Emissions Data and Calculations

SAU 70 Climate Action Plan Appendix A

HHS GHG Emissions Inventory and Forecast

		2023			2030			2050		
Sector	Subsector	Activity Data	Units	Emissions (MTCO2e)	Activity Data	Units	Emissions	Activity Data	Units	Emissions
Building Energy	Electricity	830,397	kWh/yr	115.4	865,841	kWh/yr	120.36	872,541	kWh/yr	121.29
Building Energy	Wood Chips - Biogenic	702	tons/yr	1,165.4	732	tons/yr	1,215.19	737	tons/yr	1,224.59
Building Energy	Wood Chips - Anthropogenic	702	tons/yr	311.08	732	tons/yr	311.08	737	tons/yr	311.08
Building Energy	Propane	2,135	GGE/yr	12.21	2,226	GGE/yr	12.73	2,243	GGE/yr	12.83
Building Energy	#2 Fuel Oil	12,558	gallons/yr	128.22	13,094	gallons/yr	133.69	13,196	gallons/yr	134.73
Subtotal - Anthropogenic				566.9			577.87			579.93
Subtotal - Biogenic				1,165.4			1,215.19			1,224.59
Water Consumption	Surface Water	0.104	MG	10.24	0.108	MG	10.68	0.108	MG	10.65
Wastewater	Stationary CH4			9.55			10.36			10.37
	Stationary N2O			0.03			0.03			0.03
	Process N2O			2.29			2.39			2.39
	Fugitive N2O			3.32			3.45			3.46
Subtotal				25.4			26.90			26.90
Transportation	Employee Commute	32,289	gallons gasoline	300.6	32,410.63	gallons gasoline	301.73	33,999	gallons gasoline	316.52
		388	gallons diesel	3.97	389.92	gallons diesel	3.98	409	gallons diesel	4.18
		18,999	kWh/yr	1.50	19,071.30	kWh/yr	1.51	20,006	kWh/yr	1.58
	Employee - SDC - Cars	365	gallons gasoline	3.39	8,677.21	gallons gasoline	3.53	8,655	gallons gasoline	3.52
	Employee - SDC - Air Travel			18.0			18.77			18.72
	Student Commute - Cars	30,744	gallons gasoline	286.22	32,067.09	gallons gasoline	298.53	31,976	gallons gasoline	297.68
		370	gallons diesel	3.78	385.79	gallons diesel	3.94	385	gallons diesel	3.93
		18,091	kWh/yr	1.43	18,869.15	kWh/yr	1.49	18,815	kWh/yr	1.49
	Student Commute - School Buses	3,151	gallons diesel	32.2	3,285.90	gallons diesel	33.55	3,277	gallons diesel	33.46
	March Intensive			153.9			160.49			160.08
	Field Trips - Cars	53	gallons gasoline	0.49	55.42	gallons gasoline	0.51	55	gallons gasoline	0.51
	Field Trips - School Buses	623	gallons diesel	6.36	649.07	gallons diesel	6.63	647	gallons diesel	6.61
	Field Trips - Air Travel			6.51			6.79			6.77
	Athletics - School Buses	4,645	gallons diesel	47.43	4,843.26	gallons diesel	49.45	4,831	gallons diesel	49.32
	Maintenance Vehicles	430	gallons gasoline	3.99	430.14	gallons gasoline	3.99	430	gallons gasoline	3.99
Subtotal				869.8			894.90			908.37
Solid Waste	Landfilled Waste	31.00	tons/yr	10.76	32.32	tons/yr	11.22	32.24	tons/yr	11.19
Subtotal				10.76			11.22			11.19
Total - Anthropogenic				**1,473**			**1,511**			**1,526**
Total				**2,638**			**2,726**			**2,751**

