LA CROSSE
WISCONSIN

Community Greenhouse Gas Inventory

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Prepared by:

making change personal
paleBLUEdot LLC

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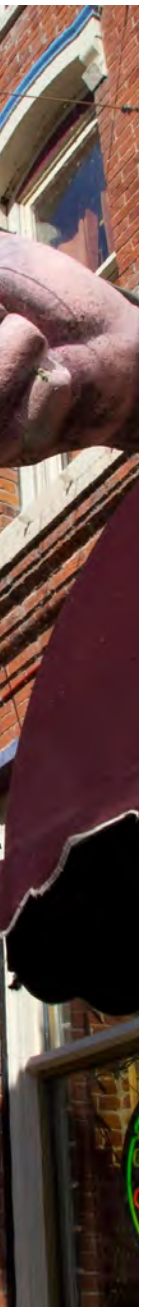


Background

The City of La Crosse is developing its first Climate Action Plan for the community. The plan will help those who live and work in La Crosse imagine and achieve a future where the earth and all who live on it thrive.

The City of La Crosse Common Council passed a resolution in 2019, which set a goal of reaching carbon neutrality community wide, in both energy and transportation, by 2050. The Climate Action Planning process seeks to establish new GHG emission reduction targets through 2030 that align with recommendations from the Intergovernmental Panel on Climate Change

This Community Greenhouse Gas (GHG) Inventory is a foundational document to support the Climate Action Planning process by reviewing the City's energy consumption and GHG emissions for the year 2020. These emissions are also compared against the City's 2019 emissions which were inventoried in 2020.

Without data, you're just another person with an opinion.

W. Edwards Deming, Engineer, Professor, and Management Consultant

Introduction

The Value of La Crosse Greenhouse Gas Inventories

The goal of the City of La Crosse community wide and municipal operations inventory is to estimate the GHG emissions associated with the activities of the people who live, work, learn, travel, visit, and recreate within the City's geographical boundaries during the subject year of 2020. The inventory must be transparent and able to be replicated, updated, and compared with future assessments for La Crosse and assessments for peer cities.

Measuring the energy aspects of human activities and the associated GHG emissions offers a unique way to compare the effectiveness of various energy and sustainability best management practices. Greenhouse gas emissions and energy[1] serve as common denominators for the comparison of kilowatts of electricity, natural gas therms, tons of coal, and gallons of liquid fuels consumed; as well as vehicle miles traveled, tons of waste processed, and gallons of potable water distributed.

Every community prepares annual operating and capital improvement budgets. These assessments can be thought of as an assessment of the environmental budget for municipal operations. Recording these performance metrics is essential to promoting efficiency and sustainable change.

[1] Energy is expressed as kBtu (a thousand British thermal units) or MMBtu (a million Btus).

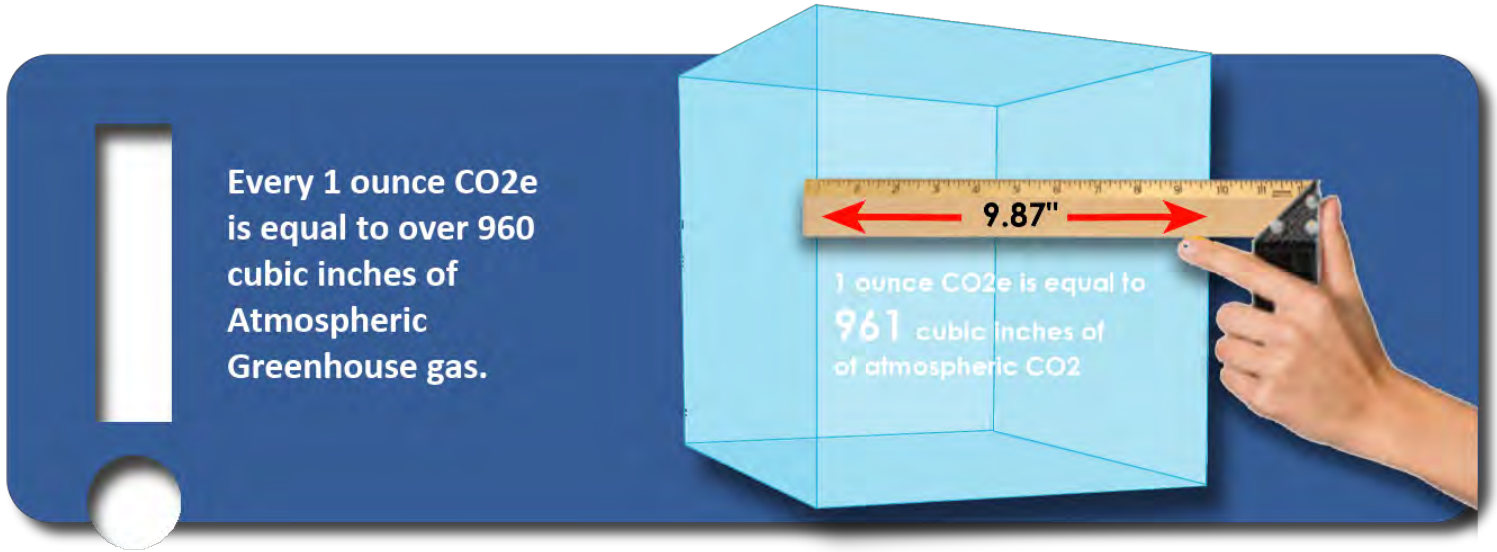
Introduction

The Carbon Cycle and the Role of Greenhouse Gases

The Carbon Cycle is exchanged among the oceans, atmosphere, and ecosystem. This cycle has been a closed, balanced system for hundreds of thousands of years. This cycle is present in the atmosphere primarily as carbon dioxide and methane. These two primary greenhouse gases uniquely allow light to pass while capturing infrared energy. This "Greenhouse Effect" directly impacts Earth's atmospheric energy and temperatures – without the historic levels of greenhouse gases present in the atmosphere, the average surface temperature of the Earth would be 0 degrees Fahrenheit.

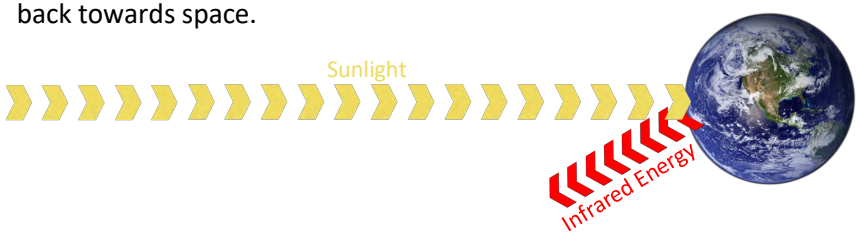
Graphic Representations

Greenhouse Gas Inventories quantify gas emissions in terms of weight - typically Metric Tons. It is important to understand that these references refer to gaseous pollution emissions which enter and occupy Earth's atmosphere. To help facilitate an increased awareness of the order of magnitude our collective GHG emissions represent, some of the emissions data reported in this report are also graphically represented in terms of volume of atmosphere. These volumes illustrate the amount of atmospheric space the referenced greenhouse gas emissions will occupy where they will remain, actively impacting our climate for as long as 200 years.



