



# City of Bloomington Common Council

## Legislative Packet – Addendum

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# Summary Report on the City of Bloomington's Greenhouse Gas Emissions Inventory 2008 to 2022

July 10, 2023

Prepared for:  
City of Bloomington  
Department of Economic and  
Sustainable Development



**GNARLY TREE**  
SUSTAINABILITY  
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# 1. Introduction

This document summarizes the methods and assumptions used for the greenhouse gas emissions back-cast and inventory for the City of Bloomington over the period 2008 to 2022. The 2008 to 2018 emissions were estimated in a previous back-cast analysis (developed in 2020); this document reflects an update to that back-cast to incorporate 2019 to 2022 emissions estimates based on the same methodologies and data sources (with all exceptions as noted). All calculations are in an accompanying spreadsheet. Section 2 describes the methodology and assumptions used for the analysis, and Section 3 presents summary results.

# 2. Methodology

Each subsection presents the approach used to estimate the emissions for one sector: Stationary Energy (Section 2.1); Transportation (Section 2.2); Solid Waste, Water Supply, and Wastewater Treatment (Section 2.3), and Industrial Processes and Product Use (IPPU; Section 2.4). Each section presents a short description of data sources and extrapolation methods used and presents key calculations in exhibits. Emission factor assumptions are shown in Section 2.5.

## 2.1 Stationary Energy Sector

### 2.1.a Grid-Supplied Electricity

For grid-supplied electricity, Duke Energy provided the total energy usage (in kWh) for the entire period, broken out by the commercial, industrial, residential, government, and unknown subsectors. For 2017 and later years, Duke provided the government sector data exclusive of electricity consumed by City utilities; for 2008 to 2016, the government subsector data encompasses all government facilities including utilities. Since the utilities' electricity consumption is counted under water supply and wastewater treatment (see Section 2.3.c), we adjusted the government-sector data for 2008 to 2016 to remove the portion of electricity attributable to utilities based on the percentage of total government energy consumed by utilities in 2018 (7.66%). Exhibit 1 shows the data provided as well as the extrapolation of government electricity consumption exclusive of utilities.

**Exhibit 1: Grid-Supplied Electricity by Subsector (kWh)**

Year	Commercial <sup>1</sup>	Government <sup>2</sup>	Industrial <sup>1</sup>	Residential <sup>1</sup>	Unknown <sup>1</sup>	Utilities <sup>3</sup>	Government (adj) <sup>4</sup>
2008	432,406,085	368,590,375	181,442,287	532,842,259	2,453,072	28,238,970	340,351,405
2009	402,799,860	374,353,554	171,191,560	516,200,450	19,686,887	28,680,507	345,673,047
2010	423,789,718	367,350,121	193,545,454	569,282,047	26,746,692	28,143,950	339,206,171
2011	427,068,987	358,091,166	192,664,588	541,914,288	16,018,804	27,434,590	330,656,576
2012	423,539,852	349,619,532	196,361,165	516,791,532	14,934,629	26,785,549	322,833,983
2013	417,209,171	337,260,371	187,425,166	529,684,604	15,896,097	25,838,671	311,421,700
2014	421,254,282	341,460,258	194,519,782	545,028,425	14,332,522	26,160,439	315,299,819
2015	383,379,382	292,423,947	175,708,111	483,847,521	11,958,777	22,403,599	270,020,348
2016	381,395,225	300,100,840	170,656,456	481,897,282	12,670,543	22,991,752	277,109,088
2017	408,075,333	284,647,430	173,125,539	495,916,646	8,438,601	23,617,209	284,647,430
2018	420,638,053	294,425,924	173,471,915	562,270,593	10,058,642	24,428,531	294,425,924

Year	Commercial <sup>1</sup>	Government <sup>2</sup>	Industrial <sup>1</sup>	Residential <sup>1</sup>	Unknown <sup>1</sup>	Utilities <sup>3</sup>	Government (adj) <sup>4</sup>
2019	416,636,574	277,022,755	170,731,329	541,833,065	17,506,480	27,047,274	277,022,755
2020	380,655,086	248,101,595	162,721,378	520,573,557	16,403,091	24,217,854	248,101,595
2021	395,136,698	259,320,211	182,903,966	537,918,927	15,882,296	25,843,110	259,298,666
2022	427,791,465	379,363,730	195,429,800	590,486,711	17,000,562	31,296,209	379,275,764

1. Data provided by Duke Energy.  
2. Data provided by Duke Energy; for 2008 to 2016, inclusive of electricity consumed by utilities; for 2017 to 2022, exclusive of utilities' electricity.  
3. For 2018, data provided by Duke Energy; for 2008 to 2017, extrapolated based on 2018 utilities' electricity consumption as a percent of total government electricity consumption (7.66%).  
4. For 2017 to 2022, data provided by Duke Energy; for 2008 to 2016, Government minus Utilities. For 2021 and 2022, reflects removal of electricity for Bloomington Transit electric busses (21,545 kWh and 87,966 respectively; see Exhibit 7).

To estimate the emissions associated with electricity consumption, we used the eGrid emission factors from the U.S. Environmental Protection Agency (EPA) for the RFC West subregion, varying the eGrid emission factors over the period based on periodic releases of new emission factors that reflect year-to-year changes in the resource mix used to generate electricity in the region. Exhibit 2 shows the emission factors for the analysis period.

Note that EPA changed its methodology for estimating the CH<sub>4</sub> emission factor in 2014, resulting in a substantial increase in that factor relative to earlier years. As such, the back-cast model applies the 2014 CH<sub>4</sub> emission factor for the earlier period to avoid an artificial jump in CH<sub>4</sub> emissions in that year that is actually attributable to a methodological change rather than a true increase in emission rates.

**Exhibit 2: eGrid Emission Factors for Grid-Supplied Electricity<sup>1</sup>**

Year	CO <sub>2</sub> (lbs/MWh)	CH <sub>4</sub> (lbs/GWh) <sup>2</sup>	N <sub>2</sub> O (lbs/GWh)
2007	1551.52	150.20	25.93
2008	1536.06	150.20	25.53
2009	1520.59	150.20	25.13
2010	1503.47	150.20	24.75
2011	1441.48	150.20	23.21
2012	1379.48	150.20	21.67
2013	1380.19	150.20	21.84
2014	1380.90	150.20	22.00
2015	1312.15	129.10	20.50
2016	1243.40	108.00	19.00
2017	1204.75	112.50	18.00
2018	1166.10	117.00	17.00
2019	1067.70	99.00	14.00
2020	985.00	86.00	12.00
2021	1046.10	95.00	14.00
2022	1046.10	95.00	14.00

Year	CO <sub>2</sub> (lbs/MWh)	CH <sub>4</sub> (lbs/GWh) <sup>2</sup>	N <sub>2</sub> O (lbs/GWh)
Source: eGrid emission factors for the RFC West subregion from the United States Environmental Protection Agency.			
1. Rows in italics with grey shading are extrapolated based on the average of the preceding and (if available) following year.			
2. To account for a change in methodology, 2008 to 2013 use the 2014 CH <sub>4</sub> emissions factor.			

### 2.1.b Natural Gas Use

The natural gas provider for Bloomington (Vectren for 2008 to 2018 and Centerpointe for 2019 to 2022) provided the total natural gas consumption data for the analysis period, broken out by the subsectors residential, commercial, and industrial, at the Monroe County level. We adjusted the natural gas usage data to scale down the county-level data to reflect the City of Bloomington based on a population ratio. Exhibit 3 shows the calculation of the adjustment factor based on population data,<sup>1</sup> and the calculation of Bloomington natural gas consumption is shown in Exhibit 4.

**Exhibit 3: Population Data for Bloomington and Monroe County**

Year	Monroe County <sup>1</sup>	Bloomington <sup>1</sup>	Adjustment Factor <sup>2</sup>
2008	136,443	77,592	0.569
2009	137,565	78,500	0.571
2010	138,422	81,096	0.586
2011	139,799	81,033	0.580
2012	141,019	78,592	0.557
2013	141,888	80,693	0.569
2014	143,339	83,423	0.582
2015	144,705	83,815	0.579
2016	145,496	86,654	0.596
2017	146,986	85,551	0.582
2018	146,917	86,522	0.589
2019	148,431	86,630	0.584
2020	149,765	88,111	0.588
2021	150,867	88,967	0.590
2022	151,970	89,824	0.591

1. United States Census Bureau (Decennial Census and American Community Survey 1-year estimates) for 2010 to 2019; for other years, extrapolated based on best fit to available data.

