,704	gallons gasoline
966,787	gallons diesel
1,531,602	GGE CNG
25,211	pounds propane

Value	Unit
857,998	tons waste
1,450	tons compost
39,161	tons compost

Value	Unit
704,621	population served

Value	Unit
416,107,019	commercial sf

Value	Unit	
704,621	population served	*Life-cycle emissions*
677,132	tons of cement used	*Life-cycle emissions*
28,747,572,000	gallons of water delivered	

Value	Unit	
198,528	tons recycled waste	*Life-cycle emissions*
126,667,135	kWh	

Benchmarking Values

Notes:

(1) All values presented below are for illustration purposes. Without an in depth look into each community's er

City of Comparison	Year of Inventory	Type of Inventory	Population	Number of Households	Number of Employees	GHG Emissions ($mtCO_2e$)
Denver, CO	2017	GPC, BASIC	704,621	287,262	439,602	11,505,692
Boulder, CO	2017	GPC, BASIC	107,125	42,679	58,362	1,547,393
Aspen, CO	2017	GPC, BASIC	7,359	6,203	10,684	305,319
Lakewood, CO	2015	GPC, BASIC	151,956	64,734	79,874	1,652,223
Seattle, WA	2016	ICLEI-USA	707,255	314,850	425,827	3,182,000
Chicago, IL	2015	GPC, BASIC	2,716,000	1,046,789	1,350,000	32,650,000
Atlanta, GA	2013	ICLEI	486,290	192,929	238,663	8,857,265
Austin, TX	2016	GPC	950,715	361,257	548,311	13,500,000
Boston, MA	2016	GPC, BASIC	685,094	263,229	368,750	6,400,000
Minneapolis, MN	2016	GPC	422,331	172,082	236,140	4,100,000
New York City, NY	2016	GPC, BASIC	8,615,000	3,142,405	4,110,000	52,000,000
Salt Lake City, UT	2009	IEAP Version 1.0	200,544	76,876	103,181	4,750,000
Vancouver, BC	2015	N/A	631,486	309,481	N/A	14,700,000
Fort Collins, CO	2017	N/A	165,080	61,532	85,148	2,000,000

missions, it is not possible to know if these datasets

Emissions per Capita	Emissions per Household	Emissions per Employee
16.3	40.1	26.2
14.4	36.3	26.5
41.5	49.2	28.6
10.9	25.5	20.7
4.5	10.1	7.5
12.0	31.2	24.2
18.2	45.9	37.1
14.2	37.4	24.6
9.3	24.3	17.4
9.7	23.8	17.4
6.0	16.5	12.7
23.7	61.8	46.0
23.3	47.5	N/A
12.1	32.5	23.5

present an "apples-to-apples" comparison.

Data Source
https://www-static.bouldercolorado.gov/docs/2017_City_of_Boulder_Greenhouse_Gas_Inventory_Report-1-201901111353.p
https://www-static.bouldercolorado.gov/docs/2017_City_of_Boulder_Greenhouse_Gas_Inventory_Report-1-201901111353.p
https://www.cityofaspen.com/564/Greenhouse-Gas-Reductions
http://www.lakewood.org/Sustainability/Planning_for_Sustainability/Greenhouse_Gas_Emissions.aspx
https://www.seattle.gov/Documents/Departments/OSE/ClimateDocs/2016_SEA_GHG_Inventory.pdf
https://www.chicago.gov/content/dam/city/progs/env/GHG_Inventory/CityofChicago_2015_GHG_Emissions_Inventory_Repo
https://atlantaclimateactionplan.wordpress.com/purpose-scope-and-process/
https://data.austintexas.gov/stories/s/2017-State-of-Our-Environment-Report-Climate-Chang/wkin-wnwu/
https://www.boston.gov/sites/default/files/imce-uploads/2018-09/boston_ghg_inventory_2005-2016.pdf
https://mplscleanenergypartnership.org/recent-news/annual-report/
https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/GHG%20Inventory%20Report%20Emission%20Year%
http://www.slcdocs.com/slcgreen/SLC%20Community%20Carbon%20Footprint%20Report%20(2).pdf
http://www.metrovancouver.org/services/air-quality/AirQualityPublications/2015LowerFraserValleyAirEmissionsInventory.pd
http://ftcollinscap.clearpointstrategy.com

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Year-to-Year GHG Emission Inventory Comparison

Notes:

(1) Inventories completed in years 2005-2014 adhered to the Demand-Centered Hybrid Life-Cycle methodology. Inventories co

(2) The inventory conducted in 2015 was a GPC BASIC+ inventory. The 2016 inventory was a GPC BASIC inventory.

(3) The categories below represent major sources.

(4) 2017 surface transportation was calculated using a geographic approach vs 2015 and 2016 surface transportation, which v

Inventory Type	Year	Population	Stationary Energy				
			Electricity (kWh)	Natural Gas (th)	Diesel (gal)	Propane (gal)	Total BASIC Emissions (mt CO_2e)
Demand-Centered Hybrid Life-Cycle methodology	2005	561,323	6,412,000,000	372,000,000	N/A	N/A	7,043,000
	2007	578,789	6,739,000,000	388,000,000	N/A	N/A	7,129,000
	2009	593,106	6,372,000,000	377,000,000	N/A	N/A	6,629,000
	2010	600,158	6,507,000,000	371,000,000	N/A	N/A	6,912,000
	2011	619,968	6,423,000,000	365,000,000	N/A	N/A	6,693,000
	2012	634,265	6,564,000,000	334,000,000	N/A	N/A	6,373,000
	2013	649,495	6,595,000,000	377,000,000	N/A	N/A	6,538,000
	2014	663,862	6,673,000,000	376,000,000	N/A	N/A	6,417,000
GPC BASIC+	2015	649,654	7,308,925,644	344,753,484	N/A	N/A	6,840,346
GPC BASIC	2016	693,292	6,812,868,483	339,047,295	N/A	N/A	5,943,160
GPC BASIC	2017	704,621	5,723,318,959	270,463,635	1,569,245	458,105	4,874,867

Demand-Centered Hybrid Life-Cycle methodology values adjusted to reflect GPC values

Year	Total Emissions ($mtCO_2e$)					Total Emissions (mt CO_2e)
	Residential and Commercial	Surface Transportation	Surface Transportation Adjusted	Waste	Waste Adjusted	
2005	7,044,000	2,540,000	2,133,600	169	110,674	9,288,274
2006					0	0
2007	7,129,000	2,608,000	2,190,720	185	121,152	9,440,872
2008					0	0
2009	6,630,000	2,355,000	1,978,200	137	89,718	8,697,918
2010	6,912,000	2,400,000	2,016,000	136	89,063	9,017,063
2011	6,693,000	2,342,000	1,967,280	126	82,514	8,742,794
2012	6,374,000	2,333,000	1,959,720	130	85,134	8,418,854
2013	6,538,000	2,387,000	2,005,080	140	91,683	8,634,763
2014	6,418,000	2,453,000	2,060,520	142	92,992	8,571,512
2015	6,262,000	2,538,000	2,131,920	154	100,851	8,494,771
2016	5,943,160	2,631,221	2,210,226		124,209	8,277,595
2017	4,874,867	2,724,443	2,288,532		133,200	7,296,598

mpleted in years 2015 through the present follow the Global Protocol for Community-Scale Greenhouse Gas Emission

was based off an induced-activity approach. This resulted in a larger 2017 value.

	Fugitive Emissions						
Electricity Emission Factor (mt CO_2e/MWh)	Fugitive Emissions from Natural Gas Distribution ($mtCO_2e$)	Fugitive Emissions from Oil and Gas ($mtCO_2e$)	Vehicle Miles Traveled (VMT)	On-Road Gasoline (gal)	On-Road Diesel (gal)	On-Road Ethanol (gal)	On-Road Electricity (kWh)
0.794	N/A	N/A	N/A	219,494,592	52,499,175	N/A	N/A
0.753	N/A	N/A	N/A	221,836,388	57,776,184	N/A	N/A
0.726	N/A	N/A	N/A	207,426,534	45,784,773	N/A	N/A
0.761	N/A	N/A	N/A	207,790,951	49,930,497	N/A	N/A
0.740	N/A	N/A	N/A	205,559,836	46,214,285	N/A	N/A
0.700	N/A	N/A	N/A	205,438,925	51,846,498	N/A	N/A
0.689	N/A	N/A	N/A	212,714,957	50,894,602	N/A	N/A
0.662	N/A	N/A	N/A	217,760,638	53,064,281	N/A	N/A
0.676	31,565	722	5,900,135,027	227,820,893	50,894,602	N/A	N/A
0.599	41,406	97	5,863,086,250	226,540,605	41,204,031	N/A	N/A
0.597	56,196	43,723	5,615,074,551	246,926,812	42,271,798	27,436,312	3,584,000

Inventories (GPC).

Mobile Energy							
Transit Diesel Fuel (gal)	Railways Electricity (kWh)	Railways (ton-miles)	Itinerant Jet Fuel Including LTO and Cruising > 3,000 ft (gal)	Local Aviation Fuel (gal)	Off-Road Transportation Diesel (gal)	Off-Road Transportation Gasoline (gal)	Off-Road Transportation CNG (GGE)
N/A	N/A	N/A	86,625,000	N/A	N/A	N/A	N/A
N/A	N/A	N/A	93,539,000	N/A	N/A	N/A	N/A
N/A	N/A	N/A	82,684,000	N/A	N/A	N/A	N/A
N/A	N/A	N/A	90,659,000	N/A	N/A	N/A	N/A
N/A	N/A	N/A	89,832,000	N/A	N/A	N/A	N/A
N/A	N/A	N/A	91,150,000	N/A	N/A	N/A	N/A
N/A	N/A	N/A	86,471,000	N/A	N/A	N/A	N/A
N/A	N/A	N/A	86,011,000	N/A	N/A	N/A	N/A
N/A	32,152,250	4,947,868,200	84,771,239	267,335	17,559,608	N/A	N/A
N/A	56,884,910	3,216,065,855	N/A	390,716	5,016,395	N/A	N/A
			128,820,803	17,640	966,787	784,704	1,531,602

				Waste			Wastewater	AFC
Off-Road Transportation Propane (lbs.)	Total Emissions Including Total Jet Fuel (mt CO_2e)	Total Emissions Including Aviation LTO (mt CO_2e)	Total BASIC Emissions (mt CO_2e)	Landfilled Waste (tons)	Composted Waste (tons)	Total Emissions (mt CO_2e)	Total Emissions (mt CO_2e)	Carbon released (tons)
N/A	3,354,000	N/A	N/A	621,135	N/A	169,000	N/A	N/A
N/A	3,534,000	N/A	N/A	598,361	N/A	185,000	N/A	N/A
N/A	3,173,000	N/A	N/A	501,740	N/A	136,000	N/A	N/A
N/A	3,297,000	N/A	N/A	500,366	N/A	136,000	N/A	N/A
N/A	3,231,000	N/A	N/A	462,639	N/A	125,000	N/A	N/A
N/A	3,221,000	N/A	N/A	474,326	N/A	64,000	N/A	N/A
N/A	3,229,000	N/A	N/A	511,263	N/A	69,000	N/A	N/A
N/A	3,291,000	N/A	N/A	525,467	N/A	71,000	N/A	N/A
N/A	3,442,963	N/A	N/A	1,087,504	60	642,528	19,779	62,678
N/A	1,695,161	N/A	1,695,161	1,054,264	6,950	624,209	19,852	N/A
25,211	3,968,965	3,333,464	#REF!	857,998	40,611	133,200	2,124	N/A

LU	Chemicals/ Refrigerants	Consumption-Based				
Total Emissions (mt CO_2e)	Total Emissions (mt CO_2e)	Food Purchases ($)	Food Purchases (population)	Upstream Stream Emissions from Vehicle Fuel Use (gal)	Cement Use (mt)	Water Supply (kg)
N/A	N/A	$ 752,000,000	N/A	N/A	352,160	N/A
N/A	N/A	$ 791,000,000	N/A	N/A	292,880	N/A
N/A	N/A	$ 831,000,000	N/A	N/A	148,660	N/A
N/A	N/A	$ 850,000,000	N/A	N/A	180,420	N/A
N/A	N/A	$ 815,000,000	N/A	N/A	175,690	N/A
N/A	N/A	$ 873,000,000	N/A	N/A	244,600	N/A
N/A	N/A	$ 948,000,000	N/A	N/A	295,030	N/A
N/A	N/A	$ 892,000,000	N/A	N/A	366,637	N/A
229,821	5	N/A	649,654	172,405,852	366,637	95,015,829,520
N/A	N/A	N/A	693,292	171,323,262	278,121	109,496,537,530
N/A	24,793	N/A	704,621	N/A	677,132	28,747,572,000

