



City of Harrisonburg 2021 and 2022 Greenhouse Gas Emissions Inventory

October 24, 2023

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Greenhouse Gas Emissions Inventory

Why Conduct An Inventory?

- Guiding Goal in the EAP
- Compare to Baseline (2016)
 - Impacts
 - Accountability
 - Trends

2021 Project Scope

- Municipal Inventory
- Community Inventory
- 100-yr and 20-yr GWP values
- Fugitive Methane Emissions



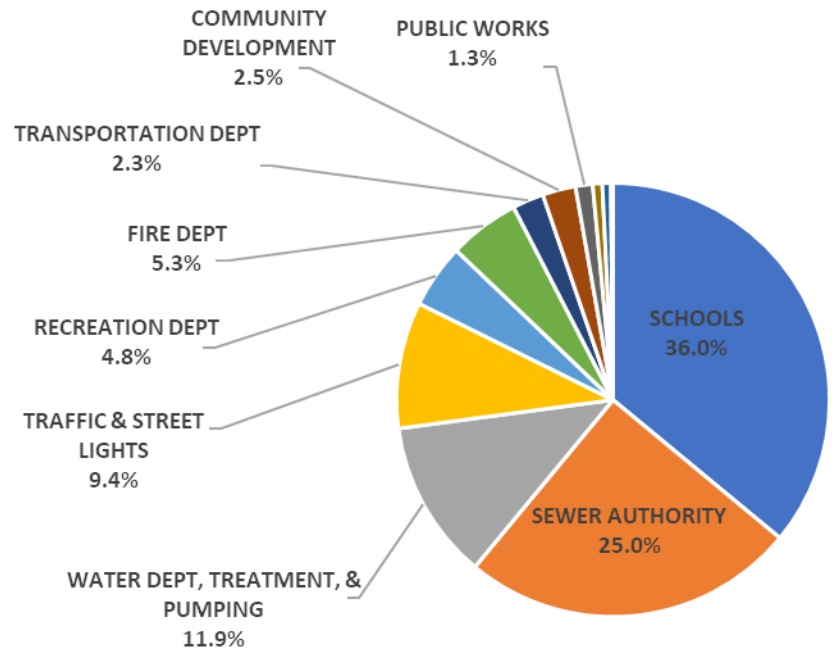
Greenhouse Gas Emissions Inventory

- Analysis Inputs
 - Electricity
 - Natural Gas
 - Natural Gas Leakage
 - Fuel Oil
 - Diesel & Gasoline
 - Water & Wastewater
 - Landfill & Recycling

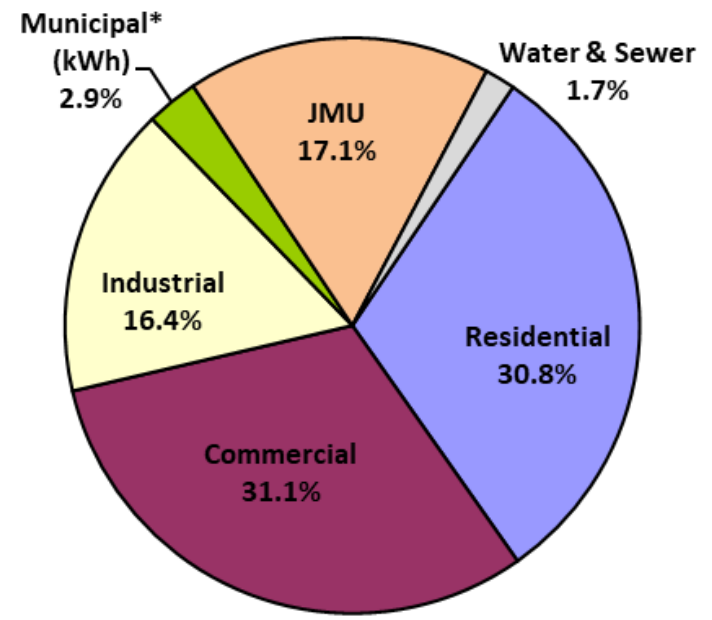


Electricity Use

2021 Municipal Electricity



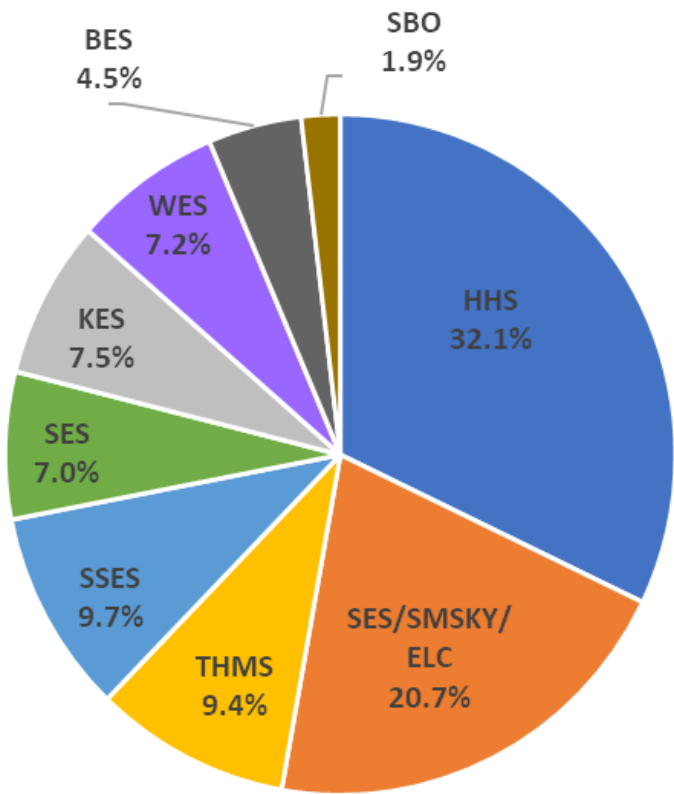
2021 Harrisonburg Community Electrical Usage



