

Greenhouse Gas Emissions Inventory

Milwaukee County Government Operations, 2016-2018



Submitted April 10, 2020

Office of Sustainability

Department of Administrative Services

Facilities Management Division

With assistance from ICLEI – Local Governments for Sustainability USA



Acknowledgements

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Special thanks to Stu Carron, Facilities Director and Teig Whaley-Smith, DAS Director, for their leadership, guidance, and support.

Please direct any questions or comments about this report to Gordie Bennett, Sustainability Director, at 414-278-4837 or sustainability@milwaukeecountywi.gov.

Background

The United Nations' [Intergovernmental Panel on Climate Change](#) (IPCC), the leading scientific body responsible for climate research, has identified human activity as the primary cause of global climate change. In a 2018 report¹, the IPCC suggests that global emissions of CO₂ must decline 45% from 2010 levels by 2030 to avoid the worst potential climate impacts on humans and the environment.

In recent years, Milwaukee County government has made several commitments to address climate change. The Department of Administrative Services and County Executive's Office have adopted an ambitious goal to reduce building energy use 20 percent relative to 2014. This goal has direct impacts on climate change, as most of the energy used to heat, cool, and power County buildings is generated through the combustion of fossil fuels - which produces greenhouse gas (GHG) emissions that contribute to climate change.

Since 2007, the County has implemented several energy and sustainability initiatives, including:

- Creating an environmental and conservation "Green Print" initiative for County government operations ([File No. 07-111](#)).
- Converting the County's fleet of transit buses to ultra-low sulfur diesel fuel, increasing fuel economy and reducing GHG emissions.
- Adopting a goal to reduce energy use in County government buildings 20% versus 2014.
- Participating with the City of Milwaukee's [Better Building Challenge](#) program (two County government buildings enrolled, representing over 400,000 square feet).
- Establishing a [Property Assessed Clean Energy](#) (PACE) program that enables commercial property owners in Milwaukee County to obtain low-cost, long-term loans for energy efficiency, renewable energy and water conservation improvements – at no cost to taxpayers.
- Establishing that County government will support the principles and targets of the Paris Climate Agreement ([File No. 17-506](#)) to keep global temperature increases below 2°C (3.8°F)².

¹ Intergovernmental Panel on Climate Change (2018). Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. Accessed 2/4/20 from <https://www.ipcc.ch/sr15/>.

² The federal government's original commitment (since withdrawn) was to reduce U.S. greenhouse gas emissions 26-28% below 2005 levels by 2025. See *USA First Nationally Determined Contributions (NDCs)* via <https://www4.unfccc.int/sites/NDCStaging/Pages/Party.aspx?party=USA>

- Co-creating the Milwaukee City-County Joint Taskforce on Climate and Economic Equity that will develop a roadmap to reduce community-wide emissions by 45% relative to 2010 levels by 2030, and to achieve net zero greenhouse gas emissions by 2050 ([File No. 19-582](#)).

Prepared by the Office of Sustainability, this report provides an inventory of Scope 1 and Scope 2 greenhouse gas emissions from Milwaukee County *government operations* for calendar years 2016-18. A community-wide emissions inventory could not be prepared because Milwaukee County-wide energy and utilities data are not available. The inventory follows internationally-recognized protocol and accounts for all significant sources of the County's operational emissions. The inventory provides a framework for the County to develop GHG reduction strategies and track progress toward its emissions reduction targets.

Methodology

Protocols & Boundaries

To be as complete, consistent and accurate as possible, Milwaukee County's operational emissions inventory follows the [Local Government Operations Protocol](#) v1.1 (LGO Protocol). First released in 2008, the Protocol serves as the national standard for quantifying and reporting emissions from local government operations. ICLEI's [ClearPath](#)™ tool was used to LGO Protocol-compliant estimates of carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) from the County's operations.

As recommended in the LGO Protocol, the inventory uses an operational control framework – accounting for all emissions from sources for which County government has full operational authority, or has the ability introduce and implement operating policies. This includes Milwaukee County Transit System (MCTS) operations, as transit vehicles, equipment, and garages are County property. However, other Milwaukee County-owned, leased facilities (e.g., Milwaukee Public Museum, Milwaukee County Historical Society, Marcus Center for Performing Arts) are outside of the County's operational control and thus *excluded* from the inventory.