Upstream Stream Emissions from Aviation Fuel Use (gal)	Total Emissions (mt CO_2e)	Total Emissions (mt CO_2e)	Total BASIC Emissions With Consumption-Based Sources (mt CO_2e)
N/A	2,683,000	13,081,000	N/A
N/A	2,732,000	13,580,000	N/A
N/A	2,550,000	12,488,000	N/A
N/A	2,682,000	13,027,000	N/A
N/A	2,592,000	12,641,000	N/A
N/A	2,789,000	12,448,000	N/A
N/A	2,997,000	12,834,000	N/A
N/A	2,973,000	12,754,000	N/A
85,038,573	2,309,716	13,485,159	N/A
94,260,628	2,337,792	10,620,174	10,620,174
N/A	2,144,725	10,613,092	10,872,020

City and County of Denver, CO Inventory Data Checklist for BASIC

INSTRUCTIONS: Use this tab to identify required data inputs and units, identify optional data and units, r

GPC Notation Keys Legend		
IE	Included elsewhere	NO
NE	Not estimated	C

Indicators	Required Data	Required data units
Community Indicators		
Population	1. Community population 2. Business square footage	# residents, sq. ft. of businesses
Physical size	1. Town land area	square miles
Community descriptors	1. GDP 2. Composition of economy 3. Climate	$, text describing composition of economy and climate
Emissions Source	**Required Data**	**Required data units**
Stationary Energy		
Utility provided electricity	1. Residential electricity consumption 2. Commercial/institutional electricity consumption 3. Manufacturing industries and construction electricity consumption 4. Electricity emission factors	kWh, MWh, tons CO2/MWh
Utility provided natural gas	1. Residential natural gas consumption 2. Commercial/institutional natural gas consumption 3. Manufacturing industries and construction natural gas consumption	therms, ccf, MMBtu

Direct access/transport natural gas/stationary diesel/propane	1. Residential energy consumption 2. Commercial/institutional energy consumption 3. Manufacturing industries and construction energy consumption	therms, ccf, MMBtu, Gallons
Energy Industries	1. Energy production used in power plant auxiliary operations within the city 2. Electricity consumed by energy industries	various fuel units AND kWh, MWh
Agriculture, Forestry, Fishing	1. Agriculture, forestry, fishing electricity consumption 2. Transmission and Distribution Loss Number	kWh, MWh
Agriculture, Forestry, Fishing	1. Agriculture, forestry, fishing fuel consumption	therms, ccf, MMBtu
Non-specified energy sources	1. Electricity consumed within the towns boundary	kWh, MWh
Non-specified energy sources	1. Fuel combustion within the towns boundary	therms, ccf, MMBtu
Fugitive emissions from coal	1. Commercial and institutional coal consumption 2. Manufacturing industries and construction coal consumption	tons

Fugitive emissions oil and gas	1. Residential natural gas and oil consumption 2. Commercial and institutional natural gas and oil consumption 3. Manufacturing industries and construction natural gas and oil wells	therms, ccf, MMBtu and gallons, wells for manufacturing
Transportation		
On-road vehicles	1. Origin destination VMT or In-boundary annual VMT	annual VMT
Transit	1. Origin destination VMT 2. Trans-boundary VMT	annual gallons
On-road vehicles	1. Electricity consumed in the town for on-road transportation	kWh, MWh
Railways	1. Electricity consumed for railway transportation in the town or county	kWh, MWh
Railways	1. Fuel combustion for railway transportation in the town or county	various fuel units
Waterborne navigation	1. Electricity consumed for waterborne navigation in the town or county	kWh, MWh
Waterborne navigation	1. Fuel combustion for waterborne navigation in the town or county	various fuel units

Aviation	1. Electricity consumed for aviation occurring in the town or county	kWh, MWh
Aviation	1. Fuel combustion for aviation occurring in the town or county	gallons of aviation gasoline, gals of jet fuel
Off-road transportation	1. Electricity consumed for off-road transportation in the town or county	kWh, MWh
Off-road transportation	1. Fuel combustion for off-road transportation in the town or county	various fuel units
Waste		

Community solid waste generated	1. Residential waste generation 2. Commercial and institutional waste generation 3. Industrial waste generation 4. Location(s) of landfills 5. Types of treatment: traditional landfill, open dump, biological treatment, OR incineration, open burning,	tons of waste, in-boundary and out-of-boundary landfill location(s), types of treatment per waste disposal location
Wastewater generation	1. Residential wastewater generation 2. Commercial and institutional wastewater generation 3. Industrial wastewater generation 4. Location(s) of wastewater treatment	gallons/person/day, in-boundary and out-of-boundary wastewater treatment designation(s)
Wastewater treatment	1. Measured methane and nitrous oxide emissions from waste water treatment facilities under local government's significant influence 2. Aerobic or anaerobic treatment system 3. Nitrification or denitrification system	kg BOD5, tons of nitrogen, aerobic or anaerobic, nitrification or denitrification

BASIC+ Sources

Indicators	Required Data	Required data units
Refrigerants	1. Refrigerants used or commercial square footage	tons, square footage

Consumption-Based Sources

Indicators	Required Data	Required data units
Food Purchases	1. Denver population 2. Retail-level food availability 3. Average GHG emissions	population, kg/capita/year, kg CO2e/kg food product
Cement Use		

Water Supply		

Optional: Information Only

Indicators	Required Data	Required data units
Recycling	1. Amount of waste recycled 2. Type of waste recycled 3. Distribution of types of waste 4. Location(s) were recycling takes place by amount	tons, % wastes, description
WindSource	1. Subscribed energy	kWh
Rooftop solar - Solar* Rewards or other solar programs	1. Energy production	kWh
Rooftop solar - non-Solar* Rewards (NO KWH PROVIDED)	1. Energy production	kWh
Community solar	1. Subscribed energy	kWh

note data availability, denote GPC notation keys, and store contact information for inventory data s

Not occurring
Confidential

Is Required Data Available (Y/N)	Data Source
Yes	U.S. Census American Community Survey 1-Year Estimates City and County of Denver Assessor
Yes	U.S. Census
Yes	U.S. Bureau of Economic Analysis City and County of Denver Weather Data Depot

Is Required Data Available (Y/N)	GPC Notation Keys	Notation Keys Comments	Data Source
Y			Xcel Energy Community Energy Reports
Y			Xcel Energy Community Energy Reports

Y			Colorado Department of Public Health and the Environment Ferrellgas Amerigas
N	NO	No known industries.	
Y	IE	Included with Xcel's Community Energy Reports under commercial electricity consumption.	Xcel Energy Community Energy Reports
Y	IE	Included with Xcel's Community Energy Reports under commercial natural gas consumption.	Xcel Energy Community Energy Reports
N	NO	No known industries.	
N	NO	No known industries.	
N	NO	No coal processing or known consumption. Coal dust emitted from coal transport is assumed to produce insignificant emissions.	

Y		Fugitive emissions from natural gas distribution. Oil and gas well production.	Xcel Energy Community Energy Reports (for fugitive emissions from natural gas) Colorado Oil and Gas Conservation Commission (number of oil and gas wells) Colorado Department of Public Health and the Environment (venting and flaring activity)
Y			DRCOG
Y			Included in DRCOG's dataset; specific data available from Regional Transportation District
Y			Denver Department of Public Health and the Environment
Y			Regional Transportation District
Y			Cambridge Systematics, Inc.
N	NO	No known sources.	
N	NO	No known sources.	

Y	IE	Included with Xcel's Community Energy Reports under commercial electricity consumption.	Xcel Energy Community Energy Reports
Y			Data to calculate in-boundary aviation can be retrieved from the Colorado Department of Revenue (gallons of aviation gas) and Federal Aviation Administration (number of aircraft). Transboundary data is provided by Denver International Airport via Denver Department of Public Health and the Environment
Y			Denver Department of Public Health and the Environment Denver International Airport
Y			Denver Department of Public Health and the Environment Denver International Airport

Y			Denver Department of Public Health and the Environment Denver Solid Waste/Denver Recycles
Y			
Y			

Is Required Data Available (Y/N)			
Y			Assessor and CDPHE

Is Required Data Available (Y/N)			
Y			Retail-level food availability and average GHG emissions per food type: 2010 USDA Loss-Adjusted Food Availability average U.S. data in Heller & Keoleian (2014).
Y			2012 Commodity Flow Survey

Y			Denver Water

Is Required Data Available (Y/N)			
Y			Denver Department of Public Health and the Environment Denver Solid Waste/Denver Recycles
Y			Xcel Energy Community Energy Reports
Y			Xcel Energy Community Energy Reports
Y			Xcel Energy Community Energy Reports
Y			Xcel Energy Community Energy Reports

sources.

Contact Information	Status
https://www.census.gov/acs/www/data/data-tables-and-tools/ Lisa Chambers City and County of Denver Assessors Office 720-913-4140 lisa.chambers@denvergov.org	On file
https://www.census.gov/quickfacts/fact/table/denvercitycolorado,denvercountycolorado/PST045217	On file
https://www.census.gov/quickfacts/fact/table/denvercitycolorado,denvercountycolorado/PST045217 City and County of Denver https://www.weatherdatadepot.com/	On file

Contact Information	Status
Patrick Schmitz Associate Product Manager Xcel Energy Patrick.T.Schmitz@xcelenergy.com	On file
Patrick Schmitz Associate Product Manager Xcel Energy Patrick.T.Schmitz@xcelenergy.com	On file

Adam Wozniak Inventory & Support Supervisor CDPHE 303-692-3160 adam.wozniak@state.co.us Scott Brockelmeyer Ferrellgas scottbrockelmeyer@ferrellgas.com Alexandra Spooner Amerigas alexandra.spooner@amerigas.com	CDPHE and Ferrell Gas data on file. Amerigas was unresponsive with requests for data.
	N/A
Patrick Schmitz Associate Product Manager Xcel Energy Patrick.T.Schmitz@xcelenergy.com	On file
Patrick Schmitz Associate Product Manager Xcel Energy Patrick.T.Schmitz@xcelenergy.com	On file
	N/A
	N/A
	N/A

Patrick Schmitz Associate Product Manager Xcel Energy Patrick.T.Schmitz@xcelenergy.com Retrieved from: https://cogcc.state.co.us/data.html#/cogis Sara Heald Colorado Department of Public Health and the Environment Technical Planner 303-692-3212 sara.heald@state.co.us	On file
Steve Cook Transportation Modeling and Operations Manager DRCOG scook@drcog.org (303) 480-6749	On file
Perry Edman Planning Project Manager - Environmental RTD perry.edman@rtd-denver.com (303) 299-2544	In progress
Mike Salisbury Transportation Energy Lead Denver Department of Public Health and the Environment Mike.Salisbury@denvergov.org	On file
Perry Edman Planning Project Manager - Environmental RTD perry.edman@rtd-denver.com (303) 299-2544	In progress
Evan Enarson-Hering Principal, Integrated Planning and Policy eenarsonhering@camsys.com (303) 353-3042	On file
	N/A
	N/A

Patrick Schmitz Associate Product Manager Xcel Energy Patrick.T.Schmitz@xcelenergy.com	On file
In-boundary aviation can be retrieved https://www.colorado.gov/pacific/revenue/colorado-motor-fuel-taxes; https://registry.faa.gov/aircraftinquiry/StateCounty_Results.aspx?Statetxt=CO&Countytxt=DENVER&PageNo=1; and http://registry.faa.gov/aircraftinquiry/statecounty_inquiry.aspx. Tom Herrod Climate & GHG Program Lead City and County of Denver Thomas.Herrod@denvergov.org (720) 865-5388	On file
Mike Salisbury Transportation Energy Lead Denver Department of Public Health and the Environment Mike.Salisbury@denvergov.org Amanda Sutton Sustainability Manager Denver International Airport amanda.sutton@flydenver.com (303) 342-2636	On file
Mike Salisbury Transportation Energy Lead Denver Department of Public Health and the Environment Mike.Salisbury@denvergov.org Amanda Sutton Sustainability Manager Denver International Airport amanda.sutton@flydenver.com (303) 342-2636	On file

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Jennifer Schwarz Regulatory Compliance Specialist Metro Wastewater Reclamation District jschwarz@mwrd.dst.co.us (303) 286-3000	On file
Jennifer Schwarz Regulatory Compliance Specialist Metro Wastewater Reclamation District jschwarz@mwrd.dst.co.us (303) 286-3000	On file
Lisa Chambers City and County of Denver Assessors Office 720-913-4140 lisa.chambers@denvergov.org	On file
Report by Heller and Keoleian retrieved from: http://binarystore.wiley.com/store/10.1111/jiec.12174/asset/supinfo/jiec12174-sup-0001-SupMat.pdf?v=1&s=b490a6f0a6bc16339015327fc73873a5bcb55d97	On file
Data is accessible in the table 'Shipment Characteristics by Origin Geography by Commodity: 2012 available at https://www.census.gov/data/tables/2012/econ/cfs/state.html	On file

Data on water use is included in Denver Water's 2017 Annual Financial Report, available at https://www.denverwater.org/about-us/investor-relations/financial-information/annual-reports.	On file
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Emission Factors

Notes:
Even emission factors shown in white cells should be checked every few years as GHG accounting methods changing earlier and should be verified with each subsequent inventory.