RMS GHG Emissions Inventory and Forecast

		2023			2030			2050		
Sector	Subsector	Activity Data	Units	Emissions (MTCO2e)	Activity Data	Units	Emissions	Activity Data	Units	Emissions
Building Energy	Electricity	351,700	kWh/yr	48.9	366,712	kWh/yr	52.70	369,549	kWh/yr	53.10
Building Energy	Wood Chips - Biogenic	305	tons/yr	506.1	318	tons/yr	527.70	320	tons/yr	531.78
Building Energy	Propane	616	GGE/yr	3.52	642	GGE/yr	3.67	647	GGE/yr	3.70
Building Energy	#2 Fuel Oil	3,500	gallons/yr	35.74	3,649	gallons/yr	37.26	3,678	gallons/yr	37.55
Subtotal - Anthropogenic				88.1			93.63			94.35
Subtotal - Biogenic				506.1			527.70			531.78
Water Consumption	Surface Water	0.0378	MG	3.72	0.039	MG	3.88	0.039	MG	3.87
Wastewater	Stationary CH4			2.91			3.16			3.17
	Stationary N2O			0.02			0.02			0.02
	Process N2O			1.27			1.32			1.32
	Fugitive N2O			1.83			1.91			1.91
Subtotal				9.8			10.28			10.29
Transportation	Employee Commute	32,190	gallons gasoline	299.7	33,435.70	gallons gasoline	311.27	33,665	gallons gasoline	313.41
		387	gallons diesel	3.96	402.25	gallons diesel	4.11	405	gallons diesel	4.14
		18,941	kWh/yr	1.50	19,674.48	kWh/yr	1.56	19,809	kWh/yr	1.57
	Student Commute - Cars	9,898	gallons gasoline	92.15	10,308.14	gallons gasoline	95.96	10,281	gallons gasoline	95.71
		119	gallons diesel	1.22	124.01	gallons diesel	1.27	124	gallons diesel	1.26
		5,824	kWh/yr	0.46	6,065.59	kWh/yr	0.48	6,050	kWh/yr	0.48
	Student Commute - School Buses	2,048	gallons diesel	20.9	2,135.35	gallons diesel	21.80	2,130	gallons diesel	21.75
Subtotal				419.9			436.46			438.31
Solid Waste	Landfilled Waste	16.00	tons/yr	5.55	16.68	tons/yr	5.79	16.64	tons/yr	5.78
Subtotal				5.55			5.79			5.78
Total - Anthropogenic				**523**			**546**			**549**
Total				**1,029**			**1,074**			**1,081**

RAY GHG Emissions Inventory and Forecast

		2023			2030			2050		
Sector	Subsector	Activity Data	Units	Emissions (MTCO2e)	Activity Data	Units	Emissions	Activity Data	Units	Emissions
Building Energy	Electricity	336,080	kWh/yr	46.7	350,425	kWh/yr	50.36	349,519	kWh/yr	50.23
Building Energy	Propane	26,030	GGE/yr	148.89	27,141	GGE/yr	155.25	27,071	GGE/yr	154.85
Building Energy	#2 Fuel Oil	8,845	gallons/yr	90.30	9,222	gallons/yr	94.16	9,198	gallons/yr	93.92
Subtotal - Anthropogenic				285.9			299.76			298.99
Water Consumption	Surface Water	0.0758	MG	7.46	0.079	MG	7.78	0.079	MG	7.76
Wastewater	Stationary CH4			4.32			4.68			4.69
	Stationary N2O			0.02			0.02			0.02
	Process N2O			1.54			1.60			1.61
	Fugitive N2O			2.23			2.32			2.32
Subtotal				15.6			16.41			16.40
Transportation	Employee Commute	24,398	gallons gasoline	227.1	25,345.36	gallons gasoline	235.96	25,511	gallons gasoline	237.50
		294	gallons diesel	3.00	304.92	gallons diesel	3.12	307	gallons diesel	3.14
		14,356	kWh/yr	1.14	14,913.90	kWh/yr	1.18	15,012	kWh/yr	1.19
	Student Commute - Cars	9,898	gallons gasoline	92.15	10,308.14	gallons gasoline	95.96	10,281	gallons gasoline	95.71
		119	gallons diesel	1.22	124.01	gallons diesel	1.27	124	gallons diesel	1.26
		5,824	kWh/yr	0.81	6,065.59	kWh/yr	0.84	6,050	kWh/yr	0.84
	Student Commute - School Buses	2,048	gallons diesel	20.9	2,135.35	gallons diesel	21.80	2,130	gallons diesel	21.75
Subtotal				346.4			360.13			361.39
Solid Waste	Landfilled Waste	20.00	tons/yr	6.94	20.85	tons/yr	7.24	20.80	tons/yr	7.22
Subtotal				6.94			7.24			7.22
Total - Anthropogenic				**655**			**684**			**684**