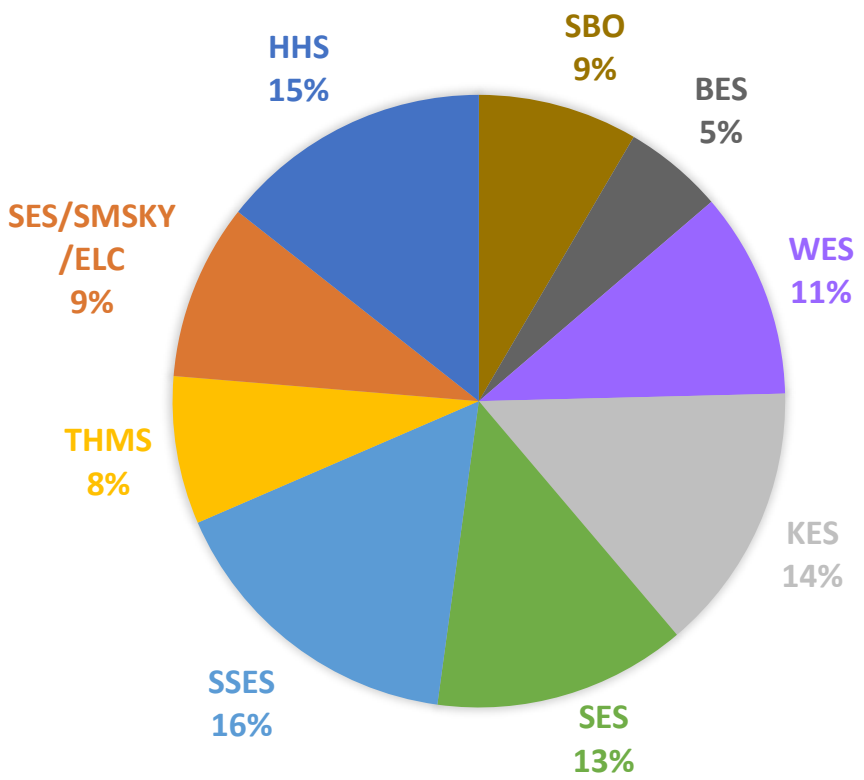


School Electricity Use

2021 School System Electricity

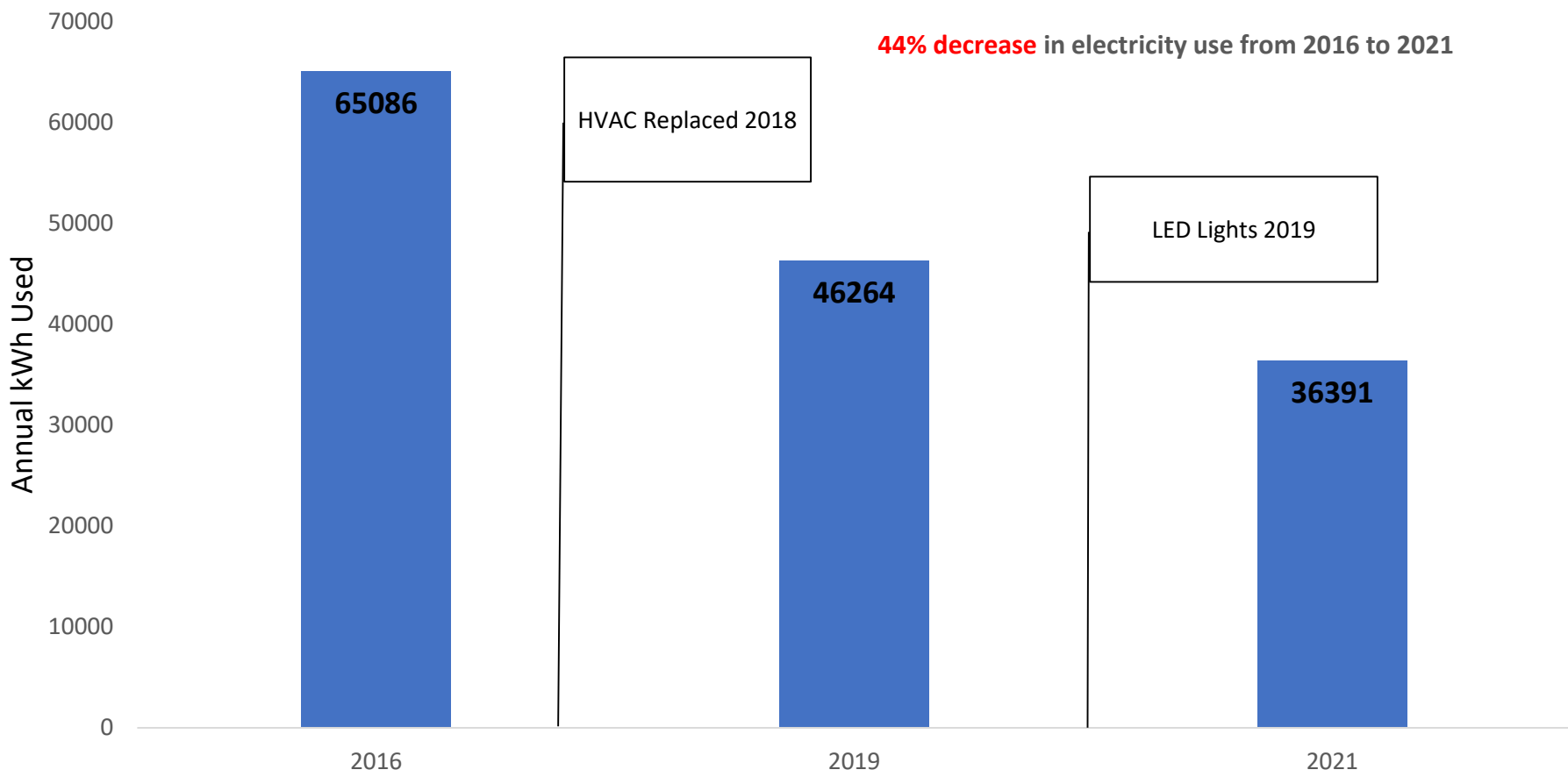


KWH/SQFT





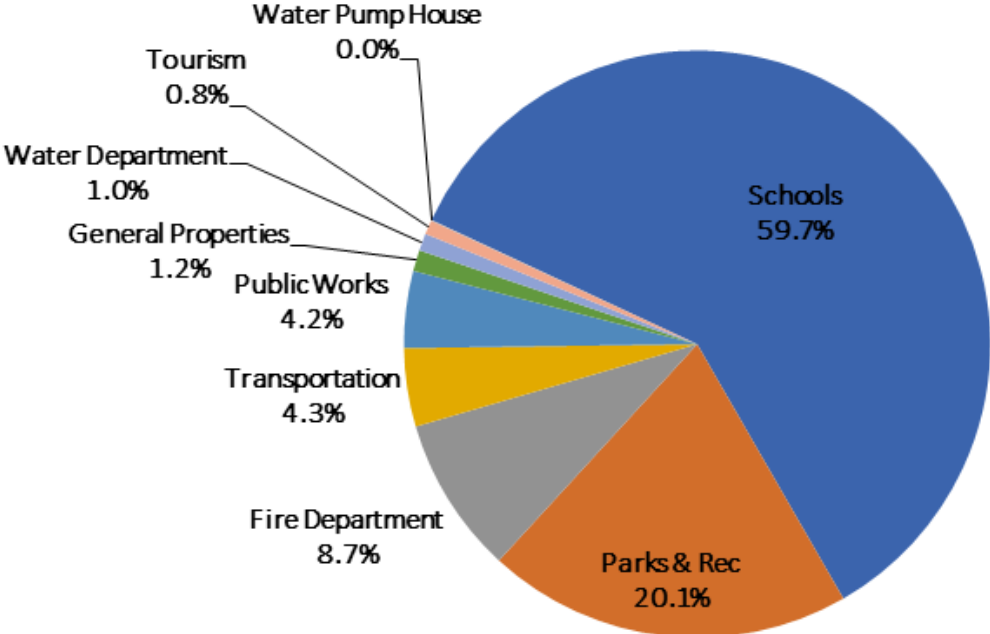
Central Stores Electricity Use by Year



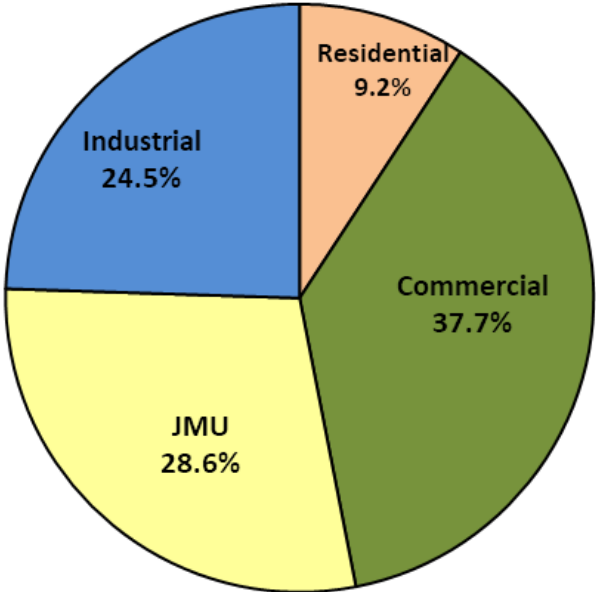


Natural Gas Use

2021 Harrisonburg Municipal Natural Gas Usage



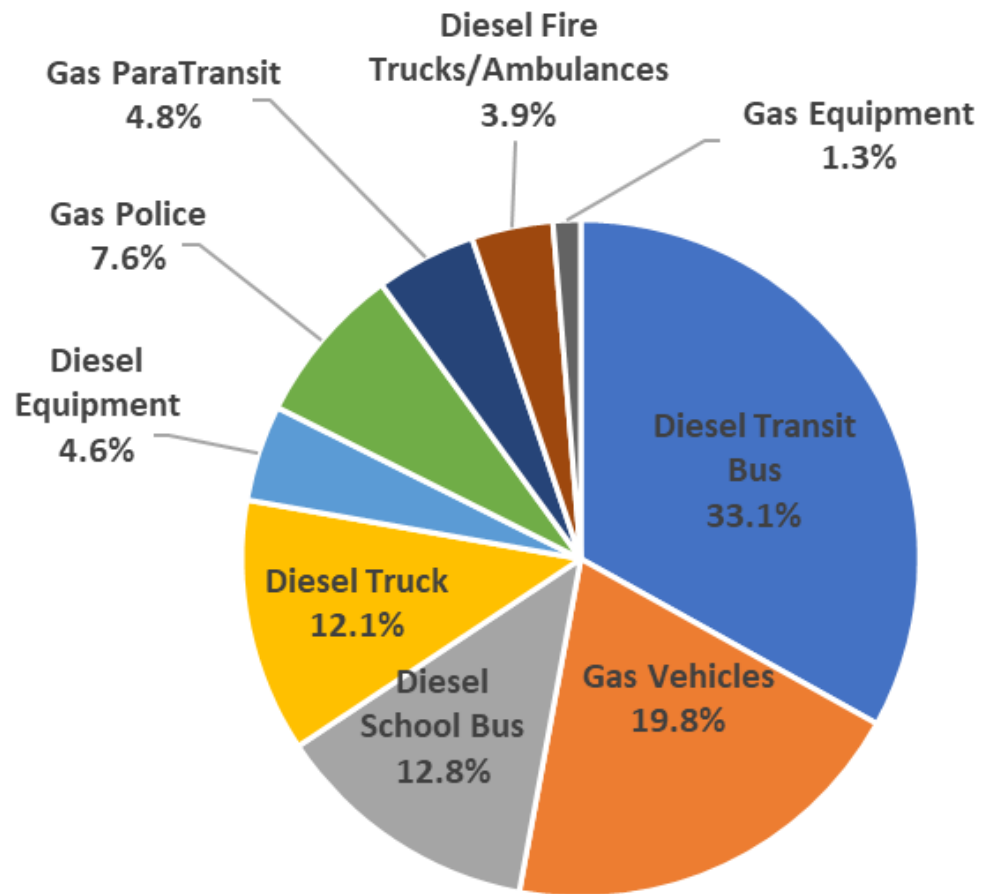
2021 Harrisonburg Natural Gas Usage



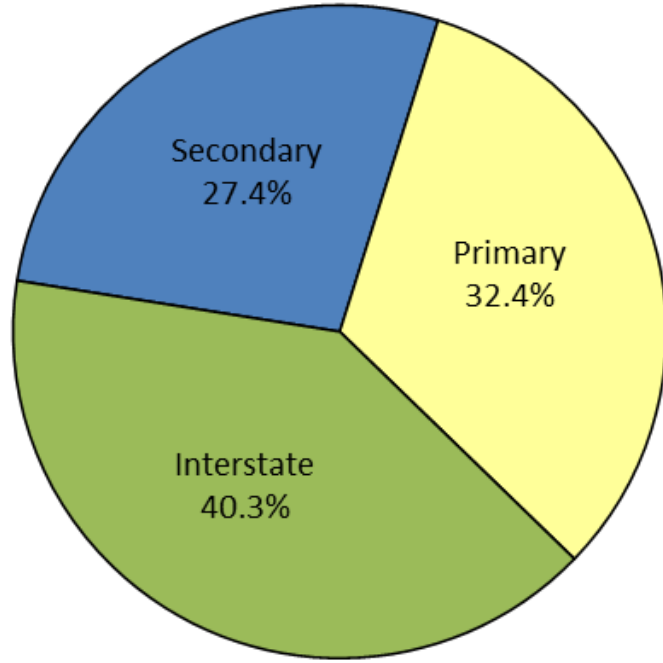


Transportation Fuel Use

2021 Fleet Transportation/Equipment Fuels



Harrisonburg VMT By Road Type (2021)





Municipal Emissions

100-yr GWP

Sector	ClearPath 2016 (mtons)	ClearPath 2019 (mtons)	ClearPath 2021 (mtons)	2021 Sector (%)	2021 - 2016 Baseline Difference (%)
Buildings/Facilities	8,698	8,974	7,980	38.7%	-8.3%
Water & Sewer	3,920	3,932	3,812	18.5%	-2.8%
Vehicle Fleet	3,473	3,590	3,129	15.2%	-9.9%
Natural Gas (Methane) Leakage	2,130	2,306	2,194	10.7%	3.0%
Transit Fleet	2,003	2,143	2,004	9.7%	0.0%
Street/Traffic Lights	1,029	1,041	947	4.6%	-8.0%
Electric Grid Loss	479	567	531	2.6%	10.9%
Totals	21,732	22,553	20,597	100.0%	-5.2%