Constants

Conversion Factors	
2,204.62	lbs.
2,000.00	lbs.
1,000.00	kWh
1,000.00	MWh
1,000.00	kg
1,000,000	g
100.00	cubic feet of natural gas
0.1000	MMBtu of natural gas
0.1385	MMBtu of distillate fuel
1.0000	gallon gasoline equivalent
1.00	kg
1.00	liter
1.00	square meter

Global Warming Potentials	
Common Name	**Formula**
Carbon Dioxide	CO_2
Methane	CH_4
Nitrous Oxide	N_2O

Buildings

Electricity	
Utility	**Greenhouse Gas**
Xcel Energy	CO_2
Xcel Energy	CO_2
Various	CH_4
Various	N_2O

Natural Gas	
Utility	**Greenhouse Gas**
Xcel Energy	CO_2
Xcel Energy	CH_4
Xcel Energy	N_2O

Diesel	
Utility	**Greenhouse Gas**
Various	CO_2
Various	CH_4

Various	N_2O

Propane	
Greenhouse Gas	**Value**
CO_2	0.00559
CH_4	0.0000010
N_2O	0.0000001

Transportation

Gasoline	
Greenhouse Gas	**Vehicle Type**
CO_2	All
CH_4	Passenger Vehicle
CH_4	Light Truck
CH_4	Heavy Vehicle
CH_4	Motorcycle
N_2O	Passenger Vehicle
N_2O	Light Truck
N_2O	Heavy Vehicle
N_2O	Motorcycle

Diesel	
Greenhouse Gas	**Vehicle Type**
CO_2	All
CH_4	Passenger Vehicle
CH_4	Light Truck
CH_4	Heavy Truck
CH_4	Heavy Vehicle (Bus)
N_2O	Passenger Vehicle
N_2O	Light Truck
N_2O	Heavy Truck
N_2O	Heavy Vehicle (Bus)

Ethanol	
Greenhouse Gas	**Vehicle Type**
CO_2	All
CH_4	Light Duty
CH_4	Heavy Duty
N_2O	Light Duty
N_2O	Heavy Duty

Railways	
Greenhouse Gas	**Value**
CO_2	0.023
CH_4	0.0018

N_2O	0.0006

Jet Fuel	
Greenhouse Gas	**Value**
CO_2	9.57
CH_4	0.27
N_2O	0.31

Aviation Gasoline	
Greenhouse Gas	**Value**
CO_2	8.31
CH_4	7.04
N_2O	0.11

Equipment Emission Factors (Propane)	
Greenhouse Gas	**Vehicle Type**
CO_2	All

CNG	
Greenhouse Gas	**Vehicle Type**
CO_2	Heavy Duty Vehicle
CH_4	Heavy Duty Vehicle
N_2O	Heavy Duty Vehicle

Waste

Landfilled Waste	
Waste Component	**Value**
MSW	0.06
Newspaper	0.043
Office paper	0.203
Corrugated containers	0.12
Magazines/third-class mail	0.049
Food scraps	0.078
Grass	0.038
Leaves	0.03
Branches	0.062
Dimensional lumber	0.062
Oxidization factor	10%
Collection efficiency rate for landfills with gas collection systems	75%

Composted Waste	
Value	**Description**
0.00050	mt CH_4/ton waste
0.00023	mt N_20/ton waste

Recycled Materials	
Waste Component	**From using recycled inputs instead of virgin inputs ($mtCO_2e$/short ton)**
Paper and paperboard (mixed paper)	3.52
Glass	0.28
Metals (mixed)	3.97
Plastics (mixed)	0.98
Wood (dimensional lumber)	2.46

Wastewater

Municipal Wastewater Treatment	
Source	**Greenhouse Gas**
Process N2O emissions for WWTPs with nitrification and denitrification	N_2O
Fugitive N2O Emissions from Effluent Discharge	N_2O
Combustion gas	CH_4
Combustion gas	N_2O
Days Year	N/A
Density of methane	N/A
Conversion	N/A
Methane Destruction Efficiency	N/A
Molecular weight ratio of N2O to N2	N/A
Industrial Commercial Discharge Multiplier	N/A

Fugitive Emissions and Refrigerants

Fugitive and Process Emissions: Production Emissions from Natural Gas Wells	
Greenhouse Gas	**Value**
CH_4	10.62

Fugitive and Process Emissions: Transmission Emissions from Natural Gas Wells	
Greenhouse Gas	**Value**
CH_4	0.40
CH_4	1,250.00
CH_4	1,185.00

CH_4	0.62
CH_4	983.70
CH_4	964.20

Fugitive and Process Emissions: Venting/Flaring Emissions from Natural Gas Wells	
Greenhouse Gas	**Value**
CH_4	54.71

Fugitive and Process Emissions: Oil Wells	
Greenhouse Gas	**Value**
CH_4	439.43
CH_4	6.26
CH_4	3.85

Fugitive and Process Emissions: Refrigerants	
Refrigerants	**Global Warming Potential**
R-134A	1,430
R-22	1,810
HCFC 123	77
R-114	10,000

Refrigerant Emissions from Commercial AC leakage	
Variable	**Value**
Square feet per ton of cooling (sf/ton)	300
Amount of refrigerant (kg) per ton of cooling	1
Estimated refrigerant loss	5%

Cement	
Variable	**Value**
Portland Cement (lb CO_2e/lb. cement)	1.34

Water Delivery	
Variable	**Value**
Delivered water (mt CO_2e/MG)	0.64

; become more sophisticated and accurate; the ones shown in light blue have a higher likelihood of

1	metric ton
1	US ton
1	MWh
1	GWh
1	metric ton
1	metric ton
1	therm
1	therm
1	gal diesel
33.7	kWh
2.2	lbs.
0.3	gallons
10.8	square foot

GWP	Source
1	GHG Protocol: https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf
28	
265	

Value	Units
0.593	mt CO_2/MWh
0.612	mt CO_2/MWh
0.00006	mt CH_4/MWh
0.00001	mt N_2O/MWh

Value	Units
0.0053	mt CO_2/th
0.0000005	mt CH_4/th
0.00000001	mt N_2O/th

Value	Units
0.010243	mt CO_2/gal
0.00000040	mt CH_4/gal

0.000000100	mt N_2O/gal

Units	Source
mt CO_2/gal	ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) – Appendix C: Built Environment Emission Activities and Sources, Version 1.1, July 2013: http://icleiusa.org/ghg-protocols/.
mt CH_4/gal	
mt N_2O/gal	

Value	Units
0.009	mt CO_2/gal
0.020	g CH_4/mile
0.023	g CH_4/mile
0.033	g CH_4/mile
0.007	g CH_4/mile
0.017	g N_2O/mile
0.025	g N_2O/mile
0.013	g N_2O/mile
0.068	g N_2O/mile

Value	Units
0.010	mt CO_2/gal
0.001	g CH_4/mile
0.001	g CH_4/mile
0.005	g CH_4/mile
0.005	g CH_4/mile
0.001	g N_2O/mile
0.002	g N_2O/mile
0.005	g N_2O/mile
0.005	g N_2O/mile

Value	Units
0.006	mt CO_2/gal
0.055	g CH_4/mile
0.197	g CH_4/mile
0.067	g N_2O/mile
0.175	g N_2O/mile

Units	Source
kg CO_2/ton-mile	EPA's Emission Factors for Greenhouse Gas Inventories, Table 9: https://www.epa.gov/sites/production/files/2018-
g CH_4/ton-mile	

g N_2O/ton-mile	03/documents/emission-factors_mar_2018_0.pdf.

Units	Source
kg CO_2/gal	All aviation emission factors from: Local Government Operations Protocol, Version 1.1, May 2010: https://www.theclimateregistry.org/wp-content/uploads/2014/12/2010-05-06-LGO-1.1.pdf.
g CH_4/gal	
g N_2O/gal	

Units	Source
kg CO_2/gal	All aviation emission factors from: Local Government Operations Protocol, Version 1.1, May 2010: https://www.theclimateregistry.org/wp-content/uploads/2014/12/2010-05-06-LGO-1.1.pdf.
g CH_4/gal	
g N_2O/gal	

Value	Units
0.00566	mt CO_2/gal

Value	Units
0.0001	mt CO_2/standard cubic foot
1.966	g CH_4/mile
0.175	g CH_4/mile

Description	Source
mt CH_4/ton waste	ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) – Appendix E: Solid Waste Emission Activities and Sources, Version 1.1, July 2013: http://icleiusa.org/ghg-protocols/.
mt CH_4/ton waste	
mt CH_4/ton waste	
mt CH_4/ton waste	
mt CH_4/ton waste	
mt CH_4/ton waste	
mt CH_4/ton waste	
mt CH_4/ton waste	
mt CH_4/ton waste	
mt CH_4/ton waste	

Source
Documentation for Greenhouse Gas Emissions and Energy Factors Used in the Waste Reduction Model (WARM): https://www.epa.gov/sites/production/files/2016-03/documents/warm_v14_management_practices.pdf. Assumes green waste. Values are adjusted to CH4 and N2O emission factors.

Landfill with gas collection but no energy recovery ($mtCO_2e$/short ton)	Total avoided emission factor ($mtCO_2e$/ton recycled)
0.57	4.09
0.04	0.32
0.04	4.01
0.04	1.02
0.33	2.79

Value	Units
7	g N_2O/person/year
0.005	kg N_2O-N/kg sewage-N
0.0032	kg CH_4/MMBtu
0.00063	kg N_2O/MMBtu
365.25	Days
662	Grams per cubic meter
0.0283	m^3/ft^3
99%	
1.57	44/28
1.25	

Units	Source
mt CH_4/active well	EPA's State Inventory Tool Emissions from Natural Gas and Oil Systems for Colorado: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

Units	Source
mt CH_4/miles of gathering pipeline	EPA's State Inventory Tool Emissions from Natural Gas and Oil Systems for Colorado:
mt CH_4/number of gas processing plants	
mt CH_4/number of LNG storage compressor stations	

mt CH_4/miles of transmission pipeline	Systems for Colorado: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool
mt CH_4/number of gas transmission compressor stations	
mt CH_4/number of gas storage compressor stations	

Units	Source
mt CH_4/million BTU of natural gas vented and flared	EPA's State Inventory Tool Emissions from Natural Gas and Oil Systems for Colorado: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

Units	Source
kg CH_4/1000 barrels produced	EPA's State Inventory Tool Emissions from Natural Gas and Oil Systems for Colorado: https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool
kg CH_4/1000 barrels refined	
kg CH_4/1000 barrels transported	

Notes
Taken from IPCC: https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html

Notes
Taken from: https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html

Notes
Taken from the EPA's Life Cycle Inventory: https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NRMRL&dirEntryId=338320&subject=Health%20Research&showCriteria=0&searchAll=Waste%20Management%20or%20Materials%20Management&sortBy=revisionDate

Notes
Denver Water

Source
Provided in Xcel Energy's 2017 Community Energy Report. Also shown as "Option 2" Xcel's *CRR-Energy-Carbon-Summary-Final* .
Shown as "Option 3" Xcel's *CRR-Energy-Carbon-Summary-Final* .
EPA's eGrid: eGRID 2016 summary tables, table 1, sub region RMPA. https://www.epa.gov/sites/production/files/2018-02/documents/egrid2016_summarytables.pdf.

Source
ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) – Appendix C: Built Environment Emission Activities and Sources, Version 1.1, July 2013: http://icleiusa.org/ghg-protocols/.

Source
ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) – Appendix C: Built Environment Emission Activities and Sources, Version 1.1, July 2013: http://icleiusa.org/ghg-protocols/. Assumes distillate fuel oil number 2 and that diesel is primarily used in generators by the

fuel oil number 2 and that diesel is primarily used in generators by the commercial/industrial sector.

Source
ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) – Appendix D: Transportation and Other Mobile Emission Activities and Sources, Version 1.1, July 2013: http://icleiusa.org/ghg-protocols/. Value is 8.78 kg CO2e/gal.