2. Adjustment factor calculated as Bloomington population divided by Monroe County population.

<sup>1</sup> The 2020 Census reported a Bloomington population of 79,168, which represents an 8 percent decrease relative to the 2019 1-year estimate from the American Community Survey (ACS); additionally, the Census Bureau changed its methodology for population estimates under the ACS thereafter. The decreased population may be the result of methodology changes, the impact of the COVID pandemic on the City's student population, or an actual decrease in the population. For this analysis, we assume that the sharp decrease between 2019 and 2020 does not reflect actual trends; for consistency with the previous back-cast analysis, we instead project the population for the 2020 to 2022 years based on the 2010 to 2019 period.

**Exhibit 4: Natural Gas Consumption by Subsector**

Year	Monroe County <sup>1</sup>			Adj <sup>2</sup>	Bloomington <sup>3</sup>		
	Residential	Commercial	Industrial		Residential	Commercial	Industrial
2008	19,958,673	10,436,463	103,352	0.569	11,349,967	5,934,939	58,773
2009	19,049,368	10,226,887	85,487	0.571	10,870,316	5,835,863	48,782
2010	18,778,711	9,956,783	305,940	0.586	11,001,708	5,833,287	179,238
2011	18,591,976	10,007,362	76,637	0.580	10,776,641	5,800,660	44,422
2012	15,454,449	8,444,924	64,933	0.557	8,612,996	4,706,483	36,188
2013	19,184,576	10,180,592	74,749	0.569	10,910,443	5,789,795	42,511
2014	21,679,820	11,746,503	75,174	0.582	12,617,610	6,836,441	43,751
2015	18,885,471	10,378,083	70,866	0.579	10,938,708	6,011,119	41,047
2016	15,437,766	8,741,491	61,267	0.596	9,194,371	5,206,227	36,489
2017	16,194,544	9,046,084	62,498	0.582	9,425,792	5,265,138	36,376
2018	20,731,079	11,144,690	76,565	0.589	12,208,896	6,563,304	45,091
2019	19,652,076	10,779,653	78,592	0.584	11,469,702	6,291,417	45,869
2020	17,751,146	9,383,559	64,481	0.588	10,443,515	5,520,621	37,936
2021	19,363,356	10,745,730	90,857	0.590	11,418,677	6,336,816	53,579
2022	18,813,948	10,264,080	101,522	0.591	11,120,208	6,066,707	60,006

1. Data provided by Vectren for 2008 to 2018 and by Centerpointe for 2019 to 2022.
2. See Exhibit 3.
3. For each subsector, Monroe County consumption times the adjustment factor.

**2.1.c IU CHP**

Indiana University’s Central Heating Plant (IU CHP) provided data on the fossil fuels used for 2017 to 2021, including natural gas, coal, and fuel oil. We extrapolated the fuel usage over the period 2008 to 2016, and for 2022 based on changes in IU Bloomington enrollment over the back-cast period, as shown in Exhibit 5.

**Exhibit 5: IU CHP Fuel Usage Data and Extrapolation**

Year	IU CHP Fuel Usage <sup>1</sup>			IU Enrollment <sup>2</sup>	Extrapolation Factor <sup>3</sup>
	Coal (tons)	Natural Gas (dekatherms)	Fuel Oil (gallons)		
2008	8,594	1,087,894	4,481	40,351	0.925
2009	9,018	1,141,654	4,702	42,345	0.971
2010	9,042	1,144,701	4,714	42,458	0.974
2011	9,098	1,151,710	4,743	42,718	0.980
2012	8,973	1,135,938	4,678	42,133	0.966
2013	9,020	1,141,816	4,703	42,351	0.971
2014	9,088	1,150,497	4,738	42,673	0.979
2015	9,194	1,163,924	4,794	43,171	0.990
2016	9,317	1,179,480	4,858	43,748	1.003

Year	IU CHP Fuel Usage <sup>1</sup>			IU Enrollment <sup>2</sup>	Extrapolation Factor <sup>3</sup>
	Coal (tons)	Natural Gas (dekatherms)	Fuel Oil (gallons)		
2017	10,521	1,114,422	9,684	43,710	
2018	8,053	1,236,908	0	43,503	
2019	6,406	1,239,898	0	43,260	
2020	5,999	1,196,433	0	43,064	
2021	6,803	1,261,947	0	45,328	
2022	8,114	1,299,257	0	47,005	1.074
Average, 2017/2018	9,287	1,175,665	4,842	43,607	
Average, 2017-2021	7,556	1,209,922	1,937	43,773	

1. Data for 2017 to 2021 provided by IU CHP. For other years, extrapolated based on average values (for 2017/2018 for earlier years, and for 2017 to 2021 for 2022) times the extrapolation factor.  
2. Source: Indiana University Historical Student Enrollment, Bloomington campus (fall term).  
3. For 2008 to 2016, calculated as the year's enrollment divided by the average of the 2017 and 2018 enrollment. For 2022, calculated as the year's enrollment divided by the average enrollment for 2017 to 2021.

## 2.2 Transportation Sector

### 2.2.a Public Transit

Bloomington Transit provided fuel data broken out by type (diesel vs. gas and fixed routes vs. access) and vehicle miles travelled (VMT) broken out by fixed route versus access for the period 2008 to 2018. To further break out the VMT into diesel and gas vehicles, we assumed that the proportion of miles in each category is proportional to the share of fuel in each category, as shown in Exhibit 6.

For 2019 to 2022, Bloomington Transit provided the VMT and fuel consumption for diesel (including fixed route and paratransit vehicles) and gasoline (for fixed route and support vehicles), as shown in Exhibit 7.

**Exhibit 6: Bloomington Transit Fuel Usage and Vehicle Miles Travelled**

Year	Diesel (gallons) <sup>1</sup>		Gas (gallons) <sup>1</sup>		Total Miles <sup>1</sup>			
	Fixed	Access	Fixed	Access	Fixed <sup>1</sup>	Access <sup>1</sup>	Diesel <sup>2</sup>	Gas <sup>3</sup>
2008	283,343	0	2,659	0	1,047,382	0	1,037,644	9,738
2009	277,123	279	2,441	1,994	1,033,727	18,627	1,026,983	25,371
2010	276,612	871	2,823	17,442	1,033,208	148,543	1,029,831	151,920
2011	277,948	1,174	3,338	16,118	1,052,559	138,808	1,049,494	141,873
2012	282,035	900	3,529	18,052	1,066,252	154,063	1,060,392	159,923
2013	274,676	142	3,184	20,803	1,056,764	162,041	1,045,750	173,055
2014	285,846	270	0	21,533	1,053,200	158,597	1,055,166	156,631
2015	286,995	1,285	5,275	23,107	1,071,784	165,955	1,061,183	176,556
2016	288,675	6	7,600	25,145	1,081,252	158,155	1,053,550	185,857



Year	Diesel (gallons) <sup>1</sup>		Gas (gallons) <sup>1</sup>		Total Miles <sup>1</sup>			
	Fixed	Access	Fixed	Access	Fixed <sup>1</sup>	Access <sup>1</sup>	Diesel <sup>2</sup>	Gas <sup>3</sup>
2017	277,394	0	6,496	25,281	1,057,488	153,766	1,033,291	177,963
2018	274,914	0	6,163	28,757	1,104,341	174,809	1,080,129	199,021

1. Data provided by Bloomington Transit.

2. For each category (fixed and access), calculated as total miles times the percent diesel (calculated as diesel gallons divided by the sum of diesel and gas gallons), then summed across fixed and access.

3. For each category (fixed and access), calculated as total miles times the percent gas (calculated as gas gallons divided by the sum of diesel and gas gallons), then summed across fixed and access.

### Exhibit 7: Bloomington Transit Fuel Consumption and Vehicle Miles Travelled by Fuel<sup>1</sup>

Year	Diesel		Gas		Electricity	
	Gallons	VMT	Gallons	VMT	kWh	VMT
2018	274,914	1,080,129	34,920	199,021		
2019	289,314	1,163,850	9,239	64,575		
2020	208,297	983,416	6,304	47,908		
2021	221,538	1,016,371	6,855	48,896	21,545	614
2022	240,053	996,122	6,941	45,710	87,966	15,121

1. Data provided by Bloomington Transit, including fixed route (diesel, gas, and electric), paratransit (diesel), and support vehicles (gas).