Throughout the inventory, emissions are reported in metric tons of carbon dioxide equivalent (MTCDE). Hundred-year global warming potential (GWP) values from the 5th IPCC Climate Assessment Report³ (AR5) are used to convert CH₄ and N₂O to CO₂-equivalent units.

Emissions Scopes

Scopes are used to keep track of greenhouse gas emissions to avoid double counting within and between entities. According to the LGO Protocol, three scopes of emissions may be applicable to local government operations:

- **Scope 1:** All direct emissions from facilities or equipment operated by a government. For Milwaukee County government, these emissions come from fuel combusted by the County to operate and maintain MCTS buses and other fleet vehicles, as well as County-owned equipment and buildings.
- **Scope 2:** Indirect emissions associated with a government's consumption of purchased or acquired electricity, steam, heating, and cooling. Examples include purchased electricity and associated transmission and distribution losses, as well as district steam (downtown and County Grounds), and district cooling (County Grounds only).
- **Scope 3 (excluded):** All other indirect or embodied emissions not covered in Scope 2. Although omitted from this inventory, Scope 3 emissions would include Milwaukee County employee commuting, embodied emissions in goods purchased by the County, and emissions associated with the County's solid waste disposal.

This inventory accounts for Scope 1 and Scope 2 emissions that occurred during calendar years 2016-2018. This includes emissions generated by Milwaukee Mitchell General Airport buildings and facilities, vehicles, and equipment, but excludes emissions from private air travel. Calendar year 2016 was selected as the baseline year for the inventory because it is the earliest year for which accurate and complete source data was available.

Scope 3 emissions are excluded from the inventory because they are optional under the LGO Protocol. Moreover, Scope 3 emissions are less directly impacted by Milwaukee County government's policies and programs.

³ Intergovernmental Panel on Climate Change (2014). Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the IPCC [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

Data Quality & Analysis

The Office of Sustainability (OS) worked primarily with Milwaukee County department contacts to collect the data required for the inventory – see detailed listing in Appendix A. Additionally, Tom Herrod, ICLEI Senior Program Officer, provided an informal review of the Milwaukee County’s ClearPath data - see Appendix B. Where possible, Mr. Herrod’s findings and recommendations are incorporated into the inventory.

Activity data refer to the relevant measurement of energy use or other greenhouse gas-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled.

The following activity data are excluded from the inventory, for the reasons indicated:

- **Scope 1:**
 - Diesel fuel use - emergency generators⁴
 - Physical or chemical processing, other than fuel combustion⁵
 - Accidental leakage of refrigerants⁶
 - Release of landfill gases⁷
- **Scope 3**
 - All activities excluded – for rationale, see Emissions Scopes section.

Emission factors are used to convert energy usage or other activity data into associated quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g. pounds CO₂/kWh of electricity).

All emissions are quantified in the inventory using the following basic equation:

$$\text{Activity Data (usage)} \times \text{Emission Factor (MTCDE/usage)} = \text{Emissions from Activity (MTCDE)}$$

Results & Analysis

⁴ Some data on emergency generators is included in the County’s inventory, but this is assumed incomplete.

⁵ Process emissions are not applicable to Milwaukee County’s operations.