Earth's Infrared Energy

When sunlight strikes the Earth, it warms the surface and becomes heat energy – or **infrared energy**. This infrared energy then radiates back towards space.

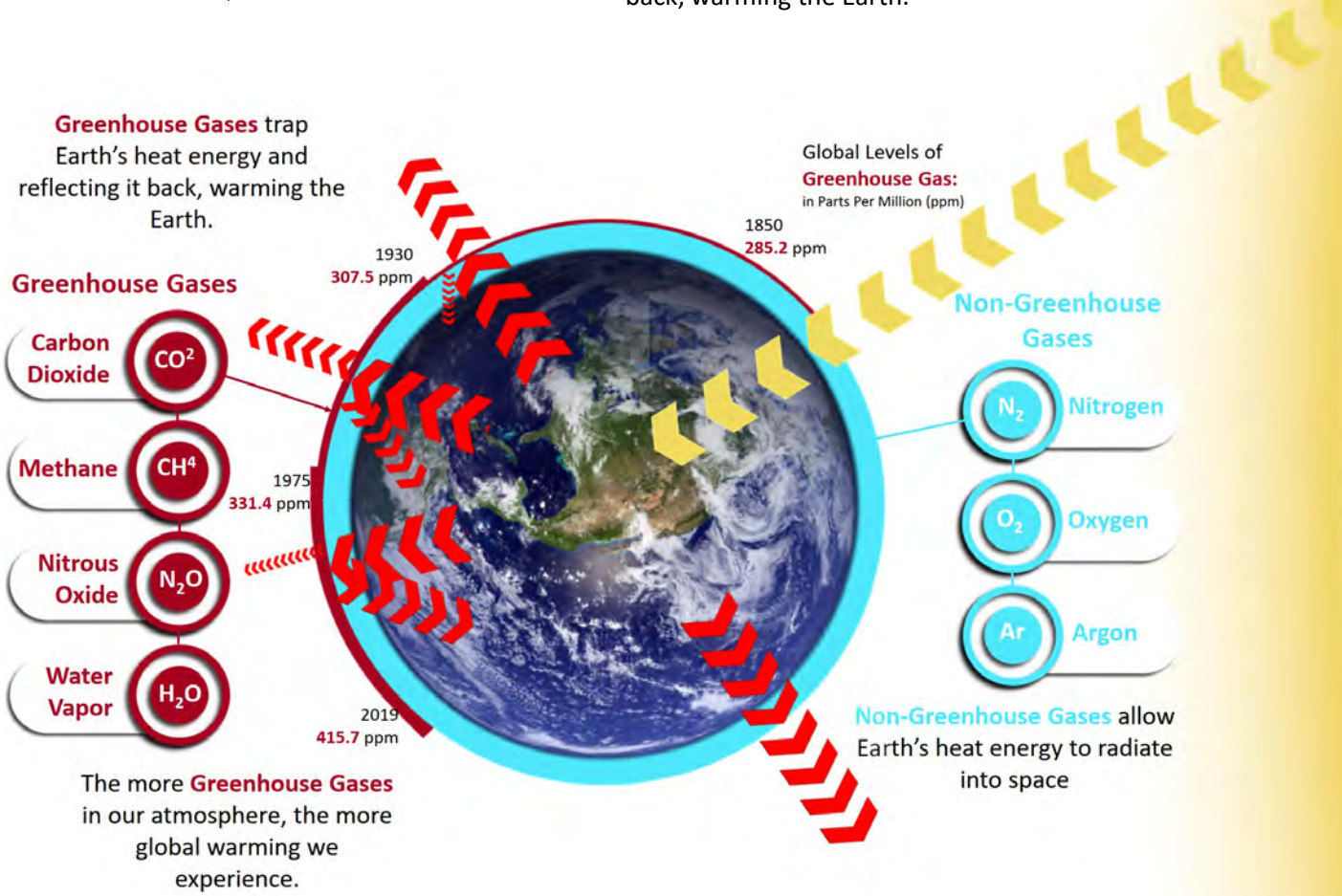


Greenhouse Gas Impact on Our Climate

Our atmosphere is made up of both **Non-Greenhouse** and **Greenhouse Gases** gasses.

Non-Greenhouse Gases do not react to visible light, nor infrared light. That means both sunlight and infrared energy pass through them un-affected, allowing Earth's heat energy to radiate into space.

Greenhouse Gases also do not react to visible light, however, they **DO** react to infrared energy, trapping Earth's heat energy and reflecting it back, warming the Earth.



Introduction

What is a Greenhouse Gas Inventory?

A community Greenhouse Gas (GHG) Inventory follows a standard protocol to quantify a city's greenhouse gas (GHG) emissions, including CO2, CH4, N2O. GHG inventories fluctuate year-to-year as we change our energy consumption, get access to better data, or gain new knowledge about how GHGs impact the atmosphere.

What Are GHG's?

Greenhouse Gases (GHG) absorb radiation and trap heat in the Earth's atmosphere. They are the basis of the Greenhouse Effect. The more GHGs there are, the more heat that is trapped in our atmosphere, leading to Global Warming and Climate Change. GHGs measured in this inventory include carbon dioxide, methane, and nitrous oxide.

Why Measure GHG?

As described by David Osborne and Ted Gaebler "If you don't measure results, you can't tell success from failure. If you can't see success, you can't reward it. If you can't see failure, you can't correct it." GHG inventories are useful. Planners need them, elected officials want them, and the future may see their development as a basic requirement of state and federal funding.

What is CO2e?

Carbon Dioxide (CO2) is a GHG emitted naturally and from fossil fuel combustion for energy and heat. Global warming contributions from other greenhouse gases are referred to in terms of "carbon dioxide equivalent" or CO2e, which represents the amount of CO2 that would have the same global warming potential as other GHGs. Community GHG inventories are tracked in terms of metric tons of CO2e.