Source
ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) – Appendix D: Transportation and Other Mobile Emission Activities and Sources, Version 1.1, July 2013: http://icleiusa.org/ghg-protocols/.

Source
(1) Ethanol CO2 emission factor from: ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) – Appendix D: Transportation and Other Mobile Emission Activities and Sources, Version 1.1, July 2013: http://icleiusa.org/ghg-protocols/. (2) Ethanol CH4 and N2O emission factors from: Local Government Operations Protocol, Version 1.1, May 2010: https://www.theclimateregistry.org/wp-content/uploads/2014/12/2010-05-06-LGO-1.1.pdf.

Notes
2016 Climate Registry Default Emissions Factors: https://www.theclimateregistry.org/wp-content/uploads/2014/11/2016-Climate-Registry-Default-Emission-Factors.pdf. CO2 Emissions factors source from Table 12.1 for 'Propane'.

Notes
(1) CNG CO2 emission factor from: ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) – Appendix D: Transportation and Other Mobile Emission Activities and Sources, Version 1.1, July 2013: http://icleiusa.org/ghg-protocols/. (2) CNG CH4 and N2O emission factors from: Local Government Operations Protocol, Version 1.1, May 2010: https://www.theclimateregistry.org/wp-content/uploads/2014/12/2010-05-06-LGO-1.1.pdf.

Source
ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) – Recycling and Composting Emissions Protocol, Version 1.0, July 2013: http://icleiusa.org/ghg-protocols/. Emission factors represent those for avoided emissions from a facility with landfill gas capture but no energy production.

Source
ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) – Appendix F: Wastewater and Water Emission Activities and Sources, Version 1.1, July 2013: http://icleiusa.org/ghg-protocols/.
Standard assumption

Community Indicators

Notes:

(1) Land area from the U.S. Census: https://www.census.gov/quickfacts/fact/table/denvercitycolorado,denve

(2) 2017 population, number of households, and housing units estimate from the U.S. Census American Comr

(3) GDP from the U.S. Bureau of Economic Analysis: https://www.bea.gov/system/files/2018-09/gdp_metro0

(4) Climate type is defined using the Koppen Climate Classification, which designates a classification of BSk: h

(5) Number of occupied housing units from the U.S. Census American Community Survey 1-Year estimates, av

(6) Number of multi-family households from the U.S. Census American Community Survey 1-Year estimates, c represents the sum of the number of occupied housing units with '3-4 apartments', 5 to 9 apartments' and '1

(7) Number of commercial business and institutions from the U.S. Census American Community Survey 2016 I

(8) Number of industries is from the U.S. Census American Community Survey 2016 Business Patterns, availab

(9) Number of municipal buildings is provided in a spreadsheet from the City and County of Denver's Assessor

(10) Commercial, industrial, municipal, and multi-family building square feet is provided in a spreadsheet fro

(11) Number of people employed in the city is from the U.S. Census American Community Survey 2016 Busine

(12) HDD and CDD data is available for zip code 80210 (assumed to be representative of City) from www.wea

(13) Data on 2017 sales taxes collected is drawn from City and County of Denver's Comprehensive Annual Fin

(14) Total retail sales calculated based on the sales taxes collected in Denver in 2017 and the City's retail sale

Community Indicator	Value
Land area (km^2)	398
Resident population	704,621
GDP	$ 51,639,571,589
Composition of economy	Federal, high-tech, tourism, financial, higher education
Climate	Semi-arid, with low humidity
Number of housing units	320,545
Number of occupied housing units	296,938
Number of households	287,262
Number of multi-family households	126,586
Number of commercial businesses and institutions	24,938
Number of industries	48
Number of municipal buildings	2,677
Commercial businesses and institutional units area (sq. ft.)	416,107,019
Industrial buildings area (sq. ft.)	74,423,147
Municipal buildings area (sq. ft.)	28,156,786
Multi-family household building area (sq. ft.)	84,932,025
Number of people employed in the city	439,602
Heating degree days	3,966
Cooling degree days	1,454
Sales Taxes	$721,512,000
Retail sales	$19,767,452,055

ercountycolorado/PST045217.

munity Survey 1-Year estimates, available for download at https://www.census.gov/acs/www/data/data-tables-and-tools/.
0918_0.pdf. PDF on file. Original GDP values include the Denver-Lakewood-Aurora area, and Denver's GDP
ttps://www.weatherbase.com/weather/weather-
vailable for download at https://www.census.gov/acs/www/data/data-tables-and-tools/. PDF on file.

vailable for download at https://www.census.gov/acs/www/data/data-tables-and-tools/. Number
0 or more apartments'. PDF on file.

Business Patterns, available for download at https://www.census.gov/acs/www/data/data-tables-and-
ble for download at https://www.census.gov/acs/www/data/data-tables-and-tools/. PDF on file.
's Office titled 'real_property_apartment_and_commercial_characteristics.xls'. Spreadsheet is available at
m the City and County of Denver's Assessors Office titled
ess Patterns, available for download at https://www.census.gov/acs/www/data/data-tables-and-tools/. PDF
atherdatadepot.com using 60 degrees Fahrenheit as the balance point temperature.
ancial Report (CAFR), Table Titled 'Sales Tax by Category' on page 179:
s tax rate for 2017 (per Denver's 2017 CAFR, 2017 sales tax rate was 3.65%).

PDF on file.

Energy Data

Notes:

(1) Data on electricity and natural gas consumption was provided in Xcel Energy's Community Energy Report for 2017 for the City and County of Denver. Xcel provides these reports on an annual basis. Spreadsheet is on file. Commercial electricity use includes electricity use in metered and non-metered street lights within the community. Electricity consumed by electric vehicles was removed from the stationary totals; it was assumed that electricity consumed by electric vehicles was metered at an adjacent building. Commercial electricity includes electricity consumed by electric vehicles and railways (Light Rail and Commuter Rail); these values were subtracted from the Commercial Electricity totals.

*(2) Xcel's Community Energy Reports provide data on the total renewable energy credits (RECs) and renewable energy production occurring within the community. Data on RECs purchased and energy production through on-site solar energy systems that are a part of the Xcel Solar*Rewards program is provided in kilowatt hours (kWh). Data on the total capacity of on-site solar systems not enrolled in Solar*Rewards is provided in kilowatts (kW) of installed capacity. The inventory team estimated total annual production of these solar systems using the National Renewable Energy Labs PVWatts tool (https://pvwatts.nrel.gov/pvwatts.php), using the Denver Department of Public Health and the Environment's address as a proxy for the system location.*

(3) Data on the use of stationary diesel was provided by Adam Wozniak with the Colorado Department of Public Health and the Environment. Spreadsheet is on file. Stationary diesel use data reported by CDPHE represents the last 12 months of reported stationary diesel use from sources within the community. Because sources are only required to report their use every five years, this value may not represent the exact usage of stationary diesel in the inventory year, but is assumed to be a very close approximation of total use in the inventory year.

(4) Data on propane use was provided by Scott Brocklemeyer with FerrellGas; spreadsheet is on file. Scott provided data on gallons of propane purchased by Industrial/Commercial and Residential customers served by FerrellGas in Denver zip codes. Total use in each zip code was attributed to Denver based off an approximation of the percent of the land area of the zip code that is within the City and County of Denver. Amerigas was unresponsive to data requests after multiple attempts.
(5) Per Amanda Sutton, Sustainability Manager at Denver International Airport, a very small amount of electricity (i.e., less than 7,000 kWh) used at the airport is provided by United Power. As this electricity use results in a minimal amount of emissions (i.e. less than 5 metric tons), it has not been included in the inventory.

(6) OPTION 2 and OPTION 3 emission factors refer to the different electricity emission factors provided by Xcel Energy in their CRR-Energy-Carbon-Summary-Final*. OPTION 3 emission factors exclude RECs Xcel retired on behalf of customers, while OPTION 2 includes these RECs.*

Emissions Summary	
Scope 1	1,457,221
Scope 2	3,417,646
Scope 3	N/A
Information-Only Avoided Emissions	(75,639)
Total (Scope 1 and Scope 2)	**4,874,867**

Utility Data								
Electricity	**Electricity Provided by Xcel Energy (kWh)**	**Total Electricity (kWh)**	**Emissions (mt CO_2) Using OPTION 2 Emission Factor**	**Emissions (mt CO_2) Using OPTION 3 Emission Factor**	**Emissions (mt CH_4)**	**Emissions (mt N_2O)**	**Emissions (mt CO_2e) Using OPTION 2 Emission Factor**	**Emissions (mt CO_2e) Using OPTION 3 Emission Factor**
Commercial	4,091,603,473	4,091,031,278	2,425,982	2,503,711	254	37	2,442,935	2,520,665
Industrial	797,533,935	797,533,935	472,938	488,091	50	7	476,243	491,396
Residential	837,800,147	834,753,747	495,009	510,869	52	8	498,468	514,329
Multi-family	1,058,482,546	1,058,482,546	627,680	647,791	66	10	632,067	652,178
Total Electricity	**5,726,937,554**	**5,723,318,959**	**3,393,928**	**3,502,671**	**356**	**52**	**3,417,646**	**3,526,389**

Natural Gas	**Natural Gas Provided by Xcel Energy (th)**	**Emissions (mt CO_2)**	**Emissions (mt CH_4)**	**Emissions (mt N_2O)**	**Emissions (mt CO_2e)**
Commercial	80,406,952	426,318	40	1	427,656
Industrial	73,502,947	389,713	37	1	390,936
Residential	116,553,736	617,968	58	1	619,909
Multi-family	53,444,021	283,360	27	1	284,250
Total Natural Gas	**270,463,635**	**1,433,998**	**135**	**3**	**1,438,501**

Propane	**Ferrell Gas (gal)**	**AmeriGas (gal)**	**Total Consumption (Gal)**	**Emissions (mt CO_2)**	**Emissions (mt CH_4)**	**Emissions (mt N_2O)**	**Emissions (mt CO_2e)**
Commercial and Industrial	457,165		457,165	2,556	0	0	2,580
Residential	940		940	5	0	0	5
Total Propane	**458,105**	**0**	**458,105**	**2,561**	**0.458**	**0.046**	**2,586**

Stationary Diesel	Total Consumption (gal)	Emissions (mt CO_2)	Emissions (mt CH_4)	Emissions (mt N_2O)	Emissions (mt CO_2e)
Commercial and Industrial	1,569,245	16,074	1	0	16,134
Total Diesel	**1,569,245**	**16,074**	**1**	**0**	**16,134**

Information-Only Renewable Energy					
Xcel Windsource/RECs Retained by the Customer	**Electricity Provided by Xcel Energy (kWh)**	**Emissions (mt CO_2)**	**Emissions (mt CH_4)**	**Emissions (mt N_2O)**	**Emissions (mt CO_2e)**
Commercial and Industrial	22,058,442	13,081	1	0	13,172
Residential	31,017,950	18,394	2	0	18,522
Total RECs (Windsource)	**53,076,392**	**31,474**	**3**	**0**	**31,694**

On-site Solar (Solar Rewards)/RECs owned by Utility	Electricity Provided by Xcel Energy (kWh)	Emissions (mt CO_2)	Emissions (mt CH_4)	Emissions (mt N_2O)	Emissions (mt CO_2e)
Commercial and Industrial	49,122,716	29,130	3	0	29,333
Residential	15,249,063	9,043	1	0	9,106
Total Solar Rewards	**64,371,779**	**38,172**	**4**	**1**	**38,439**

On-site Solar (non-solar Rewards)/RECs Retained by Customer	Electricity Provided by Xcel Energy (kWh)	Emissions (mt CO_2)	Emissions (mt CH_4)	Emissions (mt N_2O)	Emissions (mt CO_2e)
Commercial and Industrial	863,563	512	0	0	516
Residential	4,685,289	2,778	0	0	2,798
Total On-Site Solar	**5,548,852**	**3,290**	**0**	**0**	**3,313**

Community Solar/RECs owned by Utility	Electricity Provided by Xcel Energy (kWh)	Emissions (mt CO_2)	Emissions (mt CH_4)	Emissions (mt N_2O)	Emissions (mt CO_2e)
Commercial and Industrial	2,027,964	1,203	0	0	1,211
Residential	1,642,148	974	0	0	981
Total Solar Gardens	**3,670,112**	**2,176**	**0**	**0**	**2,192**
Total Information-Only Renewable Energy Avoided Emissions from Customer Owned RECs	**58,625,244**	**34,765**	**4**	**1**	**35,008**
Total Information-Only Renewable Energy Avoided Emissions from Utility Owned RECs	**68,041,891**	**40,349**	**4**	**1**	**40,631**
Total Information-Only Renewable Energy Avoided Emissions	**126,667,135**	**75,114**	**7.87**	**1.15**	**75,638.53**

Fugitive Emissions

Notes:
(1) Data on active oil and gas wells from the Colorado Oil and Gas Information System, available at https://
(2) Based off information in a report by the Environmental Defense Fund, the leakage rate for natural gas a.
based off an assumption of the amount supplied to the system, which is calculated from the amount consur
(3) Assume that the density of natural gas is 0.8 kg per cubic meter and that natural gas is 93.4% methane (
(4) There is one active natural gas compressor station in Denver (per COGIS, pdf on file).
(5) Per conversations with Sara Heald at Colorado Department of Public Health and the Environment (CDPH
operators. In the absence of data, we have assumed that no venting and/or flaring occurs.