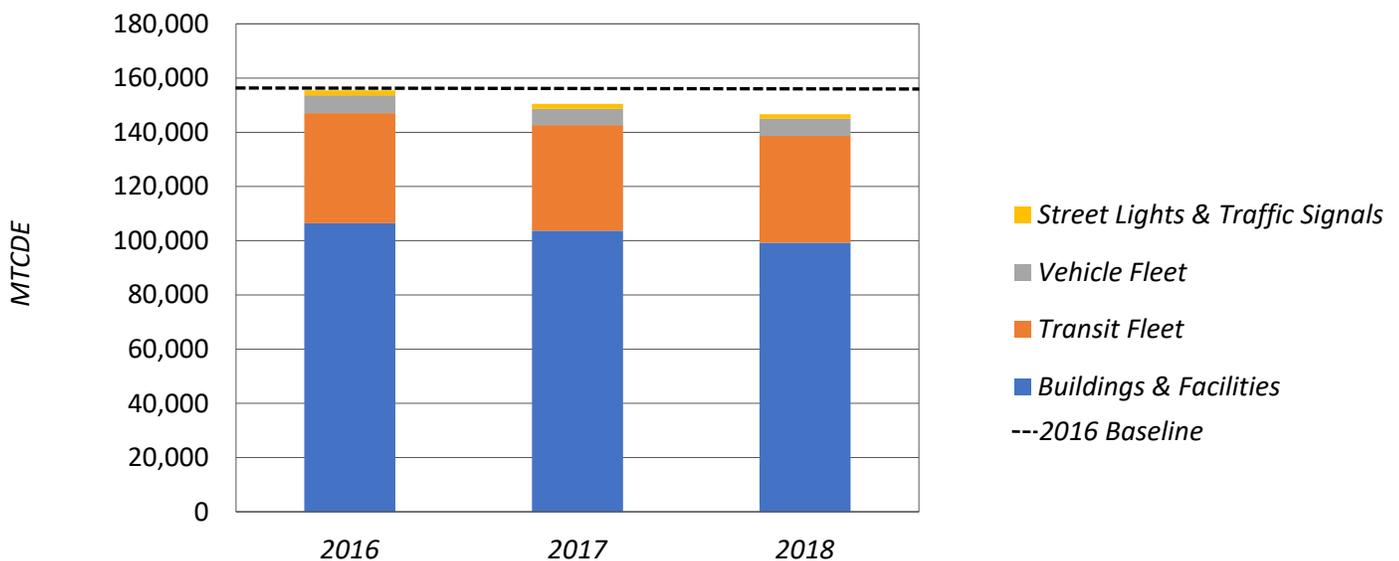
⁶ Not acquired due to communication and time constraints.

⁷ Landfill gas monitoring is only done at Milwaukee County’s Doyne and Franklin landfills, however these sites are exempt from EPA GHG emissions reporting thus emissions data is not available. Moreover, Milwaukee County does not have historic data on annual waste deposited at its other landfills.

During 2018, Milwaukee County government operations generated approximately 146,678 metric tons of carbon dioxide equivalent (MTCDE) - see Figure 1. This is roughly equivalent to the greenhouse gas emissions generated by 31,142 passenger vehicles driven for one year⁸. Buildings & Facilities represents the largest sector of the County’s operational emissions (68% of total emissions in 2018), followed by Transit Fleet (27%), and Vehicle Fleet (4%).

Milwaukee County’s total operational emissions decreased by around six percent between 2016 and 2018. The reduction is mainly attributable to energy and fuel reductions in two sectors: Buildings & Facilities and Transit Fleet. Compared with 2016, the County’s purchased electricity was eight percent lower during 2018 – even after accounting for differences in year-to-year weather (see Table 2). Moreover, the closing of Children’s Adolescent Treatment Center (CATC) and other County Grounds facilities helped to reduce weather-normalized district cooling by 70 percent. Finally, Transit Fleet fuel use decreased largely because MCTS buses traveled 400,000 fewer miles in 2018 compared with 2016.

Figure 1. Emissions by Sector, Milwaukee County Government Operations.



⁸ U.S. Environmental Protection Agency (2019). Greenhouse Gas Equivalencies Calculator. Accessed 2/24/20 from <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

Table 2. Weather-Normalized Energy Use, Milwaukee County Government Operations.

Energy Type	Million kBtu			2018 vs. 2016
	2016	2017	2018	
Natural Gas	451	474	476	6%
Purchased Electricity	357	341	327	-8%
District Steam	193	201	212	10%
District Cooling	31	18	9	-70%
Total	1,032	1,034	1,024	-1%

Another significant factor that contributed to Milwaukee County’s reduction in operational emissions is ‘greener’ purchased energy. Most notably, emissions per megawatt-hour from the County’s purchased electricity decreased by 8 percent since 2016 - see Table 3.