For IU busses, the diesel gallons used each year was provided by IU for the 2008 to 2018, as well as VMT for 2018. Because the emission factors for diesel busses are based on VMT, we extrapolated this variable over the 2008 to 2017 period by assuming the mileage varies proportionally to the amount of diesel used.

For 2019 to 2022, fuel consumption and mileage data were not available. We assumed that the variation in IU Bus activity would be similar to variation in Bloomington Transit's diesel bus activity during this period and calculated an extrapolation factor relative to 2018. These calculations are shown in Exhibit 8.

### Exhibit 8: IU Bus Fuel Usage and Vehicle Miles Travelled

Year	Diesel (gallons) <sup>1</sup>	VMT <sup>2</sup>	Extrapolation Factor <sup>3</sup>
2008	123,597	461,357	1.236
2009	124,957	466,433	1.250
2010	132,738	495,478	1.327
2011	119,048	444,376	1.190
2012	118,997	444,186	1.190
2013	128,470	479,546	1.285
2014	112,219	418,885	1.122
2015	103,089	384,805	1.031
2016	94,856	354,074	0.949
2017	91,760	342,517	0.918

Year	Diesel (gallons) <sup>1</sup>	VMT <sup>2</sup>	Extrapolation Factor <sup>3</sup>
2018	100,000	373,275	1.000
2019	107,751	402,208	1.078
2020	91,046	339,853	0.910
2021	94,097	351,241	0.941
2022	92,223	344,244	0.922

1. Data provided by IU Bus for 2008 to 2018. For 2019 to 2022, calculated as 2018 gallons times the extrapolation factor.
2. For 2018, data provided by IU Bus; for 2008 to 2017, extrapolated by multiplying the diesel gallons by the extrapolation factor; for 2019 to 2022, calculated as 2018 VMT times the extrapolation factor.
3. For 2008 to 2017, diesel gallons divided by 2018 diesel gallons; for 2019 to 2022, Bloomington Transit diesel VMT divided by 2018 Bloomington Transit diesel VMT (see Exhibit 7).

### 2.2.b On-Road Vehicles

The Indiana Department of Transportation (INDOT)<sup>2</sup> provides historical data on VMT at the county level over the period 2006 to 2018 and at the city and county level for 2016 to 2021. For 2016 to 2021, the inventory analysis relies on the city-level Bloomington data to estimate the total miles travelled by on-road vehicles. For prior years when city-level data are not available, we extrapolated Bloomington-level VMT based on the county-level data times the assumed percent of all VMT that occurred within Bloomington. We used a similar method to subdivide all Bloomington VMT into the commercial and non-commercial subsectors, since the INDOT city-level data also provides the data broken out by commercial vehicle travel. For 2022, we projected Bloomington total and commercial VMT based on best fit to the 2016 to 2021 data. Exhibit 9 shows these calculations.

#### Exhibit 9: Calculation of Daily On-Road Vehicle Miles Travelled

Year	Bloomington <sup>1</sup>	Bloomington Commercial <sup>2</sup>	Percent Bloomington Commercial <sup>3</sup>	Monroe County <sup>4</sup>	Percent Bloomington <sup>5</sup>
2008	750,445	51,583	6.9%	2,825,000	26.6%
2009	747,788	51,401	6.9%	2,815,000	26.6%
2010	676,596	46,507	6.9%	2,547,000	26.6%
2011	730,787	50,232	6.9%	2,751,000	26.6%
2012	753,633	51,802	6.9%	2,837,000	26.6%
2013	697,316	47,931	6.9%	2,625,000	26.6%
2014	760,832	52,297	6.9%	2,864,100	26.6%
2015	743,698	51,120	6.9%	2,799,600	26.6%
2016	784,338	43,130	5.5%	2,938,870	26.7%
2017	803,408	53,689	6.7%	3,011,696	26.7%
2018	802,760	67,497	8.4%	3,048,334	26.3%
2019	1,078,979	72,371	6.7%		
2020	778,187	23,750	3.1%		

<sup>2</sup> <https://www.in.gov/indot/2469.htm>

Year	Bloomington <sup>1</sup>	Bloomington Commercial <sup>2</sup>	Percent Bloomington Commercial <sup>3</sup>	Monroe County <sup>4</sup>	Percent Bloomington <sup>5</sup>
2021	848,373	81,344	9.6%		
2022	885,264	60,281	6.8%		

1. For 2016 to 2021, data from INDOT provided at the city level; for 2008 to 2015, calculated as Monroe County daily VMT times the percent Bloomington. For 2022, forecasted based on best fit to 2016 to 2021 data.

2. For 2016 to 2021, data from INDOT provided at the city level; for 2008 to 2015, calculated as Bloomington daily VMT times the percent Bloomington commercial. For 2022, forecasted based on best fit to 2016 to 2021 data.

3. For 2016 to 2022, calculated as Bloomington commercial daily VMT divided by Bloomington total VMT; for 2008 to 2016, calculated as average of 2016 to 2018 percent.

4. Data from INDOT provided at the county level.

5. For 2016 to 2018, calculated as Bloomington daily VMT divided by Monroe County VMT; for 2008 to 2015, calculated as average of 2016 to 2018 percent.

INDOT's VMT data for commercial vehicles encompasses public transit vehicles. As such, for the back-cast, we further adjusted the commercial mileage to subtract the total public transit miles (for IU Bus and Bloomington Transit, described in Section 2.2.a) from the commercial VMT total to avoid double-counting.

#### Exhibit 10: Annual Vehicles Miles Travelled

Year	Total <sup>1</sup>	Non-Commercial <sup>2</sup>	Commercial <sup>3</sup>	Public Transit <sup>4</sup>	Commercial adj <sup>5</sup>
2008	273,912,394	255,084,470	18,827,923	1,508,739	17,319,185
2009	272,942,792	254,181,517	18,761,276	1,518,787	17,242,489
2010	246,957,475	229,982,353	16,975,122	1,677,229	15,297,894
2011	266,737,343	248,402,612	18,334,732	1,635,743	16,698,988
2012	275,075,915	256,168,015	18,907,900	1,664,501	17,243,399
2013	254,520,366	237,025,393	17,494,973	1,698,351	15,796,622
2014	277,703,535	258,615,020	19,088,515	1,630,682	17,457,833
2015	271,449,606	252,790,968	18,658,639	1,622,544	17,036,094
2016	286,283,233	270,540,693	15,742,540	1,593,481	14,149,059
2017	293,243,920	273,647,435	19,596,485	1,553,771	18,042,714
2018	293,007,400	268,370,995	24,636,405	1,652,425	22,983,980
2019	393,827,335	367,411,920	26,415,415	1,630,633	24,784,782
2020	284,038,255	275,369,505	8,668,750	1,371,177	7,297,573
2021	309,656,145	279,965,585	29,690,560	1,416,508	28,274,052
2022	329,016,131	304,350,848	24,665,283	1,386,076	23,279,207

1. Total daily VMT from Exhibit 9 times 365.
2. Total annual VMT minus commercial annual VMT.
3. Daily commercial miles from Exhibit 9 times 365.
4. Sum of public transit miles from Exhibit 6 and Exhibit 7.
5. Total commercial VMT minus public transit VMT.

The emissions inventory uses the National Default Vehicle Fuel Efficiency and Emission Factors provided by ICLEI in ClearPath for the years 2011 through 2021. For the years 2008 to 2010, we extrapolated MPG values based on best fit of the data provided. The MPG values are shown in Exhibit 11.

### Exhibit 11: Miles Per Gallon Assumptions for On-Road Vehicles

Year	Miles Per Gallon	
	Gas Passenger Vehicle	Diesel Heavy Truck
2008	22.5522	5.9175
2009	22.7231	5.9475
2010	22.8939	5.9774
2011	23.1588	6.0462
2012	23.2824	6.0462
2013	23.4104	6.0415
2014	23.2033	6.0619
2015	23.8602	6.0998
2016	23.9569	6.1542
2017	24.2149	6.2247
2018	24.2149	6.2247
2019	24.3771	6.3925
2020	24.3771	6.4781
2021	25.3000	6.5616
2022	25.3000	6.5616

Source: Based on United States National Default values (provided by ICLEI in ClearPath). 2008 to 2010 calculated on best fit to data from 2011 to 2018.