(6) Per conversations with City and County of Denver, the 53 oil and gas wells in Denver are located in the lo
regarding gathering and transmission pipelines for oil and gas wells located in Denver, the following assum
active well; and (b) the miles of transmission pipelines are equal to the distance from Denver International A

(7) No N2O is recorded from leakage form natural gas.

(8) Coal is transported through Denver on open air railways, and a small amount is converted to coal dust. I
operations from coal. Since post-mining includes the handling and transportation of coal and most of the G
emissions from transporting coal were not calculated. Conversations with Clemson University, who research
confirmed that fugitive emissions from transporting coal via open air rails were likely to be insignificant.

Emissions Summary	
Scope 1	99,919
Scope 2	N/A
Scope 3	N/A
Total	**99,919**

Leakage Rate for Natural Gas Distribution		
Source	**Total Therms**	**Total Fugitive Emissions (mt CO_2)**
Commercial	80,406,952	5
Industrial	73,502,947	5
Residential	169,997,757	11
Total	**323,907,656**	**21**

Oil and Gas Wells	
Source	**Value**
Oil Produced (Barrels)	10,184
Natural gas wells (number of wells)	53
Number of miles of natural gas gathering pipeline	53
Number of miles of natural gas transmission pipeline	14
Number of gas processing plants	0
Number of LNG storage compressor stations	0
Number of gas transmission compressor stations	0
Number of gas storage compressor stations	1
Million BTU of natural gas vented and flared	0

Natural Gas Production, Transmission, and Venting/Flaring		
Source	**Total Fugitive Emissions (mt CH_4)**	**Total Fugitive Emissions (mt CO_2e)**
Natural Gas Production	563	15,760

Natural Gas Transmission	994	27,834
Natural Gas Venting and Flaring	0	0
Total	**1,557**	**43,594**

Emissions from Oil Wells		
Source	**Total Fugitive Emissions (mt CH_4)**	**Total Fugitive Emissions (mt CO_2e)**
Oil Production	4	125
Oil Refining	0	2
Oil Transportation	0	1
Total	**5**	**128**

'cogcc.state.co.us/data.html#/cogis. Pdf is on file. Assume that wells
ssumes a 0.3% leakage in the distribution system. Fugitive emissions are
ned and the leakage rate.
and 1% carbon dioxide.

IE), there is no available data on venting or flaring from oil and gas facility

and footprint of Denver International Airport. In the absence of data
ptions have been made: (a) there is 1 mile of gathering pipeline for each
Airport to the intersection of I-70 and I-225 (equal to 14 miles).

IPCC provides guidance on calculating fugitive emissions from post-mining
HG emissions from coal get released during the handling, fugitive
ned emissions on the handling and distribution of coal throughout the U.S.,

Total Fugitive Emissions (mt CH_4)	Total Fugitive Emissions (mt CO_2e)
498	13,950
455	12,752
1,053	29,494
2,006	**56,196**

On-Road Data

Notes:
(1) County VMT provided by Steve Cook with DRCOG. Data on file. DRCOG only calculates VMT every five years, p
"You can use our "weekday to annual" factor of 338 times the weekday value to get annual values. This is a reg
(2) Vehicle distribution data was provided by CDPHE. Spreadsheet is on file.
(3) Assumptions: a) 10% ethanol in gasoline; b) 0% biodiesel in diesel.
(4) Used vehicle efficiencies from the EPA state inventory tool (spreadsheet on file).

Emissions Summary	
Scope 1	2,618,125
Scope 2	2,140
Scope 3	N/A
Total	**2,620,265**

GASOLINE, DIESEL, AND ETHANOL VEHICLES			
Source	**Emissions from Gasoline (mt CO_2)**	**Emissions from Gasoline (mt CH_4)**	**Emissions from Gasoline (mt N_2O)**
On-road vehicles including transit	2,168,017	106	107
Emissions from transit (diesel)	0	0	0
Total on-road vehicles minus transit	2,168,017	106	107

Fuel Additives	
Percent of ethanol in gasoline	10%
Percent of biodiesel in diesel	0%

Source	Gas cars	Gas light trucks	Gas freight trucks
Community VMT	1,595,444,447	3,089,594,581	95,075,894

Year	Total Annual VMT	VMT by Gasoline	VMT by Diesel
2017	5,615,074,551	4,793,759,553	288,675,047
Total	**5,615,074,551**	**4,793,759,553**	**288,675,047**

Fuel Efficiencies	
Vehicle Type	**MPG**
Gas cars	24.10
Gas light trucks	18.50
Diesel cars	32.40
Diesel light trucks	22.10
Gas freight trucks	7.07
Diesel freight trucks	6.59
Gas motorcycle	50.00

	LDGV	LDGT12	LDGT34
VMT Distribution:	0.3228	0.4087	0.1394

Denver 16 mix	0.3160		
Denver 28 mix	0.3157		
	LDGT1	LDGT2	LDGT3
VMT Mix:	0.0944	0.3143	0.0955
Denver 16 mix	0.1053	0.3506	0.1065
Denver 28 mix	0.1053	0.3506	0.1065
	HDGV2B	HDGV3	HDGV4
VMT Mix:	0.0300	0.0011	0.0003
Denver 16 mix	0.0206	0.0021	0.0017
Denver 28 mix	0.0158	0.0006	0.0002
	HDDV2B	HDDV3	HDDV4
VMT Mix:	0.0090	0.0028	0.0029
Denver 28 mix	0.0048	0.0015	0.0015
	Gas BUS	URBAN	SCHOOL
VMT Mix:	0.0001	0.0010	0.0018
Denver 16 mix	0.0017		0.0033
Denver 28 mix	0.0002	0.0015	0.0033
	Gasoline passenger vehicle	Gasoline Light Trucks (<6,000 lbs.)	Gasoline Light Trucks (>6,000 lbs.)
Percent of all VMT	31.57%	45.59%	15.55%
Percent of gas VMT	33.28%	48.06%	16.39%
Percent of diesel VMT			

ELECTRIC VEHICLES

Notes:

(1) Estimated number of EVs from Michael Salisbury with Denver, email on file.

(2) Estimated number of VMTs per EV from Michael Salisbury with Denver, email on file.

(3) Based off a report by the Idaho National Laboratory titled Plugged In: How Americans Charge Their Electric Ve

Estimated electric consumption of electric vehicle (kWh/mile)	0.32

Source	Emissions (mt CO_2)	Emissions (mt CH_4)	Emissions (mt N_2O)
Denver Electric Vehicles	2,125	0	0

Source	Estimated Number of Electric Vehicles	Average VMT per Vehicle	Total Electricity Consumption from Electric Vehicles (kWh)
Denver Electric Vehicles	1,600	7,000	3,584,000

ıer Steve's guidance, VMT was extrapolated based on actual 2015 VMT and projected 2020 values. DRCOG provided average wee
ional based value we developed through an analysis of regionwide traffic counts. It brings in the estimate that weekend traffic v

Emissions from Gasoline (mt CO_2e)	Emissions from Diesel (mt CO_2)	Emissions from Diesel (mt CH_4)	Emissions from Diesel (mt N_2O)	Emissions from Diesel (mt CO_2e)	Emissions from Ethanol (mt CO_2)
2,199,230	431,595	1	1	431,989	157,759
0	23,717	0	0	23,717	0
2,199,230	407,878	1	1	408,273	157,759

Gas motorcycle	Diesel cars	Diesel light trucks	Diesel freight trucks	Ethanol passenger cars	Ethanol light trucks
13,644,631	1,647,506	12,526,877	274,500,665	177,271,605	343,288,287

VMT by Ethanol	Gasoline Consumed (gal)	Diesel Consumed (gal)	Ethanol Consumed (gal)
532,639,950	246,926,812	42,271,798	27,436,312
532,639,950	**246,926,812**	**42,271,798**	**27,436,312**

Vehicle Types					
HDGV	LDDV	LDDT	HDDV	MC	All Veh
0.0358	0.0003	0.0020	0.0859	0.0052	1.0001

	0.0003			0.0027 0.0027	
LDGT4	LDDT12	LDDT34	t2 total	t4total	
0.0439	0.0000	0.0020	0.3143	0.0459	
0.0512					
0.0490	0.0000	0.0022			
HDGV5	HDGV6	HDGV7	HDGV8A	HDGV8B	
0.0010	0.0023	0.0009	0.0000	0.0000	
0.0013	0.0046	0.0054	0.0059	0.0211	
0.0005	0.0012	0.0005	0.0000	0.0000	
HDDV5	HDDV6	HDDV7	HDDV8A	HDDV8B	
0.0014	0.0065	0.0094	0.0112	0.0399	
0.0008	0.0034	0.0049	0.0059	0.0211	

Gasoline Heavy Trucks	Diesel Passenger Cars	Diesel Light Trucks	Diesel Heavy Trucks	Motorcycles	Total
1.88%	0.03%	0.22%	4.89%	0.27%	100.00%
1.98%				0.28%	100.00%
	0.57%	4.34%	95.09%		100.00%

ehicles, 85% of EV charging is assumed to occur at residences, while 15% of charging is assumed to occur at workplaces.

Emissions (mt CO_2e)
2,140

Total Residential Electricity Consumption (kWh)	Total Commercial Electricity Consumption (kWh)
3,046,400	537,600

ekday VMT, which is multiplied by 338 to estimate total annual VMT. Per DRCOG:
olumes are roughly 75% of weekday."

Emissions from Ethanol (mt CH_4)	Emissions from Ethanol (mt N_2O)	Emissions from Ethanol (mt CO_2e)	Emissions from Ethanol (mt $CO_2(b)$)	Total Emissions (Biogenic mt CO_2)	Total Emissions (Fossil Fuel mt CO_2)
31	37	10,622	157,759	157,759	2,599,612
0	0	0	0	0	23,717
31	37	10,622	157,759	157,759	2,575,896

Ethanol freight trucks	Ethanol Motorcycle
10,563,988	1,516,070

Total Emissions (mt CH_4)	Total Emissions (mt N_2O)	Total Emissions (mt CO2e)
138	145	2,641,841
0	0	23,717
138	145	2,618,125

Transit Data

Notes:

(1) Assume that all RTD buses use diesel in 2017 per telephone conversation with Igancio Correa at RTD.

(2) Data on kWh consumed by diesel buses was provided in an email from Perry Eaman with RTD on June 20, 2018. Email is on file. Data is from 2016. No 2017 data was available. No miles traveled were provided; emissions from CH4 and N2O were not calculated.

*(3) According to the EIA (https://epact.energy.gov/fuel-conversion-factors), GGE (gasoline gallon equivalent) = kWh * 0.031 AND GGE = diesel gal * 1.155. Therefore, diesel gal = (kWh * 0.031)/1.155.*

(4) Percent of transit attributable to Denver was assumed.