Methodology, Sources, and Terminology

This GHG inventory is assembled based on the Greenhouse Gas Protocol for businesses and communities established by GHG Protocol (www.ghgprotocol.org/) and is consistent with the protocol established by ICLEI Local Governments for Sustainability. The terminology used in this report is consistent with international Carbon Footprinting protocols. Unless noted otherwise, the Greenhouse Gas (GHG) emissions shown in this report are in metric tons of CO2e: Carbon Dioxide Equivalent. CO2e is a standard for expressing the impact of all greenhouse gas including those from other pollutants including methane (CH4), nitrous oxide (N2O), and fluorinated gasses like Chlorofluorocarbons (CFC) in terms of the equivalent amount of CO2 that would have the same impact.

GHG inventories, generally, arrive at an estimated emission in each emissions sector by multiplying raw consumption data - total electricity consumed as an example - by an emissions factor which define the greenhouse gasses emitted per unit of raw consumption. The chart to the right illustrates the sources used for all raw consumption and emission factor data used in the GHG inventory calculations.

GHG Emission Sector	Project Resource
Residential Energy Consumption - Electricity	Data Source: Xcel Energy
	Emissions Factors: Same as above
Residential Energy Consumption - Natural Gas	Data Source: Xcel Energy
	Emissions Factors: US EPA
Commercial/Institutional Energy Consumption - Electricity	Data Source: Xcel Energy
	Emissions Factors: Same as above
Commercial/Institutional Energy Consumption - Natural Gas	Data Source: Xcel Energy
	Emissions Factors: US EPA
Transportation - On Road	Data Source: State of Wisconsin DOT
	Emissions Factors: US EPA MOVES model
Waste - Solid Waste	Data Source: City of La Crosse, La Crosse County, Xcel Energy, State of Wisconsin
	Emissions Factors: US EPA Warm Model, State of Wisconsin Waste Characterization Study, US EPA
Water and Wastewater	Data Source: City of La Crosse
	Emissions Factors: US Community Protocol population based emissions models / Fuel Mix Disclosure Report / US EPA eGRID, US EPA

Greenhouse Gas Sectors

Where do GHGs come from?

Energy

Emissions are produced from the combustion of natural gas, coal, and other fossil fuels primarily for heating, cooling, and electricity generation.

Transportation

Emissions come from the combustion of fossil fuels for ground transportation and air travel.

Solid Waste

Emissions in the inventory estimate the decomposition of biodegradable waste (e.g., food and yard waste) in the landfill.

Water + Wastewater

Emissions from energy uses are calculated for the collection and treatment of wastewater.

Section 02

Findings in Brief

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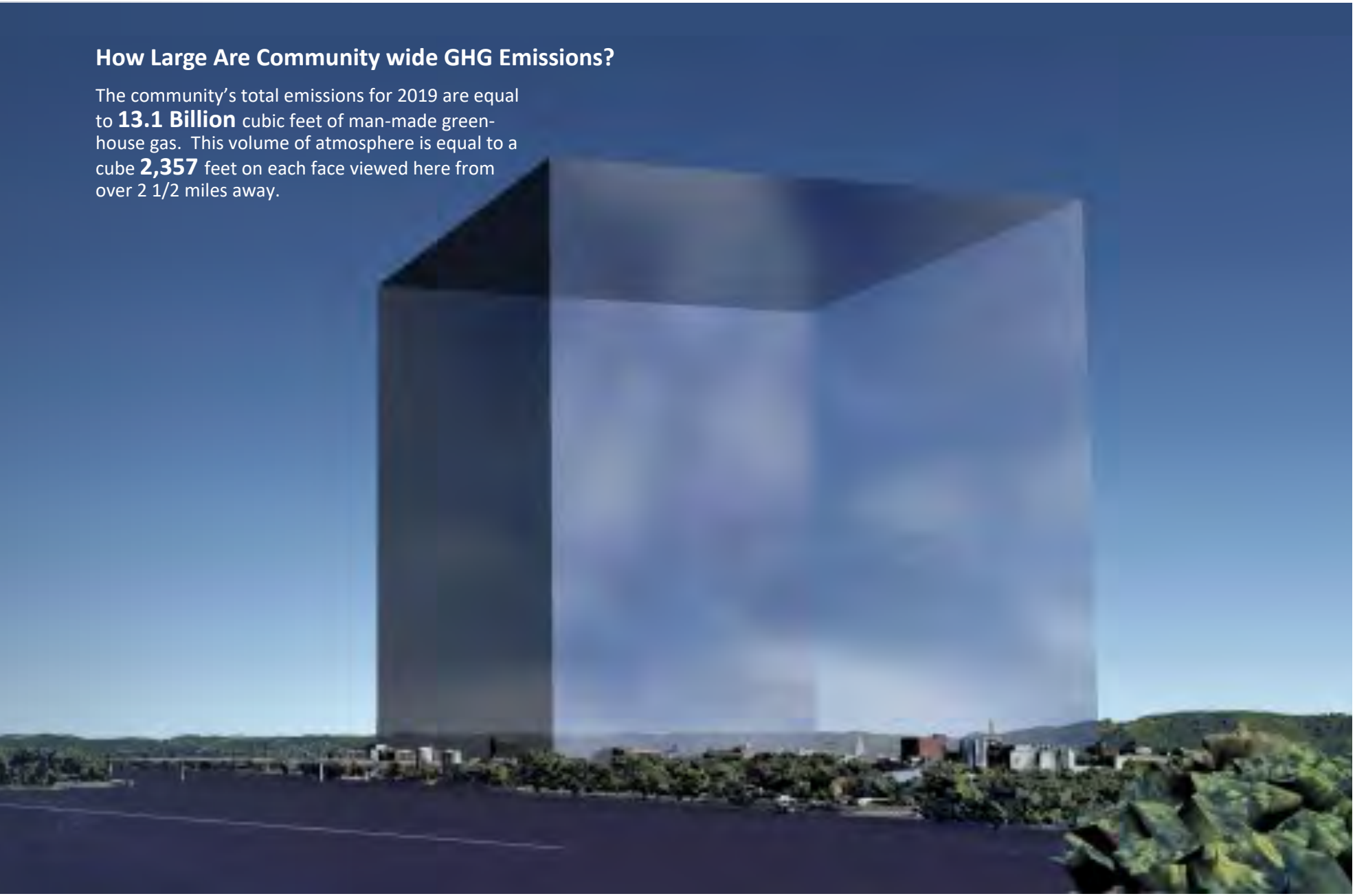
2019 By The Numbers		2020 By The Numbers		2 Year History Dashboard	
GHG Emissions	775,227	GHG Emissions	667,101	GHG Emissions	-108,126 -13.95%
15.00	MT Per-Capita	12.7	MT Per-Capita	-2.34	MT Per-Capita
15.72	MT / Job	13.53	MT / Job	-2.19	MT / Job
0.2235	MT / $1,000 GDP	0.1963	MT / $1,000 GDP	-0.03	MT / $1,000 GDP
Population	51,666	Population	52,680	Population	+1,014 +1.96%
GDP	$3,469,222,001	GDP	$3,399,092,125	GDP	-$70,129,876 -2.02%
$67,147	GDP Per-Capita	$64,523	GDP Per-Capita	-$2,624	GDP Per-Capita
Employment	49,316	Employment	49,316	Employment	0 0%