Table 3. Carbon Intensity of Milwaukee County’s Purchased Electricity

Year	Grid Electricity Emissions Factors (lbs./MWh) ⁹				
	CO ₂ ¹⁰	CH ₄ ¹¹	N ₂ O ¹⁰	CO ₂ e ¹²	% Change vs. 2016
2016	1,461.70	0.108	0.019	1,469.76	--
2017	1,455.00	0.108	0.019	1,463.06	-0.5
2018	1,344.80	0.117	0.017	1,352.58	-8.0

Table 4 displays the County’s operational emissions by year, scope, and sector. In 2018, Scope 1 (direct) emissions comprised 47% of total emissions from County government operations. Scope 1 emissions primarily arise from activities in two sectors: Transit Fleet and Buildings & Facilities (56% and 34% of Scope 1 emissions, respectively).

¹⁰ WEC Energy Group. 2019. Edison Electric Institute and American Gas Association ESG/Sustainability Reporting Template. 2016-18 GHG Emissions – Owned Generation + Purchased Power. Accessed 1/31/20 from <https://www.wecenergygroup.com/csr/eei-aga-esg-sustainability-template.pdf>

¹¹ Emissions & Generation Resource Integrated Database (eGRID). 2018 and 2016 summary tables. Accessed 2/17/20 from <https://www.epa.gov/energy/egrid-summary-tables>

¹² GHG Protocol. Global Warming Potential Values. IPCC 5th Assessment (AR5). Accessed 3/2/20 from https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf

Approximately 10 percent of Scope 1 emissions are attributable to the Vehicle Fleet sector, which includes all the County’s non-transit vehicles and equipment.

Scope 2 (indirect) emissions made up 53% of the County’s total operational emissions in 2018. During that year, purchased electricity and associated transmission and distribution (T&D) losses comprised 81% of Scope 2 emissions. Other sources of 2018 Scope 2 emissions include district steam (16%), Street Lights & Traffic Signals (2%), and district cooling (1%).

A summary of emissions by year, scope, and activity is provided in Appendix C.

Table 4. Emissions by Scope & Sector, Milwaukee County Government Operations.

	MTCDE		
	2016	2017	2018
Scope 1			
Transit Fleet	40,615	38,958	39,440
Buildings & Facilities	21,617	22,728	23,776
Vehicle Fleet	6,599	6,003	6,323
Scope 1 Total	68,831	67,689	69,539
Scope 2			
Buildings & Facilities	84,825	80,980	75,471
Street Lights & Traffic Signals	1,811	1,810	1,668
Scope 2 Total	86,636	82,790	77,139
Grand Total	155,466	150,479	146,678

Benchmarking

Benchmarking emissions from Milwaukee County government operations is challenging due to the wide range of data quality and methodologies used by other governments. Moreover, government operational emissions are not available through the CDP Open Data Portal¹³. Lastly, differences in a government’s climate and services can greatly impact its operational emissions. Nevertheless, Table 5 compares Milwaukee County’s operational emissions against several peer governments. Based on this limited sample, it appears that the County’s operational emissions may be higher than average.

¹³ CDP states the Open Data Portal is the most comprehensive collection of self-reported environmental data in the world. Unfortunately, CDP no longer collects data on local government emissions; rather, it focuses on community scale inventories. For more information, visit <https://www.cdp.net/en/data>.

Table 5. Operational Emissions, Milwaukee County vs. Peer Governments.

Government	State	Most Recent Inventory	Total Emissions (MTCDE) ¹⁴	Total Residents ¹⁵	Emissions per 1000 Residents (MTCDE)
Milwaukee County	WI	2018	146,678	948,201	155
King County	WA	2017	270,000	2,118,119	127
Pima County	AZ	2014	125,000	1,004,675	124
Alameda County	CA	2003	30,438	1,510,271	20

Conclusion

Milwaukee County government appears to be making some progress on reducing its operational greenhouse gas emissions. However, meeting the County’s ambitious emissions reduction targets will require significant changes to operations, infrastructure and services.