Emissions Summary	
Scope 1	23,717
Scope 2	N/A
Scope 3	N/A
Total	**23,717**

Transit Buses				
Source	**Emissions (mt CO_2)**	**Emissions (mt CH_4)**	**Emissions (mt N_2O)**	**Total Emissions (mt CO_2e)**
Transit Buses	23,717			23,717
Total Transit Emissions	**23,717**	**0**	**0**	**23,717**
Fuel Use				
	RTD fuel use	**Units**	**Percentage Attributable to City and County of Denver**	**Total Fuel Use Attributable to City and County of Denver**
Diesel Fuel--RTD 2017	346,184,424	kWh	25%	86,546,106
Diesel Fuel--RTD 2017	9,291,530	gal diesel	25%	2,322,882

Railways Data

Notes:
(1) Per a phone message from Ignacio Correa-Ortiz to Emily Artale 3/4/19, electricity consumed by the Light Rail is m
Schmitz from Xcel Energy, this electricity use is included in Xcel's commercial sections of the Community Energy Repo
(2) Ton-miles through Denver includes inbound, intra, outbound, and 80% of all statewide traffic. Data provided by E
based on tonnage traveled in 2014 and only includes Class 1 rails (which are assumed to contribute the most GHG er
(3) Electricity used to power the Light Rail is noted as TPSS LR on RTD's reporting table, as shown in an email from Pe
used to power the commuter rail.
(4) Approximately 71% of rail boardings are attributed to Denver based on previous research performed by Denver. E

Emissions Summary	
Scope 1	19,564
Scope 2	34,595
Scope 3	N/A
Total	**54,159**

Railways Emissions				
	Emissions ($mtCO_2$)	Emissions ($mtCH_4$)	Emissions (mtN_2O)	Emissions ($mtCO_2e$)
Denver	19,388	1.5	0.51	19,564
Total Emissions				**19,564**

Freight Train Data
Ton-Miles
842,943,342

Commuter Rail Emissions				
	Emissions ($mtCO_2$)	Emissions ($mtCH_4$)	Emissions (mtN_2O)	Emissions ($mtCO_2e$)
Denver	34,355	3.6	1	34,595
Total Emissions				**34,595**

Commuter Rail and Light Rail	
	kWh Used
Total kWh used for commuter rail	81,482,989
Percent of commuter rail attributed to Denver	71%
Total kWh used for commuter rail in Denver	57,934,405

ıetered separately from any building's electricity consumption. Per emails with Patrick
ɔrts.
Evan Enarson-Hering with Cambridge Systematics, Inc, consultant to CDOT. Data is
missions).
erry Edman June 20, 2018. Email is on file. It is assumed that CRT TPSS is electricity

Email is on file.

Aviation Data

Notes:

(1) Aviation activity at the Denver International Airport (DEN) is attributed to Denver based on the 2011 DEN traveled su which showed that 28.5% of passengers originated from Denver County. PDF is on file.

(2) DEN fuel use data was provided in an email from Tom Herrod with the City and County of Denver. Email is on file. No provided in this email but are not accounted for in this section of the inventory since Scope 3 aviation emissions only acc

(3) Data on the number of aircraft registered in the state of Colorado and in Denver County specifically was provided by https://registry.faa.gov/aircraftinquiry/statecounty_inquiry.aspx. Data is updated on a daily basis. The values shown re

(4) Data on aviation gasoline use in the state of Colorado was obtained from the Colorado Department of Revenue Mot https://www.colorado.gov/pacific/revenue/colorado-motor-fuel-taxes, pdfs and excel spreadsheets of monthly reports is assumed that all in-boundary aviation activity in Denver uses aviation gasoline (not jet fuel).

(5) Data from Denver's Transboundary LTO (landing, take-off) Aviation emissions from Line 95 on the Output tab on '201

Emissions Summary	
Scope 1	143
Scope 2	N/A
Scope 3 Total Fuel	1,244,379
Scope 3 LTO	608,878
Total with Total Fuel	**1,244,522**
Total with LTO	**609,022**

Aviation Emissions				
Source	Emissions (mt CO_2)	Emissions (mt CH_4)	Emissions (mt N_2O)	Emissions (mt CO_2e)
Denver's Transboundary Aviation Emissions	1,232,822	35	40	1,244,379
Denver's Transboundary LTO Aviation Emissions	608,470	19	0	608,878
Denver's In-Boundary Aviation Emissions	139	0	0	143

	Fuel Breakdown			Fuel Used
Airport Fuel Use	Total Fuel Used (gal)	Scope 1 (Local)	Scope 3 (Itinerant)	Scope 1 (Local)
Denver International Airport (jet fuel)	452,002,816	0%	100%	0
Denver International Airport (aviation gasoline)	3,053	0%	100%	0

Transboundary Aviation	Local/ Itinerant	Scope	Total System Usage (gal)	Fuel Type
Denver International Airport	Itinerant	3	452,002,816	Jet fuel
Denver International Airport	Itinerant	3	3,053	Aviation gasoline
Aviation Gasoline Itinerant				
Jet Fuel Itinerant				

In-Boundary Aviation	Value
Aircraft registered in Colorado	6,755
Aircraft registered in Denver	574
Aviation Gasoline use (gallons, statewide)	197,338

Aviation Gasoline use (gallons, Denver)	16,769

urvey of origin-destination for airport travelers,

te that diesel and gasoline data were also
count for emissions from departing flights.
the Federal Aviation Administration at
flect the number of aircrafts registered on 2/6/19.
or Fuel Tax Reports for 2017 (Accessible at
are on file). Use is reported on a monthly basis. It

17 ACERT_5.1_ACI_c2018-04-121'.

(gal)
Scope 3 (Itinerant)
452,002,816
3,053

Percent of travel allocated to Denver	Usage (gallons)
28.5%	128,820,803
28.6%	872
	872
	128,820,803

Off-Road Data

Notes:
(1) Off-road data represents fuel consumed by off-road vehicles and equipment operated at DEN regardless if owned by
(2) Data provided by Amanda Sutton, Sustainability Manager at DEN, in spreadsheets titled 'DEN GHG Aggregate Data1 included for fuel use represents fuel used by both DEN operations and airport partner operations.
(3) Per Amanda Sutton: 1) it is safe to assume that all diesel is used in mobile engines, with the majority being used in h gasoline is used in mobile engines, with the majority being in heavy duty vehicles and some in lighter-duty vehicles; 3) it (i.e. baggage tugs), which would be considered heavy-duty vehicles; and 4) it is safe to assume that all propane use is st UPS, etc.) is not included in the data set. The contribution from ethanol in the gasoline is considered insignificant compa
(4) Per Amanda Sutton, data is not available on the mileage traveled by fuel and vehicle type for diesel, gasoline, and CI
(5) Propane use is reported in pounds used. One gallon of propane weighs 4.2 pounds.
(6) CNG use is reported in gallons of gasoline equivalent (GGE). There are 0.877 GGE in one hundred cubic feet of CNG (p https://epact.energy.gov/fuel-conversion-factors).

Emissions Summary	
Scope 1	26,302
Scope 2	N/A
Scope 3	N/A
Total	**26,302**

Source	Emissions (mt CO_2)	Emissions (mt CH_4)	Emissions (mt N_2O)	Total Emissions (mt CO_2e)
Gasoline	6,890	0	0	6,890
Diesel	9,871	0	0	9,871
CNG	9,507	0	0	9,507
Propane	34	0	0	34
Total	**26,302**	**0**	**0**	**26,302**

Off-Road Vehicle and Equipment Data	
Fuel Type	**Fuel Used**
Gasoline (gal)	784,704
Diesel (gal)	966,787
CNG (GGE)	1,531,602
Propane (lb.)	25,211

the City or privately owned.

' and ' 2017 ACERT_5.1_ACI_c2018-04-121'. *Data*

eavy duty vehicles; 2) it is safe to assume that all
is safe to assume that all CNG is in mobile engines
ationary. Propane used by partners (i.e. FedEx,
ured to the inventory totals.
NG.

per the U.S. DOE Alternative Fuels Data Center,

Waste and Recycling Data

Notes:

(1) Denver's DADs Waste Composition was provided by Aubrey Burgess with City and County of Denver. Pdf is on fil

(2) Data on residential waste was included in the Denver Recycles 2017 Annual Report (pdf on file); data comes fro events, E-cycle coupons, Recycled Your Holiday Lights, Appliance Collection, HHW Collections, and 'Other' Recycling the community represents data for Residential Composting, LeafDrop, and Treecycle.

(3) Data on commercial waste was provided in an email from Charlotte Pitt with Denver Recycles. Data reflects rep

(4) Residential waste from Denver is taken to the Denver-Arapahoe Disposal Site (DADS) in Aurora. Methane is cap are located in Denver. Because the final location of commercial waste is unknown, it is assumed that this waste is

(5) MSW characterization is taken from the EPA's Advancing Sustainable Materials Management: Facts and Figure 07/documents/smm_2015_tables_and_figures_07252018_fnl_508_0.pdf. MSW characterization is taken from Tab MSW, 2015. Values for grass, leaves, and branches were assumed based on a report 7.8% of MSW that is classifiea

(6) Materials Recovery characterization is taken from the EPA's Advancing Sustainable Materials Management: 20 07/documents/2015_smm_msw_factsheet_07242018_fnl_508_002.pdf.

*(7) Construction & Demolition (C&D) characterization is taken from the EPA's Advancing Sustainable Materials Ma https://www.epa.gov/sites/production/files/2018-07/documents/2015_smm_msw_factsheet_07242018_fnl_508_*

Emissions Summary	
Scope 1	108
Scope 2	N/A
Scope 3	133,091
Information-Only Avoided Emissions	(673,317)
Total (Scope 1 and 3)	**133,200**

Emissions Summary			
	Waste Generated	**Units**	**Scope**
Tons of Waste Landfilled Inside City Limits	0	Tons	1
Tons of Waste Landfilled Outside City Limits	857,998	Tons	3
Tons of Waste Composted Inside City Limits	1,450	Tons	1
Tons of Waste Composted Outside City Limits	39,161	Tons	3
Tons of Recycling Recycled Inside City Limits	0	Tons	N/A
Tons of Recycling Recycled Outside City Limits	198,528	Tons	N/A
Total Emissions	**898,609**	**Tons**	

Residential Waste		
Waste Group	**Units**	**Residential Tonnage**
Tons of Waste Landfilled Inside City Limits	Tons	0
Tons of Waste Landfilled Outside City Limits	Tons	179,264
Tons of Waste Composted Inside City Limits	Tons	1,450
Tons of Waste Composted Outside City Limits	Tons	8,176
Tons of Recycling Recycled Inside City Limits	Tons	0
Tons of Recycling Recycled Outside City Limits	Tons	40,267

Total	**Tons**	**229,157**

Commercial Waste		
Waste Group	**Units**	**Commercial Tonnage**
Tons of Waste Landfilled Inside City Limits	Tons	0
Tons of Waste Landfilled Outside City Limits	Tons	678,734
Tons of Waste Composted Inside City Limits	Tons	0
Tons of Waste Composted Outside City Limits	Tons	30,985
Tons of Recycling Recycled Inside City Limits	Tons	0
Tons of Recycling Recycled Outside City Limits	Tons	158,261
Total	**Tons**	**867,980**

Denver's DADs Waste Composition			
MSW	**C&D**	**Compostable**	**Special Waste**
63%	13%	1%	11%

Paper and Paperboard			
Newspaper/Mechanical Paper	**Office-type Papers**	**Magazines**	**Corrugated Containers**
1.3%	0.9%	0.2%	7.8%

C&D Characterization			
Concrete	**Wood Products**	**Drywall and plasters**	**Steel**
70%	7%	2%	1%

Materials Recovery Characterization			
Paper and Paperboard	**Glass**	**Metals**	**Plastics**
67%	5%	12%	5%

le.

m Figure 1: Tons Generated, Diverted, and Landfilled in 2017. Total for residential recycling below represen
g. Total for residential compost treated in the community represents data for Backyard Composting. Total fo

orts from hauler licenses in 2017. Per Charlotte, the final location that the waste is delivered to is unknown.

tured and delivered to Xcel Energy for energy production. Residential composting goes to A1 Organics that also disposed of at DADS and composting is sent to A1 Organics.

s 2015 document. PDF is on file and also available at https://www.epa.gov/sites/production/files/2018-ole 4: Materials Landfilled in the Municipal Waste Stream. Detailed paper characterization drawn from Tabl as 'Yard Trimmings'.

15 Fact Sheet, Table 2. Total MSW Recycling (by material), 2015. Pdf on file and available at https://www.e

nagement: 2015 Fact Sheet, Figure 14. C&D Generation Composition by Material (before processing), 2015. _002.pdf.

Emissions (mt CH_4)	Emissions (mt N_2O)	Emissions (mt CO_2e)
0	0	0
4,649	0	130,162
0.72	0.33	108
19	9	2,929
0	0	0
0	0	(673,317)
4,669	**9**	**133,200**

Revenue Generating Cover	Other
9%	3%

MSW Characterization				
Other Paper and Paperboard Products	Glass	Metals	Plastics	Rubber and Leather
3.1%	5.1%	9.5%	18.9%	3.3%

Brick and Clay Tile	Asphalt Shingles	Asphalt Concrete
2%	3%	15%

Rubber, Leather, and Textiles	Wood	Other
6%	4%	2%

ts data for residential recycling, E-cycle
or residential compost treated outside

.