La Crosse GHG Emissions Overview

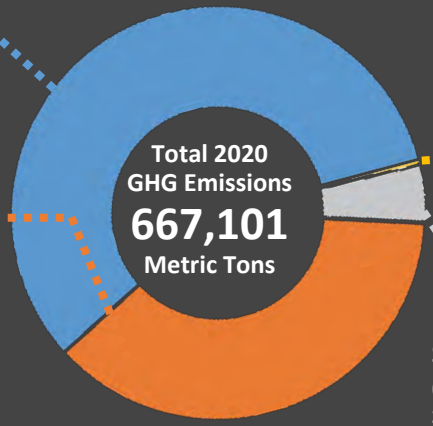
Community wide total emissions for the City of La Crosse decreased from 775,227 metric tons in 2019 to 667,101 metric tons in 2020. As an historic review of just two years, these numbers cannot yet be seen as a trend, however, we can glean some understanding of the likely underlying causes for the reduction in emissions. Reductions in 2020 are largely driven through a significantly reduced emissions factor for electricity generation as reported by Xcel Energy, a slight decrease in natural gas consumption, and a decrease in transportation volumes—presumably caused by COVID-19 impacts.

How Large Are Community wide GHG Emissions?

The community's total emissions for 2019 are equal to **13.1 Billion** cubic feet of man-made green-house gas. This volume of atmosphere is equal to a cube **2,357** feet on each face viewed here from over 2 1/2 miles away.



2020 La Crosse Community Wide GHG Emissions by Sector



Energy 57.6%
403,070 MT

Electricity 27.7%
Heating Fuel 29.9%

Electricity
22.9% Residential Share of Emissions
7,778 kWh Per Household
77.1% Commercial + Industrial Share of Emissions
3,389 kWh Per Job

Heating Fuel
24.2% Residential Share of Emissions
451 Therms Per Household
75.8% Commercial + Industrial Share of Emissions
606 Therms Per Job

Transportation 34.4%
229,553 MT

Ground 33.0%
Airport 1.4%

Ground Transportation:
95.8% Share of Sector Emissions
20,465 VMT Per Household
0.12% Electric Vehicle Share of VMT

Airport:
3.6% Share of Sector Emissions
0.45 MT GHG Per Household

Solid Waste 4.5%
31,239 MT

Solid Waste:
67,224 Solid Waste Handled (tons)
2,552 Pounds of Waste Per Capita

37,937 Landfill Tons
56.4% Share of Solid Waste Handled
8,590 Recycled Tons
12.8% Share of Solid Waste Handled
65 Organics/Yard Waste Tons
0.1% Share of Solid Waste Handled
20,632 RDF Tons (waste to energy)
30.7% Share of Solid Waste Handled

Water + Wastewater 0.5%
3,239 MT

Wastewater:
62.5% Share of Sector Emissions
3,115 Wastewater Flows (million gallons)
59,136 Gallons Per Capita

Water
37.5% Share of Sector Emissions
3,614 Water Flows (million gallons)
68,608 Gallons Per Capita

2020 La Crosse residential energy consumption averaged 7,778 kWh per household (102.3% of Statewide ave) and 451 therms (79.1% of Statewide ave).

Commercial and Industrial energy consumption averaged 3,389 kWh per job (18.5% of Statewide ave) and 606 therms (65.4% of Statewide Ave).

Vehicle miles traveled (VMT) in the City for 2020 totaled 433,569,000 miles for an average of 20,465 per household (83.8% of Statewide ave for the year)

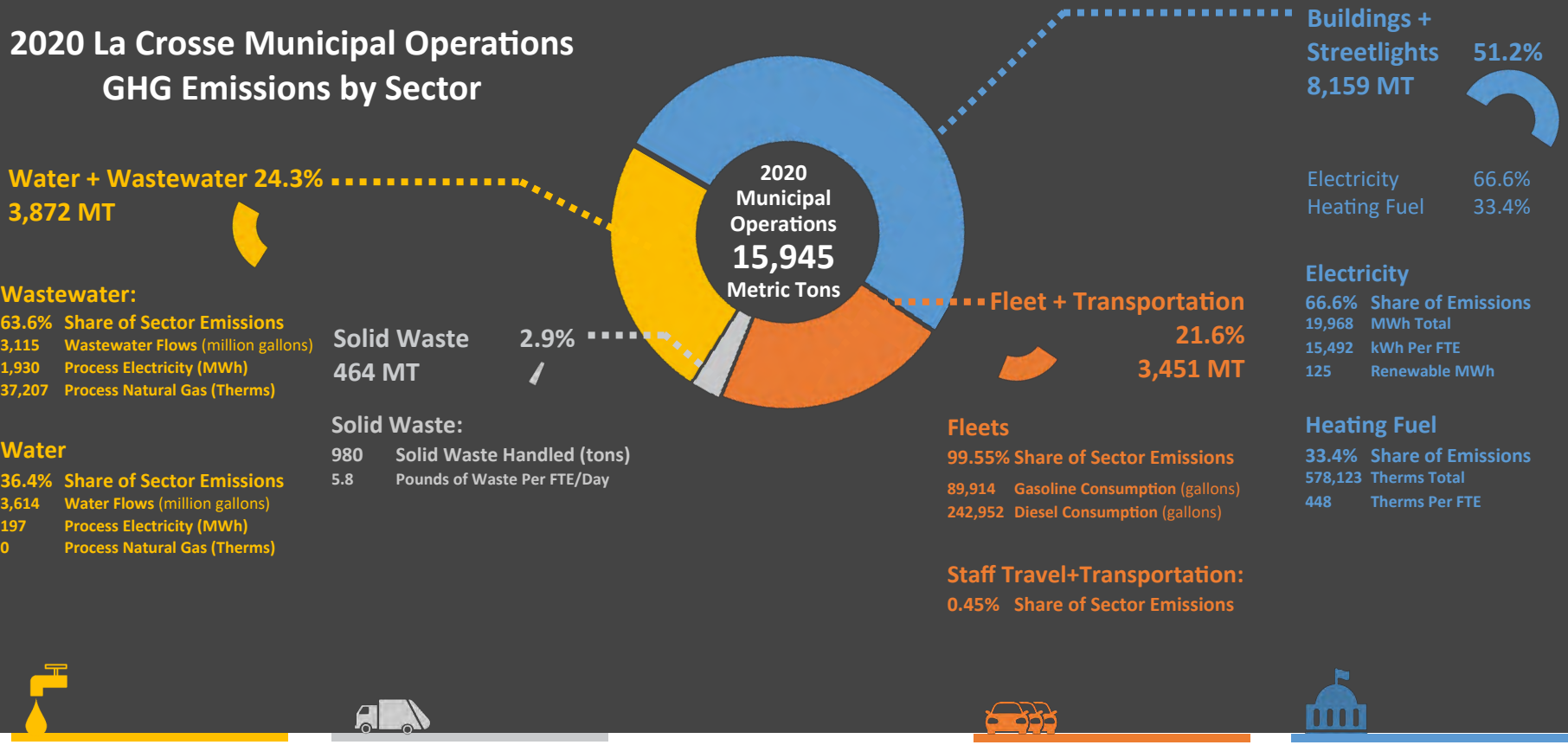
This community-wide VMT represents a 13% drop from 2019's pre-COVID levels. It is likely that VMT will increase back to 2019 levels following COVID recovery.