Emissions Source	ClearPath 2016 (mtons)	ClearPath 2019 (mtons)	ClearPath 2021 (mtons)	2021 Sector (%)	2021 - 2016 Baseline Difference (%)
Electricity	11,141	11,697	10,570	51.3%	-5.1%
Diesel	3,930	4,115	3,579	17.4%	-8.9%
Natural Gas	4,356	4,314	4,142	20.1%	-4.9%
Gasoline	1,546	1,619	1,555	7.6%	0.6%
Fuel Oil	509	557	646	3.1%	27.0%
Biogas	252	253	109	0.5%	-57.0%
Totals	21,736	22,556	20,602	100.0%	-5.2%

 **5.2% Decrease in GHG Emissions from 2016**



Municipal Emissions

20-yr GWP

Sector	ClearPath 2016 (mtons)	ClearPath 2019 (mtons)	ClearPath 2021 (mtons)	2021 Sector (%)	2021 - 2016 Baseline Difference (%)
Buildings/Facilities	8745	9017	8018	31.6%	-8.3%
Natural Gas (Methane) Leakage	6467	6998	6661	26.3%	3.0%
Water & Sewer	4452	4463	4038	15.9%	-9.3%
Vehicle Fleet	3473	3590	3129	12.4%	-9.9%
Transit Fleet	2003	2143	2004	7.9%	0.0%
Street/Traffic Lights	1034	1045	950	3.7%	-8.1%
Electric Grid Loss	482	570	534	2.1%	10.8%
Totals	26,656	27,826	25,334	100.0%	-5.0%

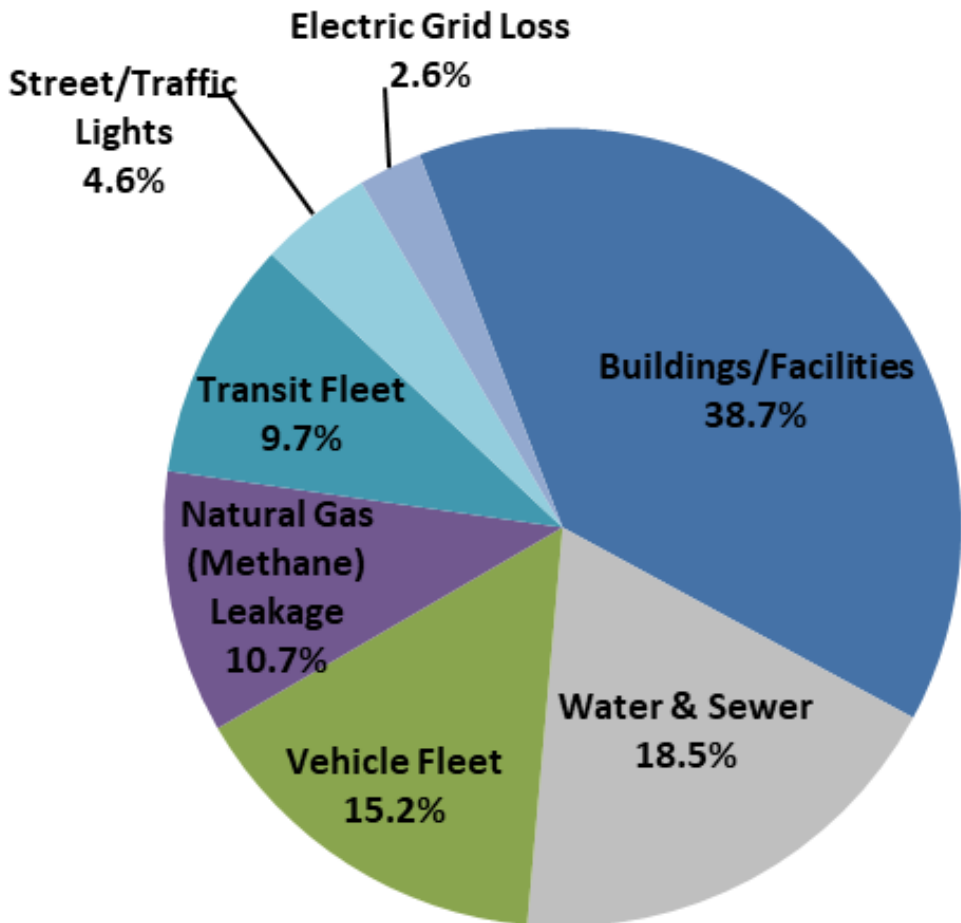
Emissions Source	ClearPath 2016 (mtons)	ClearPath 2019 (mtons)	ClearPath 2021 (mtons)	2021 Sector (%)	2021 - 2016 Baseline Difference (%)
Electricity	11,198	11,748	10,613	41.9%	-5.2%
Natural Gas	8,705	9,018	8,620	34.0%	-1.0%
Diesel	3,930	4,115	3,579	14.1%	-8.9%
Gasoline	1,546	1,619	1,555	6.1%	0.6%
Fuel Oil	513	562	652	2.6%	27.1%
Biogas	766	768	320	1.3%	-58.2%
Totals	26,659	27,830	25,339	100.0%	-5.0%

 **5.0% Decrease in GHG Emissions from 2016**



Municipal Emissions

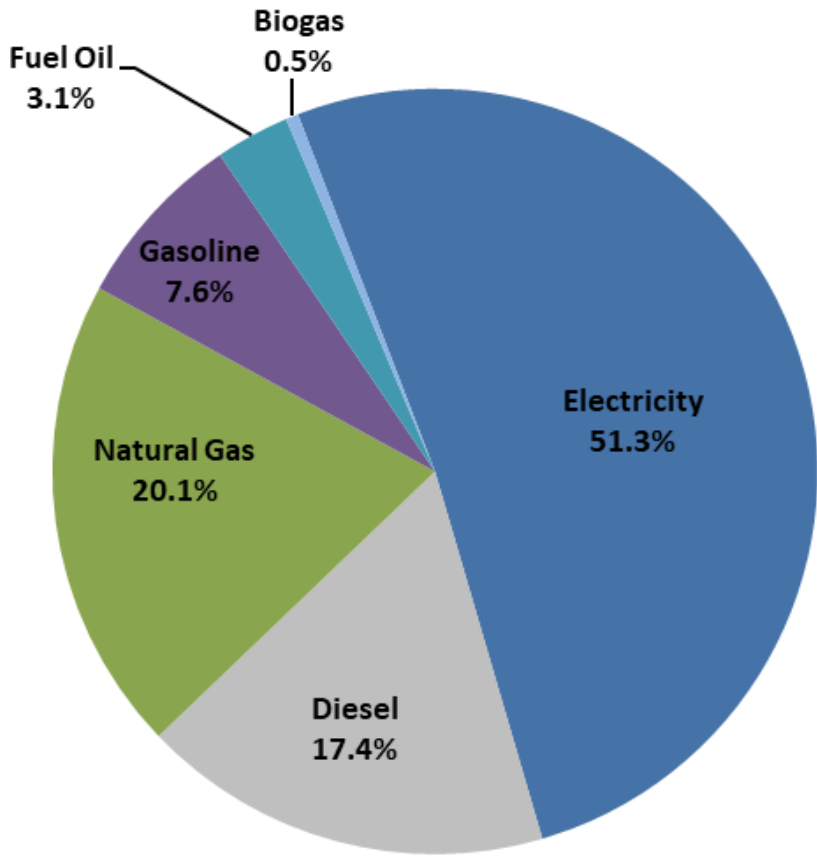
ClearPath Harrisonburg Municipal 100-yr GHG Emissions By Sector (2021)