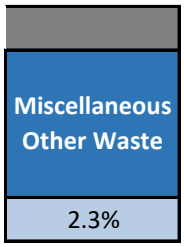
has several locations, none of which

e 5: Paper and Paperboard Products in

pa.gov/sites/production/files/2018-

Pdf on file and available at

Textiles	Wood	Other	Food	Grass	Leaves	Branches
7.6%	8.0%	2.2%	22.0%	2.6%	2.6%	2.6%


Miscellaneous Other Waste
2.3%

Wastewater Data

Notes:
(1) Per Denver, it is assumed that all of Denver's wastewater gets treated at Metro Wastewater wastewater is treated at the Robert W. Hite Treatment Facility (RWHTF).
(2) Data on the RWHTF was provided in an email from Jennifer Schwarz with Metro.
(3) Metro's emission values were allocated to Denver based on the total population served by th
(4) Per Denver, there are no septic tanks within the City and County limits.

Emissions Summary
Scope 1
Scope 2
Scope 3
Total

GHG Emissions By Process
Process N2O Emissions for WWTPs with Nitrification and Denitrification
Emissions
Total Process N2O from Nitrification and Denitrification Emissions (mt CO_2e)
Fugitive N2O Emissions from Effluent Discharge
Emissions
Total Process N2O from Nitrification and Denitrification Emissions (mt CO_2e)
Combustion Gas Emissions
Emissions as mt CH_4
Emissions as mt N_2O
Total Combustion Gas Emissions (mt CO_2e)
Flared Gas Emissions
Emissions as mt CH_4
Total Flared Gas Emissions (mt CO_2e)
Total

Input Data
Municipal Wastewater Treatment from Metro's Robert W Hite Treatment Plant
Plant uses nitrification/denitrification
Plant uses anaerobic processes
Denver's population served by the plant
Total population served by plant
Average total nitrogen discharged by plant (kg N/day)
Total emissions from nitrification/denitrification (mtCO_2e/yr.)
Total emissions from effluent (mt CO_2e/yr.)
Digester gas produced (scfd)
Digester gas flared (scfd)
Methane content of digester gas

Reclamation District (Metro). Per Metro, all of Denver's

ıe plant that lives within Denver. Methane content was

2,124
N/A
N/A
2,124

1,307
1,307
739
739
0.67
0.13
54
0.87
24
2,124

Denver Data
Yes
Yes
704,621
1,777,000
3,852
3,296
1,864
2,458,125
56,454
57%

Industrial Processes and Products Use Data

Notes:

(1) Emissions from industrial processes in Denver were provided in the EPA's FLIGHT (Facility Level Inform report for Denver for 2017 from the tool is on file. Per Xcel Energy, emissions from Xcel Energy generation represented in Xcel's electricity emissions factors. Emissions from other sources may be partially included

(2) All refrigerant information is based upon the quantity of commercial square footage within the City. S Data is on file.

(3) To be conservative, it is assumed that 25% commercial space is air conditioned using 134a refrigerant

(4) Assumptions include: a) 300 sq. ft. per ton of cooling capacity based on the commercial average from Ventilation, and Refrigeration; b) 1 kg refrigerant per ton based on a conservative estimate from the Trea Refrigerants; and c) 5% refrigerant loss per year from the Climate Leaders Greenhouse Gas Inventory Prot

(5) According to CDPHE, they no longer provide information on Tier II refrigerants due to a recent agreem

Emissions Summary	
Scope 1	24,793
Scope 2	N/A
Scope 3	N/A
Total	**24,793**

Refrigerant Use	
	Value
Commercial Square Footage	416,107,019
% Commercial Square Footage Air Conditioned	104,026,755
Tons of Cooling	346,756
Charge of coolant per ton (kg)	346,756
Refrigerant Loss (kg) of R-134A	17,338
Total metric tons of CO_2e	**24,793**

Industrial Processes	
Facility	**Emissions (mt CO_2e)**
Denver International Airport	26,694
Arapahoe Combustion Turbine Facility (Xcel generation facility)	93,274
Public Service Company Denver Steam Plant (Xcel generation facility)	56,412
Public Service Company of Colorado Larimer (Xcel generation facility)	188,475
1335 Zuni (Xcel generation facility)	4,363
Total Metric tons of CO_2e	**369,218**

ation on Greenhouse Gases Tool). An excel spreadsheet
ı facilities listed in the FLIGHT tool are already
in other categories. Therefore, emissions from those
Square footage provided by Denver Assessor's Office.

s.

the ASHRAE Pocket Guide for Air Conditioning, Heating,
ıtment of LEED of the Environmental Impact of HVAC
tocol Core Module Guidance from the EPA.

ıent with the Dept. of Homeland Security. Email on file.

Consumption-Based

Notes:
(1) Data on water use is included in Denver Water's 2017 Annual Financial Report, Table 'Treated Water Sold in Gallons by C
relations/financial-information/annual-reports.
(2) Cement use was calculated based off reported cement tons originating in Colorado from the 2012 US Commodity Flow Su
2012 available at https://www.census.gov/data/tables/2012/econ/cfs/state.html), the population of Colorado in 2012 (obta
(3) Emissions calculated from food consumption is a process-based approach based on food types and Denver's population.
and Keoleian report Greenhouse Gas Emissions Estimates of U.S. Dietary Choices and Food Loss,' *on file.*
(4) Denver Water provided an emissions factor for Denver Water from supply, treatment, delivery, and all support operation
of 'double-counting' emissions from energy supplied to Denver Water for these operations from Xcel's power grid. However,

Emissions Summary	
Scope 1	N/A
Scope 2	N/A
Scope 3	2,144,725
Total	**2,144,725**

Emissions from Consumption-Based Sources			
Source	Emissions (mt CO_2)	Emissions (mt CH_4)	Emissions (mt N_2O)
Food Purchases			
Cement Use			
Water Supply			

Water Supply	
Data Inputs	Value
Residential use (gal)	12,330,988,000
Residential irrigation (gal)	895,806,000
Commercial use (gal)	15,520,778,000
Total	28,747,572,000

Cement	
Data Inputs	Value
Denver population	704,621
Colorado population (2012)	5,186,330
Total tons of cement originating in CO (2012)	4,984,000
Total tons cement attributable to Denver (tons)	677,132

Food	
Data Inputs	Value
Denver population	704,621
Food Emissions (mt CO_2e)	1,303,185

Food			
Detailed Food Types	Retail-level Food Availability (kg/capita/yr.)	Average GHG Emissions Per Food Type (kg CO_2e/kg food type)	Denver County Population Average Food Emissions (kg CO_2e/yr.)
Grain Products	**88.5**	**0.6**	**40,598,500**

total wheat flours	61.2	0.6	24,990,793
rice	9.6	1.1	7,727,438
rye flour	0.2	0.4	58,343
corn products	15.0	0.7	6,989,699
barley products	0.3	0.6	126,832
oat products	2.1	0.5	705,396
Fresh fruit	**55.2**	**0.5**	**23,386,653**
citrus	9.4	0.5	3,325,811
apples	6.7	0.4	1,707,156
apricots	0.1	0.4	12,683
avocados	1.5	1.3	1,324,406
bananas	11.6	1.3	10,817,060
blueberries	0.5	0.3	109,287
cantaloupe	3.6	0.3	679,184
cherries	0.6	0.4	142,052
cranberries	0.0	0.3	6,976
grapes	3.4	0.3	690,670
honeydew	0.6	0.3	117,954
kiwi	0.2	0.6	84,555
mangoes	1.0	1.0	656,143
papaya	0.5	1.0	341,741
peaches	2.0	0.4	517,474
pears	1.3	0.3	255,425
pineapples	2.5	0.3	537,344
plums	0.3	0.4	86,246
raspberries	0.1	0.3	18,602
strawberries	3.0	0.4	749,717
watermelon	6.3	0.3	1,206,170
Processed fruit	**39.1**	**1.0**	**28,451,469**
canned fruit	5.3	1.1	3,899,020
frozen fruit	2.2	1.0	1,625,702
dried fruit	1.0	1.0	740,275
fruit juices	30.6	1.0	22,186,472
Fresh vegetables	**78.4**	**0.8**	**33,059,831**
artichokes	0.2	0.7	123,450
asparagus	0.6	8.9	3,499,993
bell peppers	4.1	0.9	2,567,075
broccoli	2.3	0.4	656,707
brussels sprouts	0.1	0.3	30,228
cabbage	3.2	0.1	266,347
carrots	3.4	0.5	1,251,055
cauliflower	0.6	0.4	153,889
celery	2.6	0.7	1,357,946
collards	0.3	0.3	58,131
sweet corn	3.9	0.7	1,985,481
cucumbers	2.8	0.7	1,316,091
eggplant	0.4	1.3	338,923
escarole & endive	0.1	1.5	102,875
garlic	0.9	0.3	199,971
kale	0.1	0.3	27,903
head lettuce	6.8	1.1	5,182,347
lettuce	4.5	1.1	3,447,288
lima beans	0.0	0.7	5,144
mushrooms	1.1	0.7	550,379

mustard greens	0.2	0.3	34,879
okra	0.2	0.7	77,156
onions	8.5	0.4	2,333,071
potatoes	15.5	0.2	2,297,980
Pumpkin	1.8	0.1	116,051
Radishes	0.3	0.3	58,131
snap beans	0.8	0.7	411,499
Spinach	0.7	0.1	67,785
Squash	1.8	0.1	111,612
sweet potatoes	2.6	0.3	597,589
Tomatoes	8.0	0.7	3,795,652
turnip greens	0.2	0.3	37,204
Processed Vegetables	**44.5**	**1.2**	**37,893,390**
Canned	21.6	1.1	16,757,297
Frozen	16.4	1.4	16,640,330
processed and dehydrated	2.5	1.3	2,280,858
Legumes	4.0	0.8	2,214,906
Fluid milk	**78.9**	**1.3**	**74,506,202**
Other dairy products	**45.9**	**4.1**	**171,877,919**
Yogurt	6.1	2.0	8,739,273
total cheese	14.2	9.8	97,579,298
cottage cheese	1.0	1.8	1,319,051
ice cream	8.7	3.1	18,938,099
other frozen dairy	1.0	3.1	2,184,325
Evap. Condensed milk	3.2	3.2	7,170,223
dry milk	1.7	10.4	12,311,138
half and half dairy and fat portion	2.2	3.8	5,790,998
eggnog	0.2	3.8	531,284
light & heavy cream	4.7	3.8	12,432,051
sour cream	1.9	2.6	3,407,547
cream cheese	1.1	1.9	1,474,631
Meat	**46.3**	**20.2**	**583,002,499**
Beef	25.7	26.5	479,722,183
Veal	0.1	7.8	769,446
Pork	20.1	6.9	97,347,407
Lamb	0.3	22.9	5,163,463
Poultry	**32.2**	**5.1**	**114,542,837**
Fish and seafood	**7.0**	**5.9**	**32,306,309**
fresh and frozen fish	2.8	3.8	7,583,343
fresh and frozen shellfish	2.3	11.7	19,191,621
canned shellfish	1.8	4.1	5,125,906
cured fish	0.1	4.1	405,439
Eggs	**14.4**	**3.5**	**35,893,817**
Nuts	**4.9**	**1.6**	**5,737,799**
peanuts	3.1	1.9	4,278,600
total tree nuts	1.8	1.2	1,459,200
Added sugar and sweeteners	**59.8**	**1.0**	**40,417,061**
Added fats and oils	**38.0**	**5.9**	**81,510,628**
butter	2.2	11.9	18,645,963
margarine	1.6	1.4	1,523,672
lard and beef tallow	2.2	11.9	18,226,009
shortening	7.0	2.4	11,753,078
salad and cooking oils	24.3	1.6	27,943,789
other added fats and oils	0.8	6.3	3,418,116

Total Emissions (kg CO_2e/yr.)	**1,303,184,913**

ustomer Type.' Pdf is on file and available at https://www.denverwater.org/about-us/investor-

urvey. (Data is accessible in the table 'Shipment Characteristics by Origin Geography by Commodity: ained from U.S. Census American Factfinder, and Denver's population).

Data on emissions and availability of various food products was obtained from Table S1 in the Heller

s. As some Denver Water facilities are within Xcel Energy's power territory, there may be some amount the impact of this double-counting is assumed to be minimal.