### 2.2.c Off-Road Vehicles

For the 2018 inventory, ICLEI provided emissions estimates for the off-road vehicle sector based on EPA's MOVES model. To estimate emissions over the analysis period, we adjusted the 2018 emissions values based on the change in Bloomington's population relative to 2018. This calculation is shown in Exhibit 12.

### Exhibit 12: Calculation of Off-Road Vehicle Emissions

Year	Emissions from MOVES Model (MT) <sup>1</sup>			Bloomington Population <sup>2</sup>	Adjustment Factor <sup>3</sup>
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O		
2008	44,669	13	0	77,592	0.897
2009	45,192	13	0	78,500	0.907
2010	46,686	13	0	81,096	0.937
2011	46,650	13	0	81,033	0.937
2012	45,245	13	0	78,592	0.908
2013	46,454	13	0	80,693	0.933
2014	48,026	13	0	83,423	0.964

Year	Emissions from MOVES Model (MT) <sup>1</sup>			Bloomington Population <sup>2</sup>	Adjustment Factor <sup>3</sup>
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O		
2015	48,252	14	0	83,815	0.969
2016	49,886	14	0	86,654	1.002
2017	49,251	14	0	85,551	0.989
2018	49,810	14	0	86,522	1.000
2019	49,872	14	0	86,630	1.001
2020	50,725	14	0	88,111	1.018
2021	51,218	14	0	88,967	1.028
2022	51,711	15	0	89,824	1.038

1. For 2018, MOVES model output provided by ICLEI for 2018 inventory; for other years, extrapolated based on 2018 emissions times the adjustment factor.  
2. See Exhibit 3.  
3. Bloomington population divided by 2018 Bloomington population.

### 2.2.d Air Travel

Bloomington Airport provided data on the amount of jet fuel and aviation gas used over the 2008 to 2019 period. For 2020 to 2022, fuel quantities are projected based on best fit to the available data. Consistent with the 2018 GHG inventory and back-cast, we assume that 43.51% of travel in each year is Scope 1 and 52% is Scope 3. Exhibit 13 shows the calculations.

**Exhibit 13: Calculation of Scope 1 and Scope 3 Fuel Usage for Air Travel**

Year	Fuel Quantity (Gallons) <sup>1</sup>		Scope 1 <sup>2</sup>		Scope 3 <sup>3</sup>	
	Jet Fuel	Aviation Gas	Jet Fuel	Aviation Gas	Jet Fuel	Aviation Gas
2008	843,214	139,538	366,882	60,713	438,471	72,560
2009	624,410	103,942	271,681	45,225	324,693	54,050
2010	631,987	113,987	274,978	49,596	328,633	59,273
2011	645,082	63,313	280,675	27,547	335,443	32,923
2012	599,408	97,162	260,802	42,275	311,692	50,524
2013	436,578	110,699	189,955	48,165	227,021	57,563
2014	511,465	78,458	222,538	34,137	265,962	40,798
2015	503,409	68,853	219,033	29,958	261,773	35,804
2016	547,160	64,880	238,069	28,229	284,523	33,738
2017	551,344	55,953	239,890	24,345	286,699	29,096
2018	525,416	55,733	228,609	24,249	273,216	28,981
2019	580,155	44,015	252,425	19,151	301,681	22,888
2020	468,488	37,585	203,839	16,353	243,614	19,544
2021	450,825	30,591	196,154	13,310	234,429	15,908
2022	433,161	23,598	188,468	10,267	225,244	12,271

Year	Fuel Quantity (Gallons) <sup>1</sup>		Scope 1 <sup>2</sup>		Scope 3 <sup>3</sup>	
	Jet Fuel	Aviation Gas	Jet Fuel	Aviation Gas	Jet Fuel	Aviation Gas
1. Data provided by Bloomington Airport for 2008 to 2019; for 2020 to 2022, forecasted based on best fit to available data.						
2. Quantity of fuel times 43.51% (percent of travel that is Scope 1).						
3. Quantity of fuel times 52.00% (percent of travel that is Scope 3).						

## 2.3 Solid Waste, Water Supply, and Wastewater Sector

### 2.3.a Landfill

The Indiana Department of Environmental Management (IDEM) provides data on the total quantity of solid waste at the county level for 2011 to 2021.<sup>3</sup> To identify the facilities that represent waste generated from Bloomington, we established a cutoff of 100 tons reported (on a quarterly basis) and restricted the facilities to include the following that serve Bloomington: Medora Sanitary Landfill, Sycamore Ridge Landfill, Ray's Resource Recovery and Transfer Station, 96<sup>th</sup> Street Transfer and Recycling, and Lawrence County SWMD Transfer Site. We excluded Hoosier Disposal and Recycling transfer station since the majority of waste tonnage is accounted for in the Sycamore Ridge landfill and other included facilities.

We extrapolated Bloomington-level quantities based on the ratio of the Bloomington population to the Monroe County population, which was applicable for the years 2011 to 2021. For 2008 to 2010, we multiplied the Bloomington population by an assumed rate of 0.972 tons per person, which is the average for 2011 to 2018. For 2022, we multiplied the population by an assumed rate of 0.985 tons per person, which is the average for 2011 to 2021. Exhibit 14 shows this calculation.

**Exhibit 14: Calculation of Landfill Solid Waste Tonnage**

Year	Monroe County Tons <sup>1</sup>	Census Population <sup>2</sup>			Bloomington Tons/ person <sup>3</sup>	Bloomington Tons <sup>4</sup>
		Monroe County	Bloomington	Adj		
2008		136,443	77,592	0.569	0.972	75,386
2009		137,565	78,500	0.571	0.972	76,269
2010		138,422	81,096	0.586	0.972	78,791
2011	141,274	139,799	81,033	0.580	1.011	81,888
2012	134,076	141,019	78,592	0.557	0.951	74,722
2013	136,122	141,888	80,693	0.569	0.959	77,414
2014	133,057	143,339	83,423	0.582	0.928	77,439
2015	132,507	144,705	83,815	0.579	0.916	76,750
2016	142,935	145,496	86,654	0.596	0.982	85,129
2017	148,008	146,986	85,551	0.582	1.007	86,146
2018	149,759	146,917	86,522	0.589	1.019	88,196
2019	152,257	148,431	86,630	0.584	1.026	88,863
2020	149,031	149,765	88,111	0.588	0.995	87,679

<sup>3</sup> <https://www.in.gov/idem/landquality/2406.htm>

Year	Monroe County Tons <sup>1</sup>	Census Population <sup>2</sup>			Bloomington Tons/ person <sup>3</sup>	Bloomington Tons <sup>4</sup>
		Monroe County	Bloomington	Adj		
2021	157,200	150,867	88,967	0.590	1.042	92,702
2022		151,970	89,824	0.591	0.985	88,480

1. Data provided by Indiana Department of Environmental Management (IDEM) for 2011 to 2021; based on sum of relevant landfills and transfer stations reporting over 100 tons on a quarterly basis.  
2. For Monroe County and Bloomington populations, see Exhibit 3. Adjustment factor calculated as Bloomington population divided by Monroe County population.  
3. Calculated as Monroe County tons times adjustment factor divided by Bloomington population.  
4. For 2011 to 2021, Monroe County tons times adjustment factor; for 2008 to 2010, Bloomington population times average tons per person for 2011 to 2018 (0.972); for 2022, Bloomington population times average tons per person for 2011 to 2021 (0.985).

### 2.3.b Composting

Exhibit 15 shows the tons of composting reported by the City of Bloomington Landscaping and Sanitation departments (which practice green composting) and Green Camino (EarthKeepers as of 2018; which practices bio-waste composting) for 2016 to 2021. Based on information provided, we assume that no composting was practiced prior to 2016, and that 2022 levels were similar to 2021. We were not able to obtain data on bio-waste composting for 2019 to 2022.