Municipal Emissions

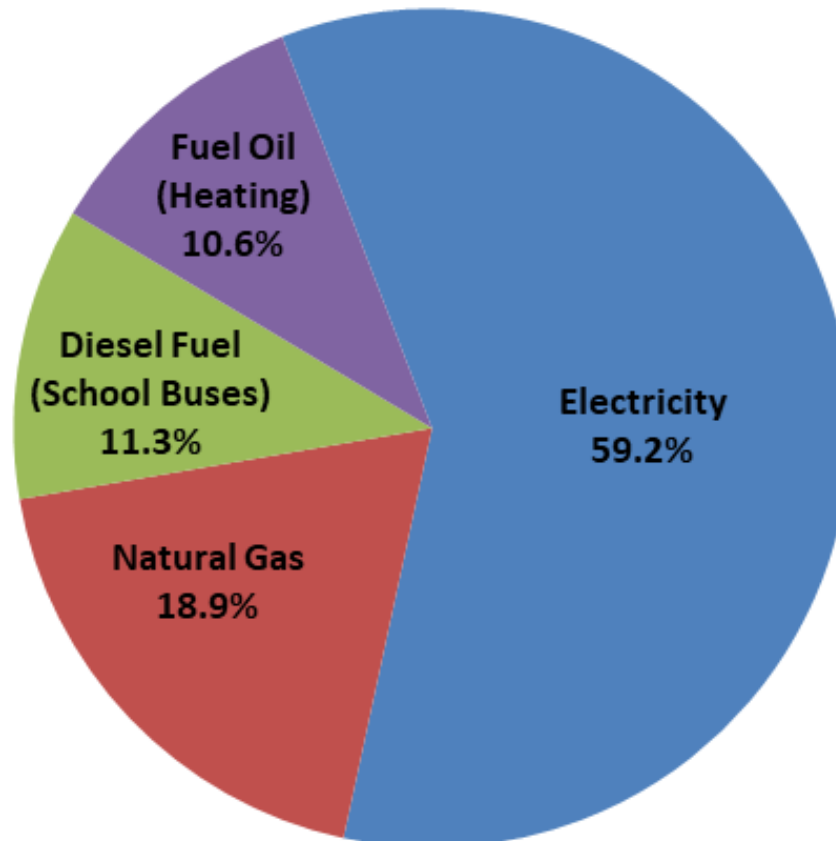
**ClearPath Harrisonburg Municipal 100-yr GHG Emissions
By Source (2021)**





Municipal Emissions

ClearPath Harrisonburg School GHG Emissions By Category (2021)





Community Emissions

100-yr GWP

Sector	ClearPath 2016 (mtons CO2e)	ClearPath 2019 (mtons CO2e)	ClearPath 2021 (mtons CO2e)	2016 Baseline Difference (%)	2021 Sector (%)
Commercial	200,943	206,151	184,274	-8.3%	30.3%
Transportation	179,691	182,964	169,626	-5.6%	27.9%
Residential	81,672	85,497	80,477	-1.5%	13.2%
Natural Gas Leakage	72,359	79,837	76,487	5.7%	12.6%
Industrial	63,908	64,257	62,613	-2.0%	10.3%
Solid Waste	16,914	23,072	19,703	16.5%	3.2%
Electricity Grid Loss	10,616	12,302	11,531	8.6%	1.9%
Water & Wastewater	3,920	3,932	3,813	-2.7%	0.6%
Totals	630,023	658,012	608,524	-3.4%	100.0%

Emissions Source	ClearPath 2016 (mtons)	ClearPath 2019 (mtons)	ClearPath 2021 (mtons)	Baseline Difference (%)	2021 Source (%)
Electricity	246,549	253,532	229,106	-7.1%	37.6%
Natural Gas	181,245	187,586	186,685	3.0%	30.7%
Gasoline	116,826	118,133	106,252	-9.1%	17.5%
Diesel	62,865	64,832	63,375	0.8%	10.4%
Solid Waste	16,915	23,072	19,703	16.5%	3.2%
Fuel Oil	5,374	10,609	3,296	-38.7%	0.5%
Biogas	252	253	110	0.5%	0.02%
Totals	630,027	658,016	608,528	-3.4%	100.0%

3.4% Decrease in GHG Emissions from 2016



Community Emissions

20-yr GWP

Sector	ClearPath 2016 (mtons CO2e)	ClearPath 2019 (mtons CO2e)	ClearPath 2021 (mtons CO2e)	2016 Baseline Difference (%)	2021 Sector (%)
Natural Gas Leakage	219,608	242,306	232,137	5.7%	28.8%
Commercial	201,985	207,130	185,119	-8.4%	23.0%
Transportation	180,037	183,295	169,919	-5.6%	21.1%
Residential	82,107	85,896	80,833	-1.6%	10.0%
Industrial	64,136	64,457	62,788	-2.1%	7.8%
Solid Waste	51,348	70,041	59,813	16.5%	7.4%
Electricity Grid Loss	10,670	12,356	11,578	8.5%	1.4%
Water & Wastewater	4,452	4,463	4,040	-9.3%	0.5%
Totals	814,343	869,944	806,227	-1.0%	100.0%

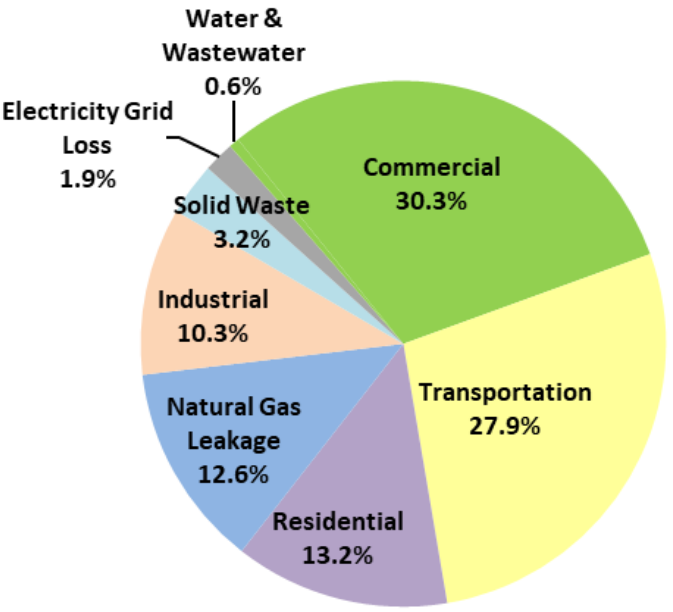
Emissions Source	ClearPath 2016 (mtons)	ClearPath 2019 (mtons)	ClearPath 2021 (mtons)	Baseline Difference (%)	2021 Source (%)
Natural Gas	328,975	350,539	342,810	4.2%	42.5%
Electricity	247,801	254,639	230,042	-7.2%	28.5%
Gasoline	117,162	118,452	106,532	-9.1%	13.2%
Diesel	62,876	64,844	63,387	0.8%	7.9%
Solid Waste	51,349	70,041	59,814	16.5%	7.4%
Fuel Oil	5,418	10,665	3,324	-38.7%	0.4%
Biogas	766	768	322	-57.9%	0.0%
Totals	814,347	869,948	806,230	-1.0%	100.0%