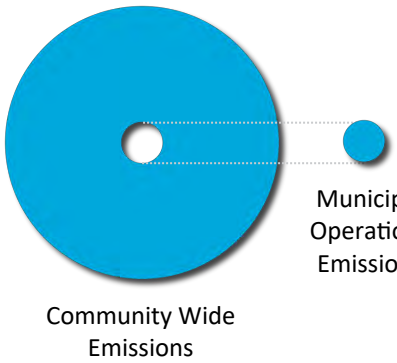
Solid waste handled in La Crosse for 2020 totaled 67,224 tons, approximately 2,552 pounds per person.

This is approximately 175% of the Statewide average of 1,454 reported in the 2020 Wisconsin State Waste Characterization study. It should be noted, however, that the Statewide number may not fully capture total waste generated.

Per Capita water use in La Crosse totaled 68,608 gallons for 2020.

This compares to the total Statewide water consumption of 43,285 per capita estimated by the USGS for 2015. The total estimated water consumption, however, may not fully capture total water use in the State.





As illustrated in the diagram to the left, the total Municipal Operations emissions account for approximately 2.3% of Community Wide emissions for 2020. The Municipal Operations emissions are included in the total Community Wide emissions reported.

Section

03

Community Comparison

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Community Comparison

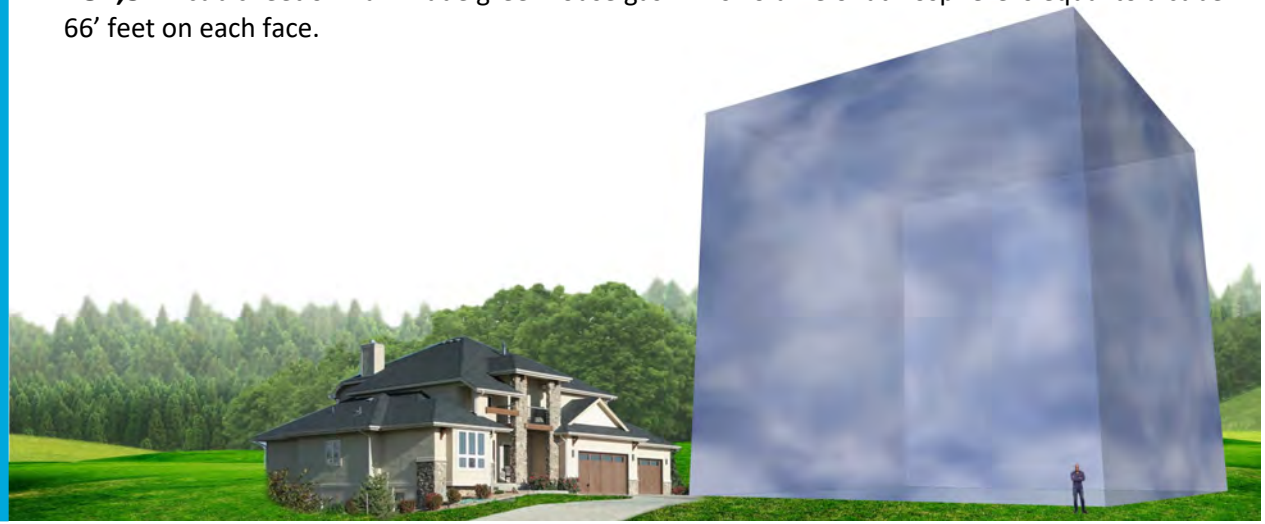
The results of community GHG inventories vary somewhat due to the information collected and variations in inventory methodology. Consequently, a direct community-to-community comparison should not be viewed as a comprehensive comparison of Greenhouse Gas emission efficiencies. We believe, however, that as an emerging practice, municipalities should look towards building and sharing data in order to develop a stronger understanding of where each municipality can advance efficiencies and meet Greenhouse Gas reduction goals. In support of this goal, comparing total community emissions between communities can only be effectively done by adjusting for differences in overall community population. To make this adjustment, community GHG emissions are regularly compared based on a per-capita basis.

Understanding La Crosse's Per-Capita Community Wide Emissions

As outlined in Section 2, the City of La Crosse's 2020 community wide emissions totaled 667,101 metric tons, for a per capita average of 12.7 metric tons (MT). Of course, this number represents only an average. The actual emissions each individual resident may be responsible for generating can vary significantly based on a range of personal choices in energy and resource consumption and waste. (Note, La Crosse's 2019, pre-COVID emissions totaled 775,227 metric tons for a per capita average of 14.7 metric tons)