During 2016-18, Milwaukee County’s operational emissions were attributable to activities in three main sectors: Buildings & Facilities, Transit Fleet, and Vehicle Fleet. To reduce operational emissions, the County government should focus on making improvements to these sectors. General strategies that could significantly impact the County’s operational emissions include:

- Reduce the energy used by County buildings and facilities.
- Grow MCTS bus service with no increase in emissions.
- Increase the fuel efficiency of County fleet vehicles and equipment.
- Transition County government operations to low-carbon fuels and renewable energy.

¹⁴ Total Scope 1 and 2 emissions. Where applicable, excludes any emissions so that the totals are comparable with Milwaukee County’s total.

¹⁵ Source: U.S. Census Bureau. Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2018. Accessed 2/7/20 from <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF>.

Finally, it should be noted that County government represents just one of many businesses in Milwaukee County. The County's operational emissions, consequently, represent a small percentage of overall community-wide emissions. Thus, a community-wide emissions inventory should be prepared if Milwaukee County-wide energy and utilities data become available. Additionally, in pursuing its emissions reduction targets, County government should prioritize solutions that have community-wide environmental, economic, and health benefits.

Appendix A. Emissions Activities - Milwaukee County Government Operations.

Scope	Source	Description	Activity	Status	Notes	Contact(s)
Scope 1: Direct Emissions	Stationary combustion	Combustion of fuels in County-owned or controlled stationary sources such as boilers, furnaces, and turbines to produce electricity, steam, heat or power.	Natural gas combustion - heating and emergency generators	Complete		OS
			Diesel combustion - emergency generators	Partial	Obtained for only the following departments: Behavioral Health Division, House of Correction, Airport, Parks, and Administrative Services.	ALL
	Mobile combustion	Combustion of fuels in County-owned or controlled mobile sources such as cars, trucks, buses, trains, ships, and in off-road equipment such as in construction, agriculture and forestry.	Vehicle fuel combustion (CNG, gasoline, biofuel, diesel, etc.)	Complete	Excludes electricity purchased for battery electric vehicles or plug-in hybrid electric vehicles.	APT FM MCTS
			Vehicle miles traveled (e.g. CNG, gasoline, biofuel, diesel, etc.)	Complete	Non-transit fleet vehicle mileage estimated from fuel combustion and average MPG of vehicles.	APT FM MCTS
			Non-road equipment fuel combustion (CNG, gasoline, biofuel, diesel, etc.)	Complete	Includes equipment used by Parks, Zoo, Sheriff and all other County departments.	FM MCTS PARKS

Appendix A. Emissions Activities - Milwaukee County Government Operations, cont.

Scope	Source	Description	Activity	Status	Notes	Contact(s)
Scope 2: Indirect Emissions	Purchased electricity	Emissions from purchased electricity, steam, and district heating/cooling that physically occur at sources owned or controlled by another entity (e.g., emissions that occur at a power plant as a result of electricity used by the County).	Purchased electricity	Complete	Includes electricity used for streetlights, traffic signals, and plug-in hybrid electric vehicles.	OS
			District steam	Complete	Purchased steam from district heating systems (downtown and County Grounds)	OS
			District cooling	Complete	Purchased chilled water from district cooling system (County Grounds)	OS

Key:

- ALL: All County government's operations, including MCTS
- APT: Airport
- FM: Fleet Management
- MCTS: Milwaukee County Transit System
- OS: Office of Sustainability
- PARKS: Parks, Recreation and Culture

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Milwaukee County LGO Inventory Review 2016-18

Conducted by Tom Herrod, ICLEI Senior Program Officer

(Milwaukee County Office of Sustainability comments shown in BLUE)

Dear Gordie,

Thank you for the opportunity to review your 2016, 2017, and 2018 Local Government Operation’s Greenhouse Gas Inventory. Having an inventory of emissions is the first step towards identifying emissions reductions strategies that will help Milwaukee County reduce it’s carbon footprint as well as identify cost savings. Below please find our recommendations:

- Strongly recommend updating Global Warming Potentials to IPCC 5th Assessment 100 year. Currently set for 2nd Assessment which is out of date. Edit in Inventory Parameters of Main Page [\(Done\)](#).
- Consider updating population numbers for each inventory year based on Census updates/estimates for each inventory year [\(Done\)](#).
- Comparison of Inventory Years indicates consistent measurement of data. Note that Building & Facility Energy consumption did decline from 2017 to 2018. A comparison of heating degree days and cooling degrees days may help inform if the reduction was a result of weather or of other activities [\(Noted\)](#).