1.0% Decrease in GHG Emissions from 2016

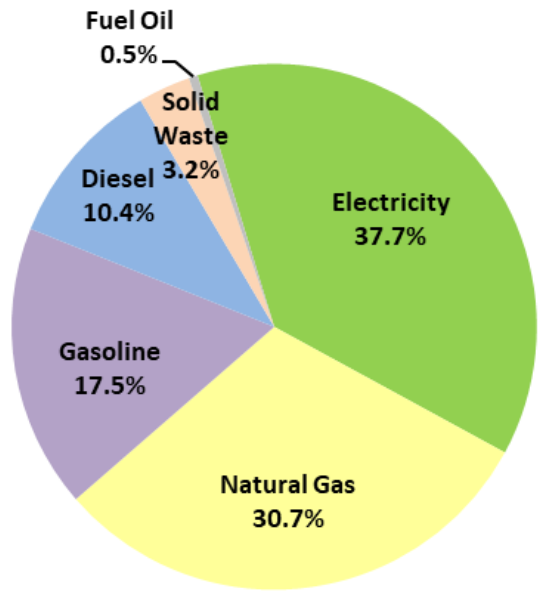


Community Emissions

100-yr ClearPath Harrisonburg Community GHG Emissions By Sector (2021)



100-yr GWP ClearPath Harrisonburg Community GHG Emissions By Source (2021)





Greenhouse Gas Emissions Inventory

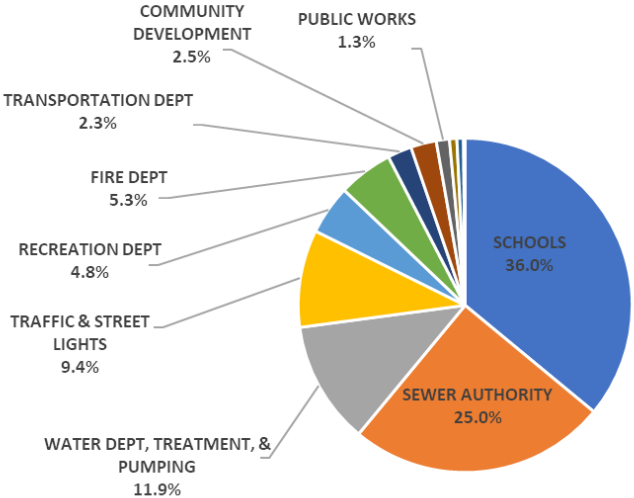
2022 Changes

- Project Scope of 2021
- Included 100% of energy for water treatment and operations
- Community transportation (VMT) numbers for 2022 were unavailable

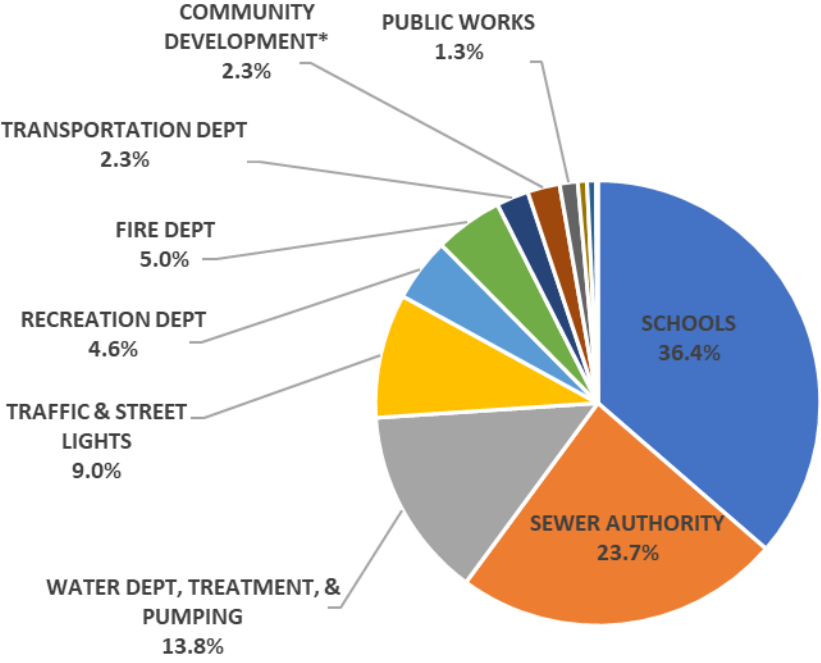


Electricity Use

2021 Municipal Electricity



2022 Municipal Electricity





School Electricity Use

School	2021 kWh	2022 kWh	Δ 2021
Harrisonburg High School	3,675,889	3,748,200	2.0%
Smithland Elementary School/Skyline Middle School/Elon Rhodes Early Learning Center	2,365,440	2,374,080	0.4%
Thomas Harrison Middle School	1,080,000	1,155,840	7.0%
Stone Spring Elementary School	1,108,776	1,326,002	19.6%
Spotswood Elementary School	800,015	969,103	21.1%
Keister Elementary School	859,388	862,822	0.4%
Waterman Elementary School	819,300	828,826	1.2%
Bluestone Elementary School	516,300	520,800	0.9%
School Board Office	214,720	218,720	1.9%
Family Resource Center	N/A	85,262	N/A



Transportation Fuel Use

Vehicle/Equipment Fuels	2016		2019		2021		2022		2022 Count	Difference 2022 - 2016 (%)
	Gallons	%	Gallons	%	Gallons	%	Gallons	%		
Diesel Transit Buses	177,985	31.7%	188,625	32.1%	174,600	33.1%	148,820	27.6%	42	-16.4%
Gas Fleet Vehicles	121,920	21.7%	118,590	20.2%	104,625	19.8%	115,386	21.4%	263	-5.4%
Diesel School Buses	89,569	15.9%	98,518	16.8%	67,379	12.8%	83,024	15.4%	62	-7.3%
Diesel Fleet Trucks	60,231	10.7%	58,749	10.0%	63,864	12.1%	60,077	11.2%	87	-0.3%
Diesel Equipment	34,439	6.1%	37,658	6.4%	24,180	4.6%	23,839	4.4%	64	-30.8%
Gas Police Vehicles	28,939	5.1%	37,597	6.4%	40,311	7.6%	44,702	8.3%	48	54.5%
Gas ParaTransit Buses	21,208	3.8%	24,833	4.2%	25,270	4.8%	29,284	5.4%	13	38.1%
Diesel Fire Trucks/Ambulances	23,728	4.2%	19,490	3.3%	20,526	3.9%	23,837	4.4%	19	0.5%
Gas Equipment	4,070	0.7%	3,417	0.6%	6,949	1.3%	9,689	1.8%	37	138.1%
TOTALS	562,089	100%	587,477	100%	527,703	100%	538,658	100%	635	-4.2%