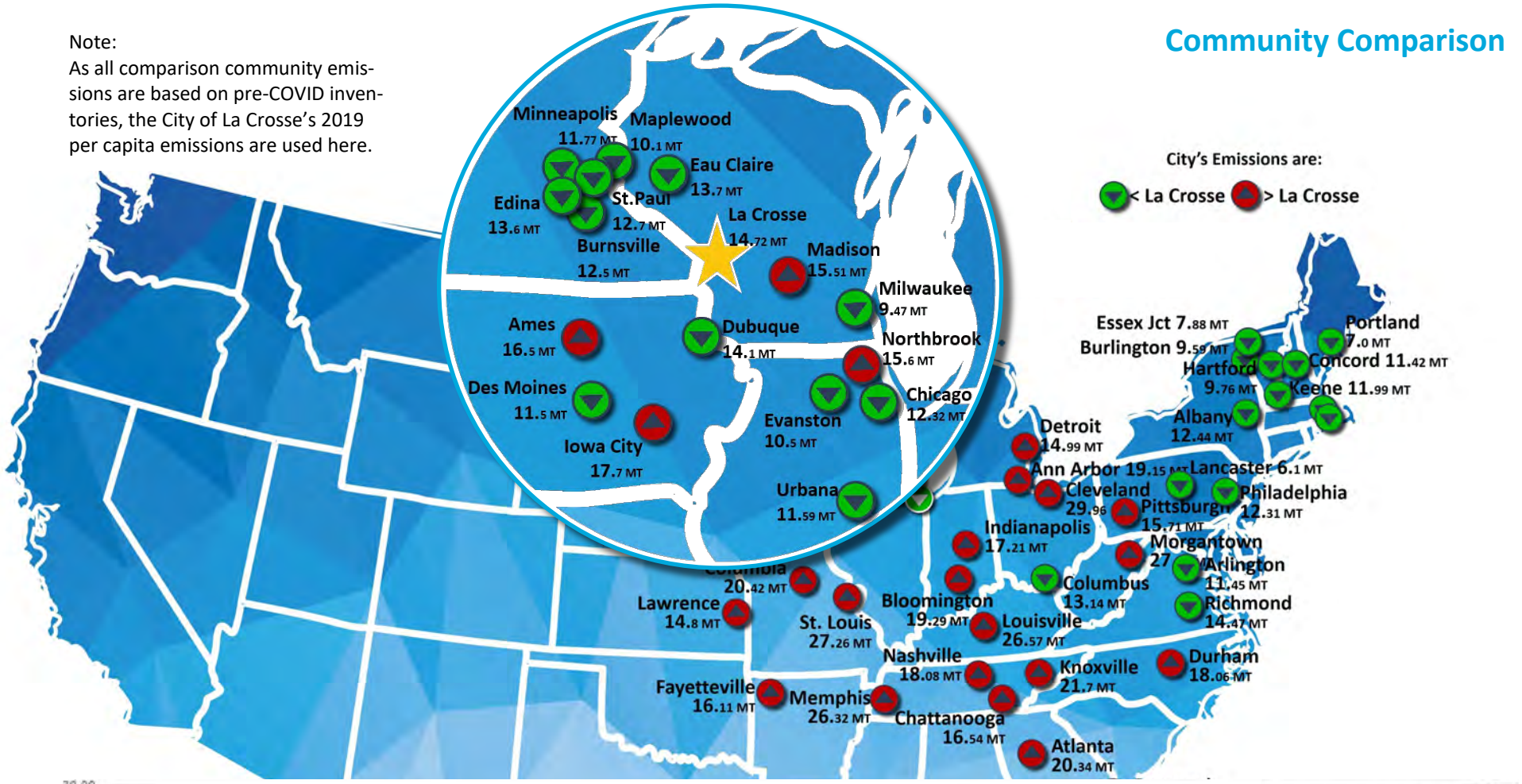
How Large Are Community Wide Per-Capita GHG Emissions?

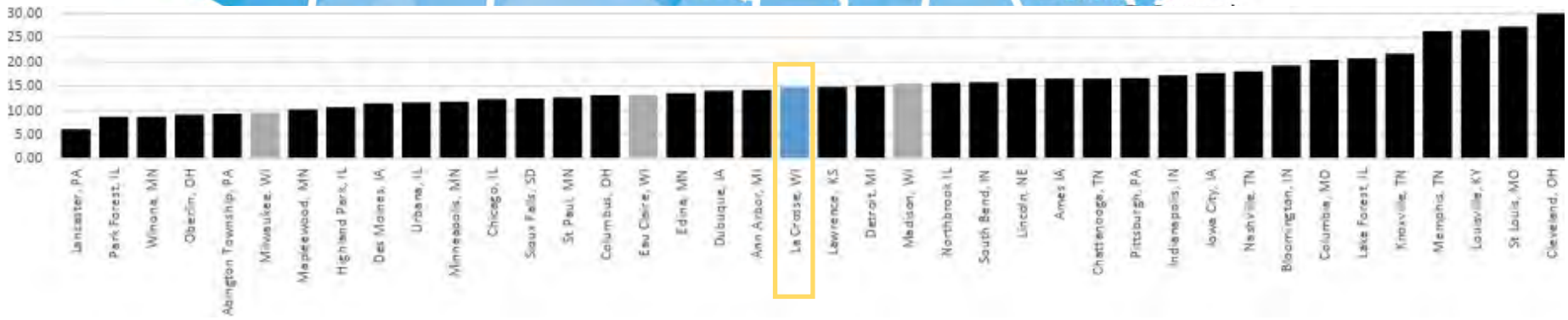
The City of La Crosse's pre-COVID community wide emissions per-capita for 2019 are equal to **287,522** cubic feet of man-made greenhouse gas. This volume of atmosphere is equal to a cube 66' feet on each face.



Community Comparison

Note:
As all comparison community emissions are based on pre-COVID inventories, the City of La Crosse's 2019 per capita emissions are used here.





Section

04

GHG Emissions Forecast

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GHG Emissions Forecast

Why Create a GHG Emission Forecast?

Increasing greenhouse gas emissions, and consequently, atmospheric concentrations, will have many effects on our global, regional, and local climate conditions. Future changes are expected to include a warmer atmosphere, a warmer and more acidic ocean, more powerful storms, broader swings in weather variability, and changes in precipitation patterns. The extent of future climate change depends our on-going GHG emissions. The more we emit, the broader our future climate changes will be. Put another way, the extent of climate change we experience in the future depends on the policies our communities put into place and the actions we as individuals take to reduce greenhouse gas emissions.

A GHG emission forecast supports GHG reduction planning efforts by anticipating what emissions may be like if actions are not taken. The potential future trends illustrated in the forecast supports planners in identifying emission sectors which may benefit from prioritization or which may harbor the greatest potential benefits for reduction strategies. Finally, the completed GHG emission forecast, combined with the underlying assumptions used to create the forecast model, can be used as a ***GHG reduction projection tool*** during future climate action planning efforts.

GHG Emissions Forecast

Business-As-Usual Forecast

Emissions are typically forecast under a business-as-usual (BAU) scenario. The Intergovernmental Panel on Climate Change (IPCC) defines a "business-as-usual" baseline case as the level of emissions that would result if future development trends follow those of the past and no changes in policies take place. A BAU forecast assumes that no emission-reduction actions will be undertaken beyond those already in place, or committed to, in the base year. The BAU forecast bases future projections on anticipated demographic changes, such as population changes and projected jobs within a community.