#### Exhibit 15: Tons of Composting

Year	Green Waste Composting <sup>1</sup>	Bio-Waste Composting <sup>2</sup>
2016	8	
2017	26	
2018	128	15
2019	650	
2020	640	
2021	700	
2022	700	

1. Data provided by City of Bloomington.  
2. Data provided by Green Camino.

### 2.3.c Water Supply and Wastewater

The 2018 inventory accounts for electricity used for water supply and wastewater treatment (24,428,531 kWh), as well as N<sub>2</sub>O emissions associated with wastewater treatment (6.58 MT). For this analysis, equivalent data were not available. As such, for the electricity use, we extrapolated based on the percentage of government electricity usage was associated with the facilities in 2018, assuming that the changes would be proportional. For the N<sub>2</sub>O emissions from wastewater treatment, we assumed that changes over the analysis period would be proportional to changes in Bloomington’s population. These calculations are shown in Exhibit 16.

## Exhibit 16: Water Supply and Wastewater Treatment Calculations

Year	Grid-Supplied Electricity (kWh)		Denitrification Emissions (MT N <sub>2</sub> O) <sup>3</sup>	Bloomington Population <sup>4</sup>	Population Adjustment Factor <sup>5</sup>
	Government <sup>1</sup>	Water/Wastewater <sup>2</sup>			
2008	368,590,375	28,238,970	5.901	77,592	0.897
2009	374,353,554	28,680,507	5.970	78,500	0.907
2010	367,350,121	28,143,950	6.168	81,096	0.937
2011	358,091,166	27,434,590	6.163	81,033	0.937
2012	349,619,532	26,785,549	5.977	78,592	0.908
2013	337,260,371	25,838,671	6.137	80,693	0.933
2014	341,460,258	26,160,439	6.345	83,423	0.964
2015	292,423,947	22,403,599	6.375	83,815	0.969
2016	300,100,840	22,991,752	6.590	86,654	1.002
2017	284,647,430	23,617,209	6.507	85,551	0.989
2018	294,425,924	24,428,531	6.580	86,522	1.000
2019	277,022,755	27,047,274	6.589	86,630	1.001
2020	248,101,595	24,217,854	6.701	88,111	1.018
2021	259,320,211	25,843,110	6.766	88,967	1.028
2022	379,363,730	31,296,209	6.831	89,824	1.038

1. Data provided by Duke Energy; for 2008 to 2016, inclusive of electricity consumed by utilities; for 2017 to 2022, exclusive of utilities' electricity.

2. For 2018 to 2022, data provided by Duke Energy; for 2008 to 2017, extrapolated based on 2018 utilities' electricity consumption as a percent of total government electricity consumption (7.66%).

3. Data for 2018 provided by the City of Bloomington 2018 inventory; other data extrapolated based on 2018 value times the population adjustment factor.

4. See Exhibit 3.

5. Calculated as Bloomington population divided by 2018 Bloomington population.

## 2.4 Industrial Processes and Product Use Sector

### 2.4.a Fugitive Natural Gas Emissions

To estimate emissions from fugitive natural gas emissions, the analysis uses the same methodology and assumptions as the 2018 inventory, which assumes a leakage rate of 0.3% from all natural gas in the residential, commercial, and industrial subsectors. We used the same emissions factors that account for this leakage rate, applying them directly to the natural gas data from described in Section o. Note that this approach excludes natural gas usage at IU CHP.

### 2.4.b Transmission and Distribution Losses from Electricity

As in the 2018 inventory, this analysis uses the grid loss factors for Indiana from the Energy Information Administration's (EIA's) Annual Electric Generator Report to estimate the transmission and distribution (T&D) losses and associated emissions. To account for changes in loss rates over the period of the analysis,



we downloaded the underlying data from the EIA<sup>4</sup> and calculated the loss factor for each year based on estimated losses, direct use, and total disposition. This calculation is shown in Exhibit 17.

### Exhibit 17: Grid Loss Rate Calculation

Year	Total Disposition <sup>1</sup>	Direct Use <sup>1</sup>	Estimated Losses <sup>1</sup>	Loss Rate <sup>2</sup>
2008	129,533,013	7,896,332	6,814,723	0.0560
2009	116,677,008	7,502,074	6,321,934	0.0579
2010	125,187,219	7,997,274	6,548,096	0.0559
2011	122,132,166	8,110,579	6,538,887	0.0573
2012	121,028,706	8,344,927	5,695,557	0.0505
2013	121,345,712	8,577,181	5,666,744	0.0503
2014	121,854,906	7,958,621	5,568,490	0.0489
2015	119,683,883	8,352,553	5,212,499	0.0468
2016	115,135,895	4,928,602	5,412,467	0.0491
2017	109,966,194	4,958,199	5,383,593	0.0513
2018	116,858,605	6,819,691	5,373,968	0.0488
2019	115,311,661	7,416,064	5,536,487	0.0513
2020	109,765,214	7,344,405	5,411,018	0.0528
2021	112,475,762	7,406,286	4,692,418	0.0447
2022	112,475,762	7,406,286	4,692,418	0.0447

1. Source for 2008 to 2018: United States Energy Information Administration. 2020. State Electricity Profiles: Indiana Electricity Profile 2018: Table 10. For 2019 to 2021: United States Energy Information Administration. 2022. State Electricity Profiles: Indiana Electricity Profile 2021: Table 10. For 2022, assumed equivalent to 2021.

2. Calculated as Estimated Losses/(Total Disposition - Direct Use).

## 2.5 Emission Factors

### Exhibit 18: Emissions Factors

Activity	Emissions Factor Denominator			Emissions Factor (lbs)		
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
Natural Gas Use	MMBtu	MMBtu	MMBtu	116.8891868	0.0110231	0.0002205
CHP Natural Gas Use	MMBtu	MMBtu	MMBtu	116.8891868	0.0022046	0.0002205
Coal Use	MMBtu	MMBtu	MMBtu	205.9119208	0.0220462	0.0035274
Fuel Oil Use	MMBtu	MMBtu	MMBtu	161.4887388	0.0066139	0.0013228
Non-commercial gas	MMBtu	miles	miles	154.8528193	0.0000412	0.0000243
Commercial diesel	MMBtu	miles	miles	162.9977662	0.0000112	0.0000106
Public transit gas	MMBtu	miles	miles	154.8528193	0.0000443	0.0000375
Public transit diesel	MMBtu	miles	miles	162.9977662	0.0000022	0.0000033

<sup>4</sup> <https://www.eia.gov/tools/faqs/faq.php?id=105&t=3>

Activity	Emissions Factor Denominator			Emissions Factor (lbs)		
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
Air travel aviation gas	gallons	gallons	gallons	18.3204289	0.0155206	0.0002425
Air travel jet fuel	gallons	gallons	gallons	21.0982557	0.0005952	0.0006834
Landfill	tons	tons	tons	0.0000000	73.0055733	0.0000000
Bio-waste composting	tons	tons	tons	0.0000000	0.4850174	0.2932150
Green waste composting	tons	tons	tons	0.0000000	1.2257712	0.4497434
T&D Losses	MMBtu	MMBtu	MMBtu	364.3169304	0.0316441	0.0055670
Fugitive emissions	MMBtu	MMBtu	MMBtu	0.0014620	0.1365519	0.0000000

### 3. Summary Results

This inventory of community GHG emissions from 2008 to 2022, developed using a consistent GHG reporting protocol and equivalent data for each year, enables the City to compare emissions over a 15-year period and track progress toward its emission mitigation commitments. The exhibits below summarize the community level results of the analysis described in Section 2 (additional detailed results and graphs can be found in the accompanying spreadsheet model).

While a detailed contribution analysis would be needed for a full assessment of the drivers of changes in emissions over the period, some overall trends are notable. For example, while community GHG emissions have seen an overall decrease between 2008 and 2022, they have been particularly variable over the last three years, with annual increases of over 9 percent in each of the last two years following a 14 percent decrease in 2019.