4.8% GHG Emissions

2025 Target	2030 Target	2035 Target
-10%	-20%	-40%



Municipal Emissions

100-yr GWP

<i>ClearPath Inventory by Sector Report</i>						
	100-yr GWP					
Sector	ClearPath 2016 (mtons)	ClearPath 2019 (mtons)	ClearPath 2021 (mtons)	ClearPath 2022 (mtons)	2022 Sector (%)	2022 - 2016 Baseline Difference (%)
Buildings/Facilities	8,698	8,974	7,980	8132	38.8%	-2.7%
Water & Sewer	3,920	3,932	3,812	3910	18.7%	20.1%
Vehicle Fleet	3,473	3,590	3,129	3438	16.4%	-1.0%
Natural Gas (Methane) Leakage	2,130	2,306	2,194	2244	10.7%	5.1%
Transit Fleet	2,003	2,143	2,004	1776	8.5%	-12.8%
Street/Traffic Lights	1,029	1,041	947	903	4.3%	-14.0%
Electric Grid Loss	479	567	531	531	2.5%	9.8%
Totals	21,732	22,553	20,597	20,934	100.0%	-3.8%

<i>ClearPath Detailed Report</i>						
	100-yr GWP					
Emissions Source	ClearPath 2016 (mtons)	ClearPath 2019 (mtons)	ClearPath 2021 (mtons)	ClearPath 2022 (mtons)	2021 Sector (%)	2022 - 2016 Baseline Difference (%)
Electricity	11,141	11,697	10,570	10553	50.4%	-5.3%
Diesel	3,930	4,115	3,579	3467	16.6%	-11.8%
Natural Gas	4,356	4,314	4,142	4413	21.1%	1.3%
Gasoline	1,546	1,619	1,555	1748	8.3%	13.0%
Fuel Oil	509	557	646	613	2.9%	20.4%
Biogas	252	253	109	143	0.7%	-43.2%
Totals	21,736	22,556	20,602	20,937	100.0%	-3.7%

 **3.8% Decrease in GHG Emissions from 2016**



Municipal Emissions

20-yr GWP

<i>ClearPath Inventory by Sector Report</i>						
	20-yr GWP					
Sector	ClearPath 2016 (mtons)	ClearPath 2019 (mtons)	ClearPath 2021 (mtons)	ClearPath 2022 (mtons)	2022 Sector (%)	2021 - 2016 Baseline Difference (%)
Buildings/Facilities	8745	9017	8018	8,169	32.4%	-6.6%
Natural Gas (Methane) Leakage	6467	6998	6661	6,211	24.6%	-4.0%
Water & Sewer	4452	4463	4038	4,169	16.5%	-6.4%
Vehicle Fleet	3473	3590	3129	3,438	13.6%	-1.0%
Transit Fleet	2003	2143	2004	1,776	7.0%	-11.3%
Street/Traffic Lights	1034	1045	950	907	3.6%	-12.3%
Electric Grid Loss	482	570	534	533	2.1%	10.6%
Totals	26,656	27,826	25,334	25,203	100.0%	-5.5%

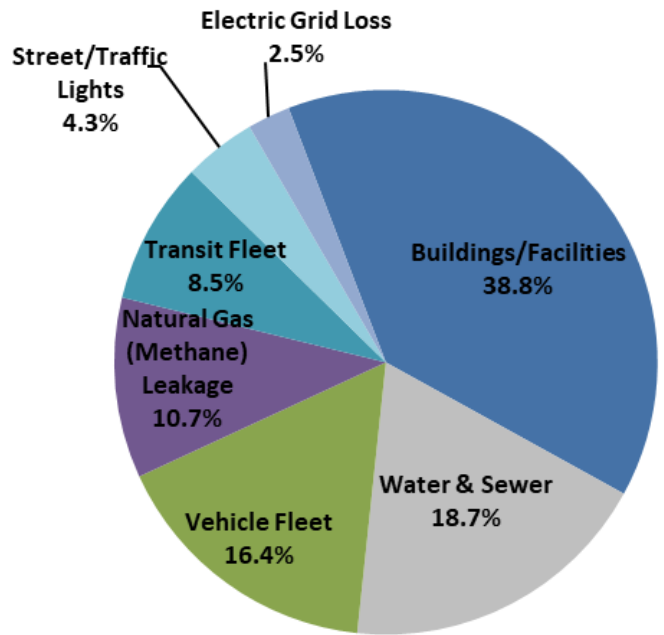
<i>ClearPath Detailed Report</i>						
	20-yr GWP					
Emissions Source	ClearPath 2016 (mtons)	ClearPath 2019 (mtons)	ClearPath 2021 (mtons)	ClearPath 2022 (mtons)	2022 Sector (%)	2021 - 2016 Baseline Difference (%)
Electricity	11,198	11,748	10,613	10,596	42.0%	-5.4%
Natural Gas	8,705	9,018	8,620	3,467	13.8%	-60.2%
Diesel	3,930	4,115	3,579	8,391	33.3%	113.5%
Gasoline	1,546	1,619	1,555	1,748	6.9%	13.0%
Fuel Oil	513	562	652	618	2.5%	20.4%
Biogas	766	768	320	387	1.5%	-49.5%
Totals	26,659	27,830	25,339	25,207	100.0%	-5.4%

 **5.5% Decrease in GHG Emissions from 2016**

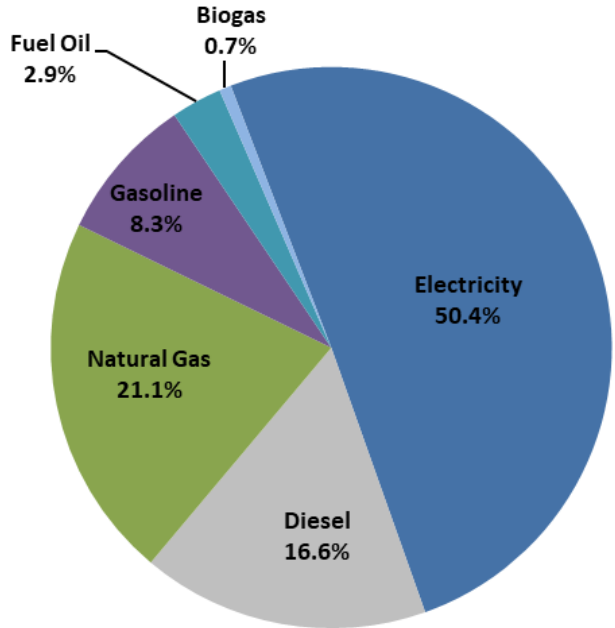


Municipal Emissions

ClearPath Harrisonburg Municipal GHG Emissions By Sector (2022)



ClearPath Harrisonburg Municipal GHG Emissions By Source (2022)