This approach allows for analysis of a community's full emissions growth potential before identifying emissions reduction strategies. As noted above, BAU emission forecasts are critical in providing insight into the scale of reductions necessary to achieve an emissions target before considering reductions likely to result from federal and statewide actions (e.g., vehicle efficiency standards), inherent technological advancements (e.g., energy-efficient appliances, lighting technology), or new local voluntary or mandatory conservation efforts (e.g., green building requirements).

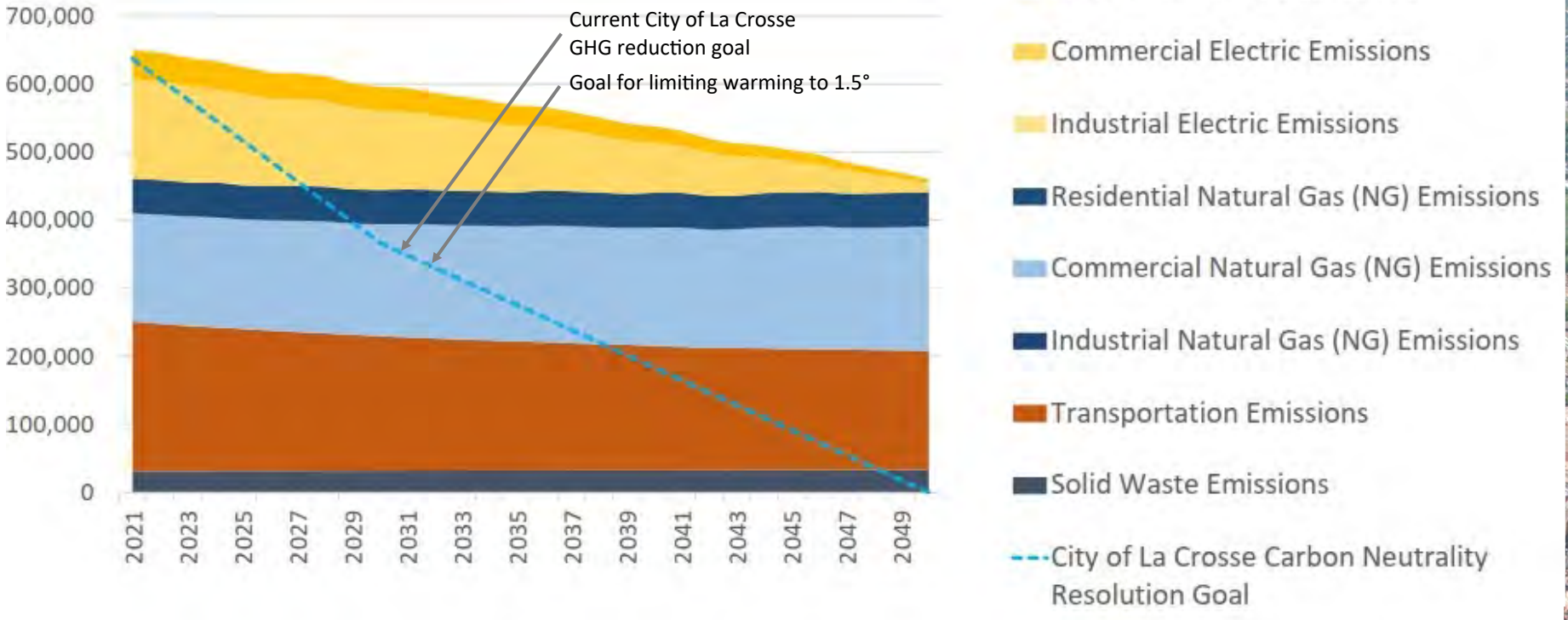
Please see the appendix for a review of all assumptions which have guided this BAU emission forecast for the City of La Crosse.

Uncertainty

GHG emissions forecasts are not predictions of what will happen, but rather modeled projections of what may happen given certain assumptions and methodologies. GHG forecasts in this report should be interpreted with a clear understanding of the assumptions that inform them and the limitations inherent in any modeling effort, as articulated in the forecast assumptions provided. The results of the forecast should be understood to contain uncertainty. Changes in industry structure over time, the particular impacts of policies, changing weather and economic conditions all add variability to how future emissions will develop.