Additional observations include:

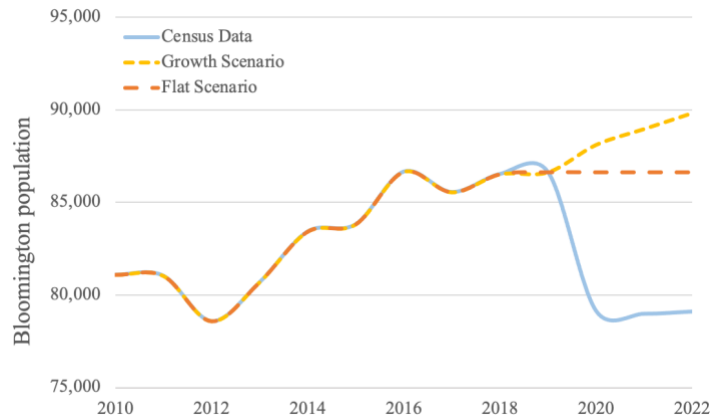
- Total emissions decreased by approximately 16 percent over the 15-year period, while population increased by 16 percent, yielding overall per-capita emissions decreases of almost 28 percent.
- Commercial energy emissions realized the largest overall decrease in emissions (almost 30 percent) and accounted for the largest share in overall community reductions over the period.
- Government emissions decreased significantly (by over 50 percent) between 2008 and 2020 before seeing sharp increases in 2021 and 2022; overall, government energy decreased by over 24 percent between 2008 and 2022.
- Transportation emissions varied over the period and realized a slight overall increase in absolute terms but decreased by seven percent on a per-capita basis. On-road vehicles had a high degree of variation in later years, with a spike in non-commercial vehicle traffic in 2019 and a significant decrease in commercial vehicle traffic in 2020.
- While most sectors had overall decreases in absolute and per-capita emissions over the period, emissions from the solid waste sector saw an overall increase on both an absolute value and per-capita basis.

It is important to note that results and trends summarized in this document are based on assumptions and extrapolation methods as described in Section 2. In some cases, these assumptions have important

implications for the interpretation of the results. For example, the model varies the emission factors for grid-supplied electricity over the analysis period based on region-specific emission factors provided by the U.S. Environmental Protection Agency. The year-to-year changes in these emission factors reflect underlying changes in the mix of resources used to generate electricity for the region, resulting in an overall decrease in emissions per kWh of electricity generated over the period. While the energy mix used by energy providers is largely outside of the control of the City, this emission factor variation is a significant driver of the overall decreasing absolute emissions in the stationary energy sector.<sup>5</sup>

Additionally, as noted in Section 2.1.b, the 2020 Census and subsequent American Community Survey (ACS) estimates used a different methodology relative to the 2010 Census and 2011 to 2019 ACS estimates and reflect a significant decrease in the population figures starting in 2020. Exhibit 19 illustrates this trend for the City; a similar trend occurs in the Census data for Monroe County. The decreased population may be the result of methodology changes, the impact of the COVID pandemic on the City’s student population, or an actual decrease in the population. For this

**Exhibit 19: City of Bloomington population data**



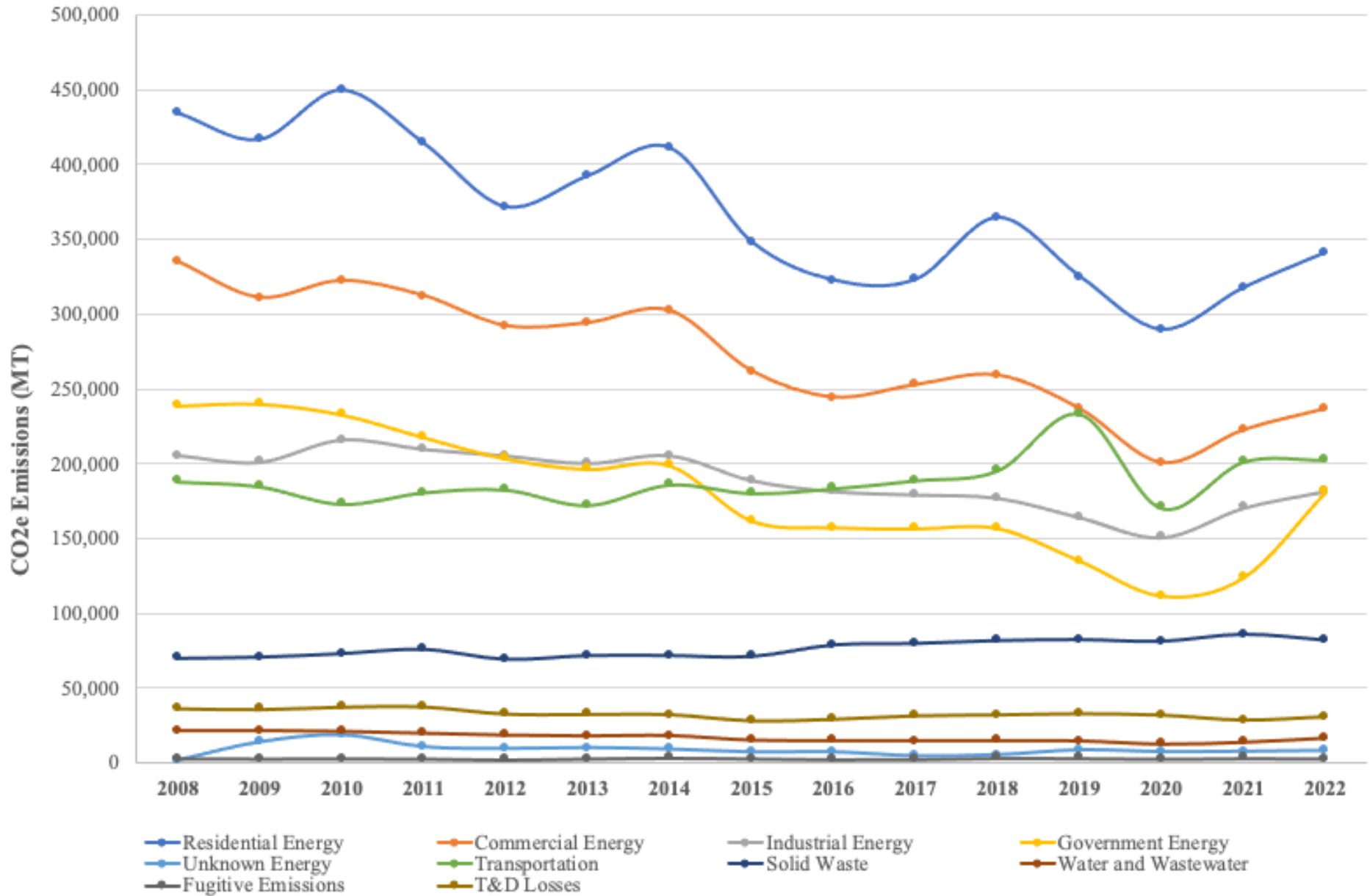
analysis, we assume that the sharp decrease between 2019 and 2020 does not reflect actual trends; for consistency with the previous analysis (and to avoid an artificial impact to the emissions estimates for the later years in the analysis period), we instead project the population for the 2020 to 2022 years based on the best fit to the 2010 to 2019 population trends (the “growth scenario” in Exhibit 19). However, as a result of this assumption, it is important to note that the population data used to extrapolate some key inputs does not reflect the U.S. Census Bureau’s current population estimates for Monroe County and Bloomington. This represents a source of uncertainty in this analysis.

<sup>5</sup> For example, the CO<sub>2</sub> eGrid emission factor decreased by 32 percent between 2008 to 2022, while electricity consumption in Bloomington increased by 8 percent (with a population increase of 16 percent).