MCS GHG Emissions Inventory and Forecast

		2023			2030			2050		
Sector	Subsector	Activity Data	Units	Emissions (MTCO2e)	Activity Data	Units	Emissions	Activity Data	Units	Emissions
Building Energy	Electricity	209,295	kWh/yr	1	218,228	kWh/yr	4	217,664	kWh/yr	4
Building Energy	#2 Fuel Oil	13,685	gallons/yr	140	14,269	gallons/yr	146	14,232	gallons/yr	145
Subtotal - Anthropogenic				141.0			149.90			149.51
Water Consumption	Surface Water	0.350056	MG	4.79	0.365	MG	5.00	0.364	MG	4.98
Wastewater	Stationary CH4			2.30			2.49			2.49
	Stationary N2O			0.01			0.01			0.01
	Process N2O			1.12			1.17			1.17
	Fugitive N2O			1.63			1.69			1.69
Subtotal				9.9			10.36			10.36
Transportation	Employee Commute	11,035	gallons gasoline	102.7	11,452.15	gallons gasoline	106.62	11,583	gallons gasoline	107.83
		133	gallons diesel	1.36	137.78	gallons diesel	1.41	139	gallons diesel	1.42
		6,493	kWh/yr	0.51	6,738.76	kWh/yr	0.53	6,816	kWh/yr	0.54
	Student Commute - Cars	4,426	gallons gasoline	41.21	4,614.99	gallons gasoline	42.96	4,603	gallons gasoline	42.85
		53	gallons diesel	0.54	55.52	gallons diesel	0.57	55	gallons diesel	0.57
		2,604	kWh/yr	0.05	2,715.59	kWh/yr	0.05	2,709	kWh/yr	0.05
	Student Commute - School Buses	3,240	gallons diesel	33.1	3,378.29	gallons diesel	34.49	3,370	gallons diesel	34.40
Subtotal				179.5			186.63			187.67
Solid Waste	Landfilled Waste	15.00	tons/yr	5.21	15.64	tons/yr	5.43	15.60	tons/yr	5.41
Subtotal				5.21			5.43			5.41
Total - Anthropogenic				**336**			**352**			**353**

GHG Reduction Targets

Milestone Year	Statewide Existing and Target Emissions (MMTCO2e)	Target Percent Reduction - SAU 70 (from 2023 levels)	
1990	15.79		Source: NH CAP 2009
2005	23.61		Source: NH CAP 2009
2021	15.24		Source: NH CAP 2009
2023	12.81		Interpolated
2030	10.737	-16%	Interpolated
2050	3.158	-75%	80% reduction from 1990 levels (NH CAP 2009)

Scaling Factors

	2023	2030	2050
Town of Hanover	12,247	12,770	12,737
Growth Rate (from 2023)		4%	4%
Student Population - HHS	674	703	701
Student Population - RMS	362	377	376
Student Population - Ray	438	457	456
Student Population - MCS	333		
Year Round Staff - HHS	37	39	39
School Year Staff - HHS	134	139	141

Notes
Town of Hanover baseline population estimate is 2015 data

Town of Hanover 2020-2050 estimates from NH Dept of Business and Economic Affairs. https://www.nheconomy.com/getmedia/0205c62d-9c30-4b00-9c9e-d81d8f17b8b3/NH-Population-Projections-2020-2050-Final-Report-092022.pdf

Source: Hanover Projections https://www.nh.gov/osi/data-center/documents/2016-subcounty-projections-final-report.pdf

Emission Factors

2023				
Electricity	306.458	lb CO2e/MWh	Source: eGRID 2024	NH State Output Rate
Electricity	42.609	lb CO2e/MWh	Source: eGRID 2024	VT State Output Rate
#2 Fuel Oil	10.21	kg CO2/gallon	Source: The Climate Registry 2023	
Diesel	10.21	kg CO2/gallon	Source: The Climate Registry 2023	
Propane	5.72	kg CO2/gallon	Source: The Climate Registry 2023	
Wood	1640	kg CO2/ton	Source: The Climate Registry 2023	
Water Conveyance	88	kWh/MG	Source: US Community Protocol 2012	
Water Treatment	620	kWh/MG	Source: US Community Protocol 2012	
Water Distribution	360	kWh/MG	Source: US Community Protocol 2012	

Conversions

MT/lb	0.000453592
MT/ton	0.907185
g/kg	0.001
kg/MT	0.001
kg/ton	907.185
MT/g	1000000

Biogenic Wood Burning Emissions

1640	biogenic kg CO2/ton
0.1	biogenic g CH4/kg
0.07	biogenic g N2O/kg

Global Warming Potential Factors

CH4	25
N2O	298