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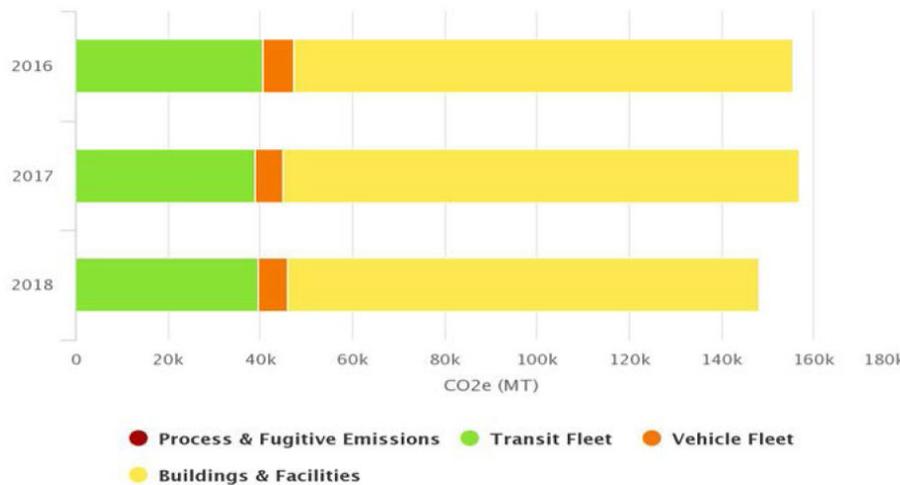
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Jakarta, Indonesia

South Asia Secretariat
Delhi, India



- Consider inputting total square footage of LGO buildings for each energy sub-sector. Future inventories may be more informative if energy use per sqft is available for comparison (Done).
- Streetlights and Traffic Lights were not included in inventory. If County pays for streetlights, consider collecting data or estimating use by billing rate. If no data available, consider inputting a record with a Notation Key of “Not Estimated” to indicate that Streetlight energy/emissions data was not available - indicating that future inventories should attempt to collect data (Electricity Streetlights and Traffic Lights are now included and reported separately from Purchased Electricity).
- Transit Fleet sub sector labelled Gas Vehicles and Heavy Equipment, however data entry is only listed as passenger vehicles. Consider clarifying in notes if there is Heavy Equipment for this sector or just passenger vehicles (Done).
- Water, Wastewater, and Solid Waste sectors do not contain records. Consider collecting data for Buildings and facilities that consume water and/or produce wastewater and solid waste (Milwaukee County does not operate a wastewater treatment facility. Water use and solid waste are Scope 3 emissions sources and thus outside of the scope of this inventory).
- Review was limited to data within ClearPath and did not include a review of source data (Noted).

Appendix C. Emissions by Milwaukee County Government Activity.

Activity	2016	2017	2018	2018 vs. 2016
Scope 1	68,831	67,689	69,539	1%
Buses	40,375	38,741	39,180	-3%
Natural Gas	21,549	22,657	23,702	10%
Gas Vehicles & Heavy Equipment	3,430	3,159	3,180	-7%
Diesel Vehicles & Heavy Equipment	2,444	2,166	2,534	4%
Small Diesel Equipment - Parks	618	591	575	-7%
Small Gas Equipment - Parks	300	258	246	-18%
Diesel Generators	67	70	74	10%
CNG Buses - Airport	45	45	45	0%
Additional Gas Vehicles - Airport	2	2	2	0%
Scope 2	86,636	82,790	77,139	-11%
Purchased Electricity	68,432	65,296	59,489	-13%
District Steam - Downtown	8,141	7,999	8,203	1%
District Steam - County Grounds	3,305	3,348	3,931	19%
T&D Losses - Electricity	3,154	3,013	2,984	-5%
Street Lights & Traffic Signals	1,811	1,810	1,668	-8%
District Cooling - County Grounds	1,793	1,324	864	-52%
Grand Total	155,466	150,479	146,678	-6%