**Exhibit 20: Summary of Community-Level Emissions (MT CO<sub>2</sub>e) by Sector/Sub-Sector**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Residential Energy	434,272	416,397	449,523	414,189	371,509	392,035	410,977	348,142	322,452	322,915	364,322	325,006	289,451	317,530	341,038
Commercial Energy	334,993	310,846	322,103	312,093	291,961	293,876	302,137	261,724	244,190	252,468	258,881	236,464	200,399	222,339	236,491
Transportation	188,209	185,015	173,324	180,974	182,844	172,508	186,196	180,513	183,635	189,012	195,602	233,328	170,504	201,479	202,725
Industrial Energy	205,580	200,977	215,905	209,632	205,334	200,222	205,390	188,911	181,576	179,350	177,149	164,267	150,890	170,539	181,610
Government Energy	238,831	240,124	232,982	217,750	203,461	196,375	198,928	161,819	157,301	156,572	156,770	134,977	111,478	123,787	181,063
Solid Waste	69,899	70,717	73,056	75,928	69,284	71,779	71,803	71,163	78,871	79,877	81,786	82,440	81,342	86,003	82,088
T&D Losses	36,468	35,835	37,637	37,816	32,614	32,357	32,216	27,718	28,825	31,347	32,058	32,892	31,908	28,291	30,769
Water and Wastewater	21,380	21,505	20,965	19,700	18,465	17,920	18,186	15,115	14,798	14,715	14,751	14,627	12,441	13,703	16,437
Unknown Energy	1,721	13,676	18,371	10,549	9,412	10,024	9,043	7,167	7,192	4,642	5,356	8,530	7,370	7,582	8,116
Fugitive Emissions	3,009	2,907	2,952	2,884	2,317	2,905	3,383	2,948	2,505	2,555	3,265	3,089	2,776	3,090	2,992
<b>Total Emissions</b>	<b>1,534,363</b>	<b>1,498,000</b>	<b>1,546,818</b>	<b>1,481,515</b>	<b>1,387,202</b>	<b>1,390,000</b>	<b>1,438,259</b>	<b>1,265,222</b>	<b>1,221,345</b>	<b>1,233,454</b>	<b>1,289,940</b>	<b>1,235,621</b>	<b>1,058,560</b>	<b>1,174,343</b>	<b>1,283,331</b>
<i>Change from 2008</i>		-2.4%	0.8%	-3.4%	-9.6%	-9.4%	-6.3%	-17.5%	-20.4%	-19.6%	-15.9%	-19.5%	-31.0%	-23.5%	-16.4%
<i>Change year-to-year</i>		-2.4%	3.3%	-4.2%	-6.4%	0.2%	3.5%	-12.0%	-3.5%	1.0%	4.6%	-4.2%	-14.3%	10.9%	9.3%

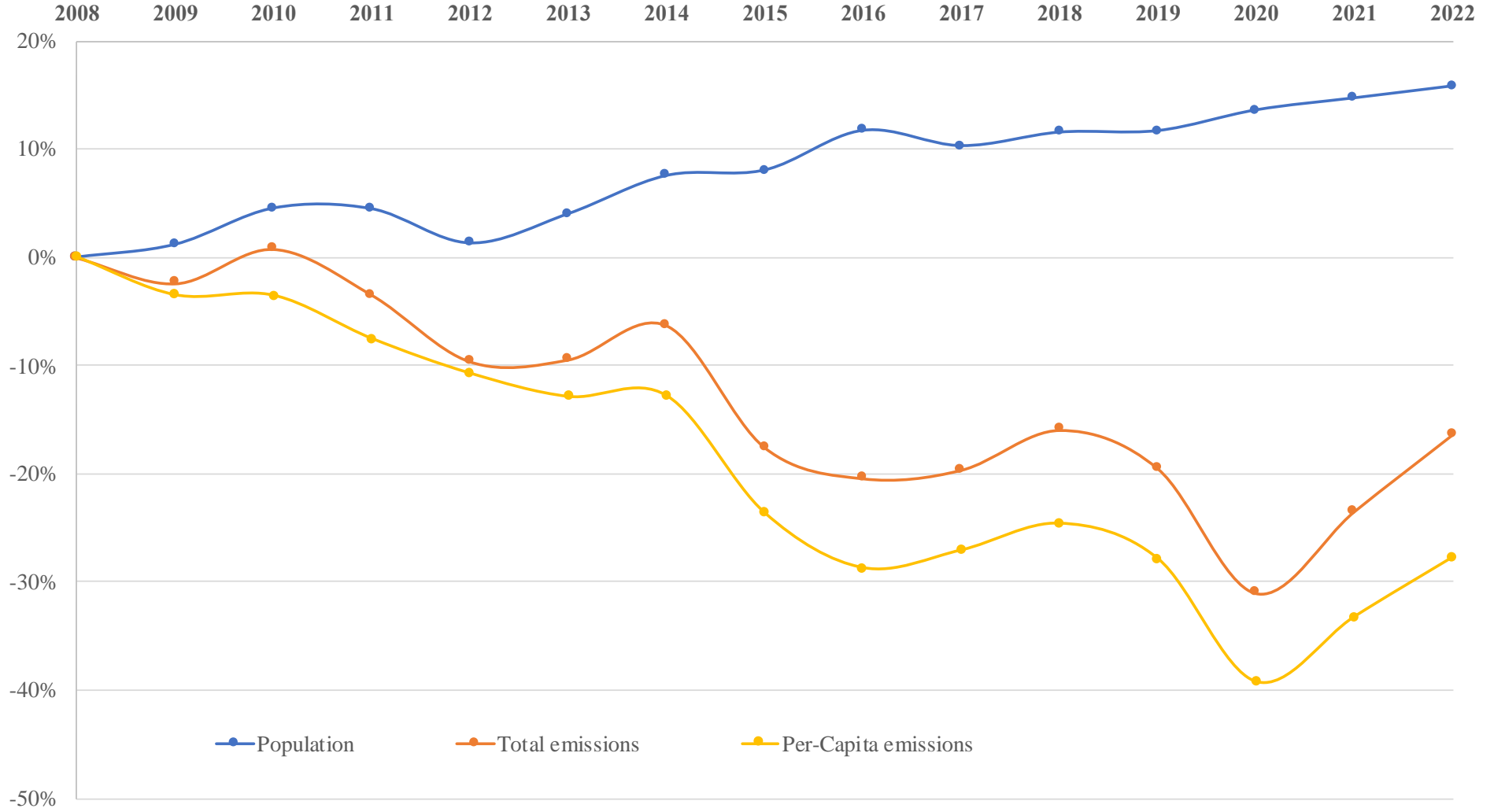
Exhibit 21: Graph of Community-Level Emissions by Sector/Sub-Sector



**Exhibit 22: Summary of Per-Capita Community-Level Emissions by Sector/Sub-Sector**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Residential Energy	5.6	5.3	5.5	5.1	4.7	4.9	4.9	4.2	3.7	3.8	4.2	3.8	3.3	3.6	3.8
Commercial Energy	4.3	4.0	4.0	3.9	3.7	3.6	3.6	3.1	2.8	3.0	3.0	2.7	2.3	2.5	2.6
Transportation	2.4	2.4	2.1	2.2	2.3	2.1	2.2	2.2	2.1	2.2	2.3	2.7	1.9	2.3	2.3
Industrial Energy	2.6	2.6	2.7	2.6	2.6	2.5	2.5	2.3	2.1	2.1	2.0	1.9	1.7	1.9	2.0
Government Energy	3.1	3.1	2.9	2.7	2.6	2.4	2.4	1.9	1.8	1.8	1.8	1.6	1.3	1.4	2.0
Solid Waste	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	1.0	0.9	1.0	0.9
T&D Losses	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.3
Water and Wastewater	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2
Unknown Energy	0.0	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fugitive Emissions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Total Emissions</b>	<b>19.8</b>	<b>19.1</b>	<b>19.1</b>	<b>18.3</b>	<b>17.7</b>	<b>17.2</b>	<b>17.2</b>	<b>15.1</b>	<b>14.1</b>	<b>14.4</b>	<b>14.9</b>	<b>14.3</b>	<b>12.0</b>	<b>13.2</b>	<b>14.3</b>
<i>Change from 2008</i>		-3.5%	-3.5%	-7.5%	-10.7%	-12.9%	-12.8%	-23.7%	-28.7%	-27.1%	-24.6%	-27.9%	-39.2%	-33.2%	-27.8%
<i>Change year-to-year</i>		-3.5%	0.0%	-4.1%	-3.5%	-2.4%	0.1%	-12.4%	-6.6%	2.3%	3.4%	-4.3%	-15.8%	9.9%	8.2%

Exhibit 23: Graph of Percent Change in Population and Emissions



A circular botanical illustration border surrounds the central text. It features various plants including ferns, a red leaf, a green leaf, a yellow flower, a purple flower, and a green leaf with a red vein. The background is a light blue-grey color.