Emissions (mt CO_2e)	
1,303,185	*Life-cycle emissions*
823,142	*Life-cycle emissions*
18,398	

Natural Gas	Natural Gas Provided by Xcel Energy (th)	Emissions (mt CO_2)	Emissions (mt CH_4)	Emissions (mt N_2O)	Emissions (mt CO_2e)
Commercial	2,389,542	12,669	1	0	12,709

GASOLINE, DIESEL, AND ETHANOL VEHICLES						
Source	Emissions from Gasoline (mt CO_2)	Emissions from Gasoline (mt CH_4)	Emissions from Gasoline (mt N_2O)	Emissions from Gasoline (mt CO_2e)	Emissions from Diesel (mt CO_2)	Emissions from Diesel (mt CH_4)
On-road vehicles including	47,081	0	77	0	45,601	1

2017 Commodity Totals in Native Units	
12140062	Ton-Hr
103286200	kWh
2389542	Therm
152092	Mlb

61,248.72	Dowtown CO2e	Scope II
115,173.00	Airport CO2e	Scope II
105,551	Dowtown CO2e	Scope I
30,372.00	Airport CO2e	Scope I

Year	Unleaded	Prem Unleaded	B5/Diesel
2017	5,362,325		4,466,318
			223,316
			4,243,002

Emissions from Diesel (mt N_2O)	Emissions from Diesel (mt CO_2e)	Emissions from Ethanol (mt CO_2)	Emissions from Ethanol (mt CH_4)	Emissions from Ethanol (mt N_2O)	Emissions from Ethanol (mt CO_2e)
0	0	159	0	0	0

E85	CNG	Propane/ Other	Total Fuel	Annual % Fuel Change	VMT	Annual % VMT Change	MPG
27,713	902,362	21,036	10,779,754				

Emissions from Ethanol (mt CO_2(b))	Total Emissions (Biogenic mt CO_2)	Total Emissions (Fossil Fuel mt CO_2)	Total Emissions (mt CH_4)	Total Emissions (mt N_2O)	Total Emissions (mt CO2e)
0	0	92,842	1	77	0

Annual % MPG Change

GPC Table 4.1

INSTRUCTIONS: Use this tab to demonstrate GPC compliance.

Notes:

(1) Adapted from Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, WRI, C40 Cities, and ICLEI.

GPC Table 4.1 - Inventory City Information

Inventory Boundary	City Information
Name of City	City and County of Denver
State	Colorado
Country	USA
Inventory year	2017
Inventory date	March 2019
Geographic boundary	County Boundary
Land area (km2)	397.8
Resident population	704,621
GDP ($)	$ 51,639,571,589
Composition of economy	Federal, high-tech, tourism, financial, higher education
Climate	Semi-arid, with low humidity
Other information	None

GPC Table 4.2

INSTRUCTIONS: Use this tab to demonstrate GPC compliance.

Notes: (1) Adapted from Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, WRI, C40 Cities, and I

GPC Table 4.2 - GHG Emissions Summary

		To
Sector		**Scope 1**
Stationary Energy	Energy use	1,741,471
	Fugitive Emissions	99,919
	Refrigerants	24,793
Transportation	All emissions	2,664,134
Waste	Treated in the City	2,233
	Treated outside the City	
Consumption-Based	Food	
	Cement	
	Water Delivery	
Total		**4,532,549**

CLEI.

otal by scope (mt CO_2e)				Total by scope (mt CO_2e)
Scope 2	**Scope 3 (BASIC)**	**Scope 3 (BASIC+)**	**Consumption-based**	**BASIC Emissions**
4,049,713				5,791,183
				99,919
				0
36,735		608,878		2,700,869
				2,233
	133,091			133,091
			1,303,185	0
			823,142	0
			18,398	0
4,086,448	**133,091**	**608,878**	**2,144,725**	**8,727,295**

Total by scope (mt CO_2e)
Total Emissions
5,791,183
99,919
24,793
3,309,748
2,233
133,091
1,303,185
823,142
18,398
11,505,692

GPC Table 4.3

INSTRUCTIONS: Use this tab to demonstrate GPC compliance.

Notes: (1) Adapted from Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, WRI, C40 Cities,

GPC Table 4.3 - GHG Emissions Report

GPC Reference Number	Scope	GHG Emissions Source (By Sector and Subsector)
I		STATIONARY ENERGY
I.1		**Residential buildings**
I.1.1	1	Emissions from fuel combustion within the city boundary
I.1.2	2	Emissions from grid-supplied energy consumed within the city boundary
I.1.3	3	Transmission and distribution losses from grid-supplied energy
I.2		**Commercial and institutional buildings and facilities**
I.2.1	1	Emissions from fuel combustion within the city boundary
I.2.2	2	Emissions from grid-supplied energy consumed within the city boundary
I.2.3	3	Transmission and distribution losses from grid-supplied energy
I.3		**Manufacturing industries and construction**
I.3.1	1	Emissions from fuel combustion within the city boundary
I.3.2	2	Emissions from grid-supplied energy consumed within the city boundary
I.3.3	3	Transmission and distribution losses from grid-supplied energy
I.4		**Energy industries**
I.4.1	1	Emissions from energy production used in power plant auxiliary operations with
I.4.2	2	Emissions from grid-supplied energy consumed by energy industries
I.4.3	3	Emissions from transmission and distribution losses from grid-supplied energy us
I.4.4	1	Emissions from energy generation supplied to the grid
I.5		**Agriculture, forestry and fishing activities**
I.5.1	1	Emissions from fuel combustion within the city boundary
I.5.2	2	Emissions from grid-supplied energy consumed within the city boundary
I.5.3	3	Transmission and distribution losses from grid-supplied energy
I.6		**Non-specified sources**
I.6.1	1	Emissions from fuel combustion within the city boundary
I.6.2	2	Emissions from grid-supplied energy consumed within the city boundary
I.6.3	3	Transmission and distribution losses from grid-supplied energy
I.7		**Fugitive emissions from mining, processing, store, and transportation of coal**
I.7.1	1	Fugitive emissions from mining, processing, storage, and transportation of coal v
I.8		**Fugitive Emissions from oil and natural gas systems**
I.8.1	1	Fugitive emissions from oil and natural gas systems within the city boundary
II		TRANSPORTATION
II.1		**On-road transportation**
II.1.1	1	Emissions from fuel combustion on-road transportation occurring in the city
II.1.2	2	Emissions from grid-supplied energy consumed in the city for on-road transporta
II.1.3	3	Emissions from transboundary journeys occurring outside the city, and T and D l
II.2		**Railways**

II.2.1	1	Emissions from fuel combustion for railway transportation occurring in the city
II.2.2	2	Emissions from grid-supplied energy consumed in the city for railways
II.2.3	3	Emissions from transboundary journeys occurring outside the city, and T and D l
II.3		**Waterborne navigation**
II.3.1	1	Emissions from fuel combustion for waterborne navigation occurring in the city
II.3.2	2	Emissions from grid-supplied energy consumed in the city for waterborne naviga
II.3.3	3	Emissions from transboundary journeys occurring outside the city, and T and D l
II.4		**Aviation**
II.4.1	1	Emissions from fuel combustion for aviation occurring in the city
II.4.2	2	Emissions from grid-supplied energy consumed in the city for aviation
II.4.3	3	Emissions from transboundary journeys occurring outside the city, and T and D l
II.5		**Off-road transportation**
II.5.1	1	Emissions from fuel combustion for off-road transportation occurring in the city
II.5.2	2	Emissions from grid-supplied energy consumed in the city for off-road transport
II.5.3	3	Emissions from transboundary journeys occurring outside the city, and T and D l
III		**WASTE**
III.1		**Solid waste disposal**
III.1.1	1	Emissions from solid waste generated in the city and disposed in landfills or ope
III.1.2	3	Emissions from solid waste generated in the city but disposed in landfills or oper
III.1.3	1	Emissions from waste generated outside the city and disposed in landfills or ope
III.2		**Biological treatment of waste**
III.2.1	1	Emissions from solid waste generated in the city that is treated biologically in th
III.2.2	3	Emissions from solid waste generated in the city but treated biologically outside
III.2.3	1	Emissions from waste generated outside the city boundary but treated in the cit
III.3		**Incineration and open burning**
III.3.1	1	Emissions from waste generated and treated within the city
III.3.2	3	Emissions from waste generated within but treated outside of the city
III.3.3	1	Emissions from waste generated outside the city boundary but treated within th
III.4		**Wastewater treatment and discharge**
III.4.1	1	Emissions from wastewater generated and treated within the city
III.4.2	3	Emissions from wastewater generated within but treated outside of the city
III.4.3	1	Emissions from wastewater generated outside the city boundary but treated wit
IV		**INDUSTRIAL PROCESSES and PRODUCT USES (IPPU)**
IV.1	1	Emissions from industrial processes occurring in the city boundary
IV.2	1	Emissions from product use occurring within the city boundary
V		**AGRICULTURE, FORESTRY and OTHER LAND USE (AFOLU)**
V.1	1	Emissions from livestock
V.2	1	Emissions from land
V.3	1	Emissions from aggregate sources and non-CO2 emission sources on land
VI		**OTHER SCOPE 3**
TOTAL		**BASIC**
TOTAL		**Partial BASIC+**

, and ICLEI.

GPC Notation Keys Legend	
IE	Included elsewhere
NE	Not estimated
NO	Not occurring
C	Confidential

GPC Color Legend
BASIC
Add'l subsectors for BASIC+
Add'l subsectors for Territorial
Other Scope 3 (Consumption-based)

Notation Keys	CO2	CH4	N2O	HFC	PFC	SF6	NF3
	617,973.2	58.3	1.2				
	495,009.0	51.9	7.6				
	834,660.3	78.0	1.7				
	2,898,919.2	303.8	44.3				
IE							
IE							
IE							
IE							
sed in power plant auxiliary operations							
IE							
IE							
NO							
NO							
NO							
	21.5	3,567.8					
	2,599,612.5	138.4	144.7				
ation	2,125.3	0.2	0.0				
osses from grid-supplied energy use							

	19,387.7	1.5	0.5				
	34,355.1	3.6	0.5				
osses from grid-supplied energy use							
NO							
NO							
osses from grid-supplied energy use							
	139.3	0.1	0.0				
NO							
osses from grid-s	608,470.2	19.4	0.0				
	26,302.0	0.0	0.0				
NO							
osses from grid-supplied energy use							
NO							
n dumps outside the city		4,648.6					
n dumps within the city							
e city		0.7	0.3				
of the city		19.4	9.0				
y							
NO							
NO							
e city							
		1.5	0.1				
NO							
hin the city							
	7,528,505	**8,874**	**210**				
	8,136,975	**8,893**	**210**				

Total CO2e	CO2(b)	Activity Data Quality	Activity Data Source	Emission Factors Quality
619,914		High	Xcel Energy, Ferrell Gas	High
498,468		High	Xcel Energy	High
837,307		High	Xcel Energy, Ferrell Gas	High
2,919,178		High	Xcel Energy	High
99,919		High	Xcel Energy, COGIS, CDPHE	High
2,618,125	157,758.8	Medium	DRCOG, CDPHE	High
2,140		Medium	City and County of Denver	High

19,564.2		High	FAF	Low
34,595.2		High	RTD	High
143.1		Medium	FAA, Colorado Dept. of Revenue	High
608,878.4		High	Denver International Airport	High
26,302.0		High	Denver International Airport	High
130,161.8		High	City and County of Denver	High
108.5		Medium	City and County of Denver	High
2,929.2		High	City and County of Denver	High
2,124.32		High	letro Wastewater Reclamation Distri	High
24,793.04		Medium	City and County of Denver	High
7,810,979	**157,759**			
8,444,650	**157,759**			

Emission Factor Source
ICLEI
Xcel Energy, EPA eGRID
ICLEI
Xcel Energy, EPA eGRID
ICLEI, EPA
ICLEI
Xcel Energy, EPA eGRID

EPA

ICLEI

ICLEI

ICLEI

ICLEI

ICLEI

EPA WARM Module

EPA WARM Module

ICLEI

ICLEI

Comments
Included within commercial and industrial energy use.
Included within commercial and industrial energy use.
No known sources exist within the community.
No known sources exist within the community.
Included within commercial and industrial energy use.
Included within commercial and industrial energy use.
No known sources exist within the community.
No known sources exist within the community.
No known sources exist within the community.

No known sources exist within the community.

No known sources exist within the community.

No known sources exist within the community.

No known sources exist within the community.

No known sources exist within the community.

No known sources exist within the community.

No known sources exist within the community.

No known sources exist within the community.

No known sources exist within the community.

GPC Table 4.4

INSTRUCTIONS: Use this tab to demonstrate GPC compliance.

Notes: (1) Adapted from Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, WRI, C40 Cities, a

Scope 3 emissions based on market-based method

Recycling	Value
Recycling	198,527.80
Total Avoided Emissions from Recycling	

Renewable Energy	Value
Renewable Energy with Customer-Owned RECs	58,625,244.00
Renewable Energy with Utility-Owned RECs	68,041,891.00
Total Avoided Emissions from Renewable Energy	
Total Community Avoided Emissions	

nd ICLEI.

Units	Emissions (mt CO_2e)
U.S. short tons	673,316.96
	673,316.96
Units	**Emissions (mt CO_2e)**
kWh	35,007.72
kWh	40,630.81
	75,638.53
	748,955