Community Emissions

100-yr GWP

<i>From ClearPath Inventory by Sector Report</i>		100-yr GWP				
Sector	ClearPath 2016 (mtons CO2e)	ClearPath 2019 (mtons CO2e)	ClearPath 2021 (mtons CO2e)	ClearPath 2022 (mtons CO2e)	2016 Baseline Difference (%)	2022 Sector (%)
Commercial	200,943	206,151	184,274	185,008	-7.9%	30.8%
Transportation	179,691	182,964	169,626	165,213	-8.1%	27.5%
Residential	81,672	85,497	80,477	76,450	-6.4%	12.7%
Natural Gas Leakage	72,359	79,837	76,487	76,144	5.2%	12.7%
Industrial	63,908	64,257	62,613	63,045	-1.4%	10.5%
Solid Waste	16,914	23,072	19,703	21,323	26.1%	3.5%
Electricity Grid Loss	10,616	12,302	11,531	9,740	-8.3%	1.6%
Water & Wastewater	3,920	3,932	3,813	3,910	-0.3%	0.7%
Totals	630,023	658,012	608,524	600,833	-4.6%	100.0%

<i>From ClearPath Detailed Report</i>		100-yr GWP				
Emissions Source	ClearPath 2016 (mtons)	ClearPath 2019 (mtons)	ClearPath 2021 (mtons)	ClearPath 2022 (mtons)	Baseline Difference (%)	2022 Source (%)
Electricity	246,549	253,532	229,106	226,538	-8.1%	37.7%
Natural Gas	181,245	187,586	186,685	183,973	-43.4%	30.6%
Gasoline	116,826	118,133	106,252	102,642	57.5%	17.1%
Diesel	62,865	64,832	63,375	62,572	-0.5%	10.4%
Solid Waste	16,915	23,072	19,703	21,324	26.1%	3.5%
Fuel Oil	5,374	10,609	3,296	3,646	-32.1%	0.6%
Biogas	252	253	110	144	-43.1%	0.02%
Totals	630,027	658,016	608,528	600,838	-4.6%	100.0%

4.6% Decrease in GHG Emissions from 2016



Community Emissions

20-yr GWP

<i>From ClearPath Inventory by Sector Report</i>		20-yr GWP				
Sector	ClearPath 2016 (mtons CO2e)	ClearPath 2019 (mtons CO2e)	ClearPath 2021 (mtons CO2e)	ClearPath 2022 (mtons CO2e)	2016 Baseline Difference (%)	2022 Sector (%)
Natural Gas Leakage	219,608	242,306	232,137	210,758	-4.0%	27.2%
Commercial	201,985	207,130	185,119	185,833	-8.0%	24.0%
Transportation	180,037	183,295	169,919	165,354	-8.2%	21.3%
Residential	82,107	85,896	80,833	76,786	-6.5%	9.9%
Industrial	64,136	64,457	62,788	63,231	-1.4%	8.2%
Solid Waste	51,348	70,041	59,813	59,033	15.0%	7.6%
Electricity Grid Loss	10,670	12,356	11,578	9,781	-8.3%	1.3%
Water & Wastewater	4,452	4,463	4,040	4,170	-6.3%	0.5%
Totals	814,343	869,944	806,227	774,946	-4.8%	100.0%

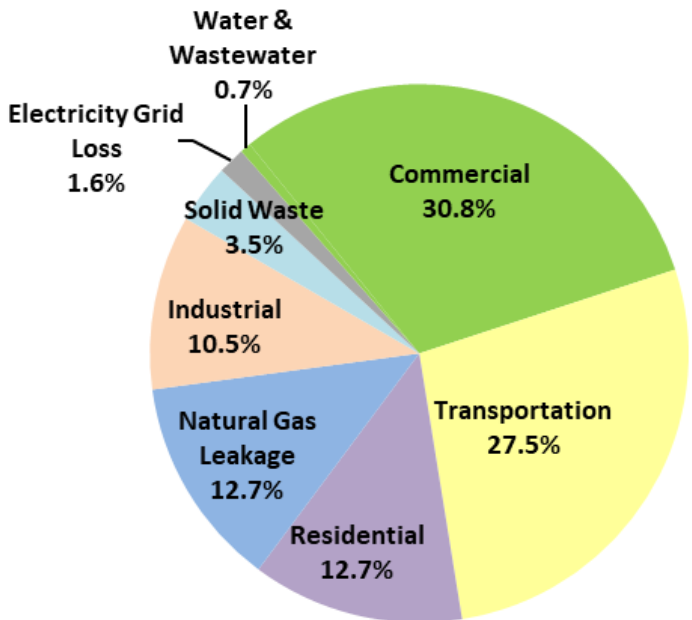
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Natural Gas	328,975	350,539	342,810	319,028	-3.0%	41.2%
Electricity	247,801	254,639	230,042	227,472	-8.2%	29.4%
Gasoline	117,162	118,452	106,532	102,772	-12.3%	13.3%
Diesel	62,876	64,844	63,387	62,582	-0.5%	8.1%
Solid Waste	51,349	70,041	59,814	59,034	15.0%	7.6%
Fuel Oil	5,418	10,665	3,324	3,674	-32.2%	0.5%
Biogas	766	768	322	388	-49.4%	0.1%
Totals	814,347	869,948	806,230	774,950	-4.8%	100.0%

4.8% Decrease in GHG Emissions from 2016

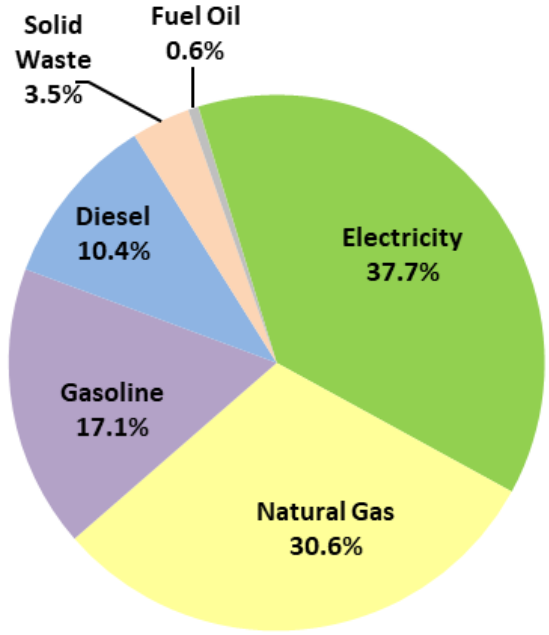


Community Emissions

100-yr ClearPath Harrisonburg Community GHG Emissions By Sector (2022)



100-yr GWP ClearPath Harrisonburg Community GHG Emissions By Source (2022)





Report Discussion & Recommendations

- Set a GHG emissions reduction goal
- Coordinate and partner with JMU and other large facilities on ways to reduce emissions
- Continue to assess GHG emissions annually
- Explore and implement ways to reduce emissions in municipal operations
- Continue support/defense of the Virginia Clean Energy Act (VCEA) of 2020
- Explore options to incentivize emission reductions at the community scale