Matt Caldie – Environmental  
Commission

# Air Quality Report

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# Introduction

- Air pollution causes harm to people's health and the environment
- Even without visible wildfire haze, pollutants can harm us
- The elderly, children, and people with pre-existing heart and lung conditions are at the greatest risk
- Concentrations are often worse in low-income neighborhoods or communities near industrial sources of pollution



# EPA Standards vs WHO Guidelines



PM <sub>2.5</sub>	primary	1 year	12.0 µg/m <sup>3</sup>
	secondary	1 year	15.0 µg/m <sup>3</sup>
	primary and secondary	24 hours	35 µg/m <sup>3</sup>
PM <sub>10</sub>	primary and secondary	24 hours	150 µg/m <sup>3</sup>

<b>PM<sub>2.5</sub>, µg/m<sup>3</sup></b>	Annual	5
	24-hour <sup>a</sup>	15
<b>PM<sub>10</sub>, µg/m<sup>3</sup></b>	Annual	15
	24-hour <sup>a</sup>	45



# Bloomington Monitoring

## PM Monitoring

- Located at Binford Elementary School (2300 E 2<sup>nd</sup> St)
- Continuous data excluded from 4/9/09 to 2/8/23; current now pending
- Intermittent data are eligible, and used to determine site values
- 7.7  $\mu\text{g}/\text{m}^3$  annual for 2020-2022, meeting 12  $\mu\text{g}/\text{m}^3$  NAAQS standard
- 16  $\mu\text{g}/\text{m}^3$  24-hour for 2020-2022, meeting 35  $\mu\text{g}/\text{m}^3$  NAAQS standard

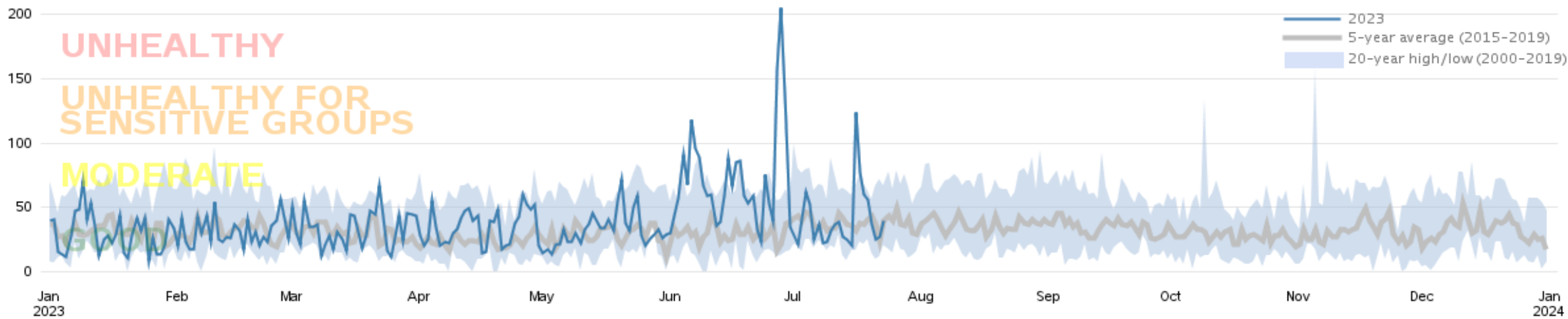
## Ozone Monitoring

- Downwind collection in Helmsburg, located in Brown County
- 0.061 ppm for 2020-2022, meeting 0.070 NAAQS standard



# PM2.5 Daily AQI Values

## Bloomington, IN



Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>

Generated: July 24, 2023



# Climate Impacts

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## Wildfires

- Wildfire seasons appear to be getting longer and more intense worldwide
- Smoke contains thousands of individual compounds, notably immense amounts of PM<sub>2.5</sub>
- More than just local. In 2020 California wildfires affected our air, and this year Canada wildfires continue to have an impact (271 AQI on 7/12)

## Extreme Heat

- Longer hotter days increase air conditioning demand, which in turn cause our oldest and dirtiest power plants to be utilized
- Plants emit heavy metals, hundreds of pollutant gasses, and lots of PM pollution
- Health risks are compounded in the presence of air pollutants and extreme heat



# What can we do?

- Bloomington can move to do our own air quality monitoring
- There are numerous ambient air pollutants we could monitor for, and many methods we could use
- Would we like to create a city-wide sensor network?



# Conducting Air Quality Monitoring



## Question

Determine your purpose. What question(s) are you trying to answer?

## Plan

Develop an approach to obtain data. Plan measurements, identify quality control tasks, and select sensors

## Setup

Select sites, setup and test sensors, and check and compare sensor measurements

## Collect

Collect measurements, review data, and conduct maintenance

## Evaluate

Analyze, interpret, communicate results, or take action



# Discussion



Thank you for your  
time!



**\*\*\* Amendment Form \*\*\***

**Ordinance #:** 23-14  
**Amendment #:** 01  
**Submitted By:** Cm. Flaherty  
**Date:** 9 August 2023

**Proposed Amendment:** (additions are shown in **bold** and deletions in ~~strikethrough~~)

1. Ordinance 23-14, Section 6 shall amended as follows:.

SECTION 6. Section 6.04.090, entitled “Fees and billing,” shall be amended as follows:

Subsection (1) shall be amended by deleting the words “beginning the month following the commencement of automated collection services by the city sanitation division” at the end of the sentence.

Subsection (1)(A) shall be amended by deleting the word “ranges” in the first sentence and by deleting the second and third sentences in their entirety, such that the subsection reads as follows:

The following fee schedule will apply based on the solid waste cart size chosen by customers.

Subsections (1)(A)(i)-(iii) shall be deleted in their entirety and shall be replaced by adding the following:

Schedule of Service Fees for Disposal of Solid Waste

(i) Thirty-five gallon solid waste cart fee schedule:

Year	Fee
Prior to January 1, 2024	\$6.51
Beginning January 1, 2024	\$8.75
<del>Beginning January 1, 2025</del>	<del>\$9.80</del>
<del>Beginning January 1, 2026</del>	<del>\$10.85</del>
<del>Beginning January 1, 2027</del>	<del>\$11.90</del>
<del>Beginning January 1, 2028</del>	<del>\$12.95</del>
<del>Beginning January 1, 2029</del>	<del>\$14.00</del>

(ii) Sixty-four gallon solid waste cart fee schedule:

Year	Fee
Prior to January 1, 2024	\$11.61
Beginning January 1, 2024	\$16.00
<del>Beginning January 1, 2025</del>	<del>\$17.92</del>
<del>Beginning January 1, 2026</del>	<del>\$19.84</del>
<del>Beginning January 1, 2027</del>	<del>\$21.76</del>
<del>Beginning January 1, 2028</del>	<del>\$23.68</del>
<del>Beginning January 1, 2029</del>	<del>\$25.60</del>

(iii) Ninety-six gallon solid waste cart fee schedule:

Year	Fee
Prior to January 1, 2024	\$18.52
Beginning January 1, 2024	\$24.00
<del>Beginning January 1, 2025</del>	<del>\$26.88</del>
<del>Beginning January 1, 2026</del>	<del>\$29.76</del>
<del>Beginning January 1, 2027</del>	<del>\$32.64</del>
<del>Beginning January 1, 2028</del>	<del>\$35.52</del>
<del>Beginning January 1, 2029</del>	<del>\$38.40</del>

Subsection (2)(C) shall be amended by replacing “\$10.00” with “\$25.00.”

Subsection (2)(D) shall be amended by replacing “\$10.00” with “\$35.00.”

Subsection (2)(E) shall be amended by inserting “(4.30)” in the first sentence and adding “In the event a resident schedules an additional pick-up and fails to place the cart at the curbside prior to the collection time, said resident will still be charged the full rate for the additional pick up” as a second sentence so that the subsection reads as follows:

Additional pick up requests: one hundred twenty-five (125) percent of regular weekly solid waste charges based on four and three-tenths (4.30) weeks on average per month, per year. In the event a resident schedules an additional pick-up and fails to place the cart at the curbside prior to the collection time, said resident will still be charged the full rate for the additional pick up.

Subsection (3) shall be amended by inserting the word “the” in the first sentence so that it reads as follows: “The fees for solid waste collection and disposal services provided to single-family residential dwellings shall be billed directly to the customer of record with CBU.” The final sentence of subsection (3) shall remain in place and unaltered.

### **Synopsis**

This amendment is sponsored by Cm. Flaherty. It removes the escalating solid waste disposal service fees that would otherwise apply on January 1 of each year from 2025 to 2029. The amendment would leave in place a proposed increase to the solid waste disposal service fee that would apply starting on January 1, 2024.

**August 9, 2023 Regular Session Action:** Pending