GHG Emissions Forecast

Business-As-Usual Forecast

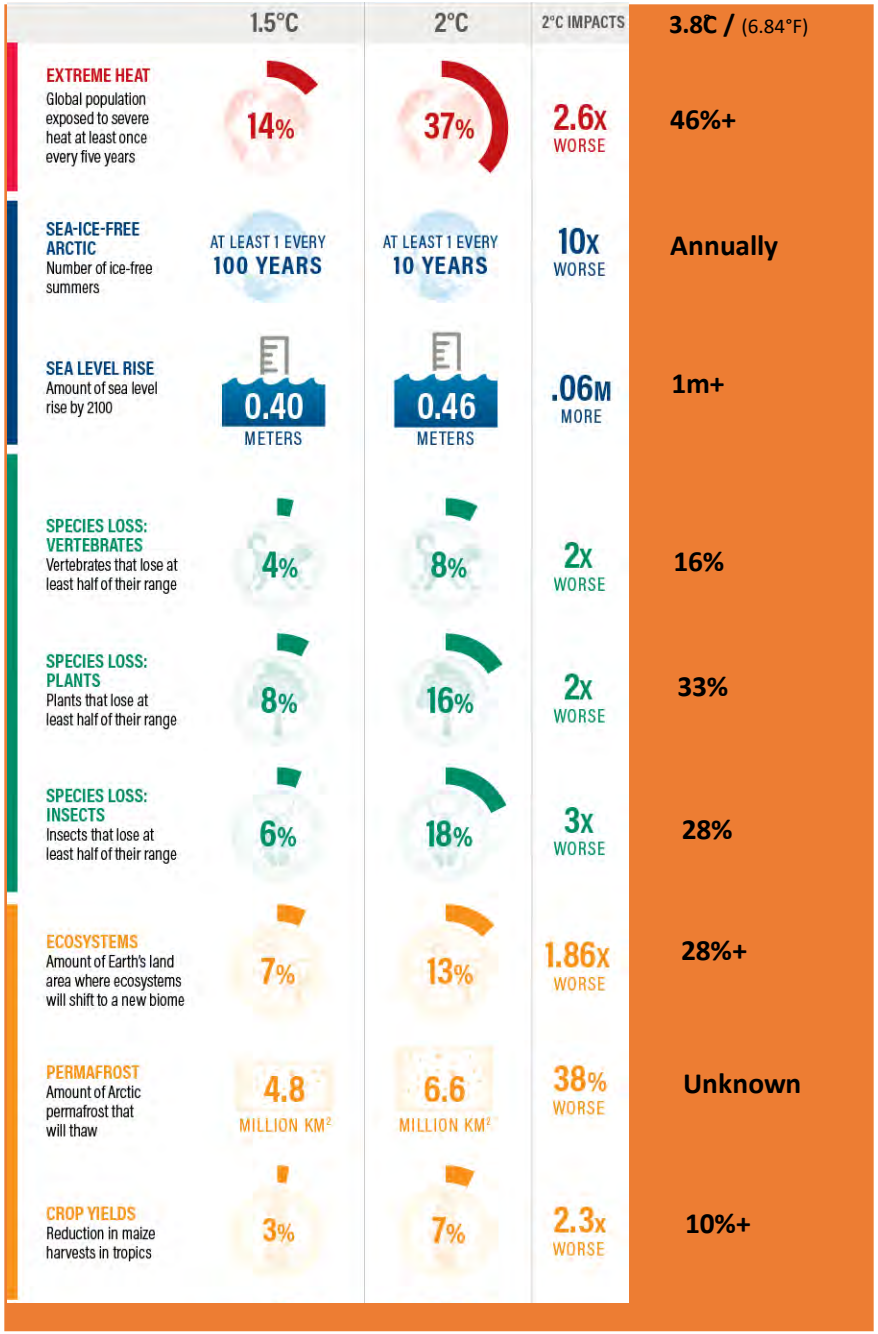


GHG Emissions Forecast

Business-As-Usual Forecast Summary

	Change from 2020		Change from 2020		Change from 2020
2030 GHG Emissions	**-12.8%**	**2040 GHG Emissions**	**-21.6%**	**2050 GHG Emissions**	**-32.7%**
Total Annual GHG	610,588	Total Annual GHG	548,752	Total Annual GHG	471,381
Goal Annual GHG	651,963	Goal Annual GHG	452,549	Goal Annual GHG	208,332
Difference	-41,375	Difference	96,203	Difference	263,049
Electricity Use Emissions:	**-60.1%**	**Electricity Use Emissions:**	**-76.6%**	**Electricity Use Emissions:**	**-100.0%**
Residential	35,198	Residential	23,847	Residential	5,150
Commercial	116,398	Commercial	73,863	Commercial	14,343
Natural Gas Emissions:	**45.9%**	**Natural Gas Emissions:**	**54.1%**	**Natural Gas Emissions:**	**76.1%**
Residential	50,125	Residential	50,861	Residential	50,458
Commercial	164,483	Commercial	174,181	Commercial	182,579
Transportation Emissions:	**-0%**	**Transportation Emissions:**	**-17.1%**	**Transportation Emissions:**	**-20.8%**
VMT (Thousands)	544,960	VMT (Thousands)	615,206	VMT (Thousands)	668,815
Solid Waste Emissions:	**46.4%**	**Solid Waste Emissions:**	**59.0%**	**Solid Waste Emissions:**	**71.4%**
LFG Emissions	31,937	LFG Emissions	32,765	LFG Emissions	33,644
Wastewater+Water :	**24.3%**	**Wastewater+Water :**	**35.0%**	**Wastewater+Water :**	**43.7%**
Wastewater Emissions	2,024	Wastewater Emissions	2,123	Wastewater Emissions	2,180
Water Emissions	1,215	Water Emissions	1,274	Water Emissions	1,309

Where BAU Projections Are Aiming



GHG Emissions Forecast

Understanding Impacts of BAU Forecast

Understanding what the BAU forecast means for La Crosse may be best achieved by placing emissions forecasts within a global perspective of climate change impacts. Global impacts can be viewed through understanding difference between 1.5℃, 2℃, and 4.6℃ degree global warming.

The International Panel on Climate Change (IPCC) is the United Nation Environment Porgramme (UNEP) body for assessing the science related to climate change and providing support in climate action policy making. The scientific consensus of the international IPCC working groups is to reduce global GHG emissions as needed in order to limit global warming to 1.5°C. In addition, the Paris Agreement aims to limit global warming to 1.5 to 2 degrees C above pre-industrial levels, considered to be the threshold for dangerous climate change.

The UNEP Emissions Gap Report published in November 2019 calculates that by 2030, global emissions will need to be 25% lower than 2018, and then reaching 80% reductions by 2050 to put the world on the least-cost pathway to limiting global warming to below 2°C. To limit global warming to 1.5°C, the same report finds emissions would need to be 55% lower than in 2018 and then achieving 90% or greater reductions by 2050.

The infographic to the left, created by the World Resources Institute summarizes some of the global climate change impact differences between reducing global emissions to cap global warming at 1.5°C vs capping global warming to 2°C. We've added an illustration of the impacts related to a 3.8°C warming - which is where current La Crosse Business-as-Usual projections point.

Source and Graphic: World Resources Institute

Section A1

GHG Inventory Calculation Summary Sheets

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Updated 1/28/2022

Citywide Emissions Inventory Data Calculations

Emissions Sectors	2019			Change from Prior Study Year	2020			Change from Prior Study Year	MMBtu Change Since 2019	GHG Change Since 2019
	Consumption	MMBtu	GHG		Consumption	MMBtu	GHG			
Electricity (Scope 2, MWh):										
Notes: **Gross Consumption**				Consumption				Consumption		
Residential	162,092	553,059	57,705	N/A	164,780	562,230	45,150	1.7%	1.7%	-21.8%
Commercial and institutional	573,353	1,956,280	204,114	N/A	555,833	1,896,501	152,298	-3.1%	-3.1%	-25.4%
Industrial (Included in Commercial)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
Streetlights - metered										
Streetlights - non-metered	2,167	7,394	771	N/A	2,347	8,007	643	8.3%	8.3%	-16.7%
Subtractions				Subtractions				Subtractions		
Residential - Wind Sourced	(2,351)	(8,021)	-	N/A	(2,312)	(7,889)	-	-1.6%	-1.6%	
Residential - Solar Sourced	-	-	-	N/A	-	-	-	N/A	N/A	
Commercial - Wind Sourced	(377)	(1,286)	-	N/A	(445)	(1,517)	-	18.0%	18.0%	
Commercial - Solar Sourced	-	-	-	N/A	-	-	-	N/A	N/A	
Industrial - Wind Sourced	-	-	-	N/A	-	-	-	N/A	N/A	
Industrial - Solar Sourced	-	-	-	N/A	-	-	-	N/A	N/A	
2 Airport, Waste, Water, Wastewater Process	(12,651)	(39,209)	-	N/A	(12,277)	(37,809)	-	-3.0%	-3.6%	
Streetlights - Wind Sourced	-	-	-	N/A	-	-	-	N/A	N/A	
Streetlights - Solar Sourced	-	-	-	N/A	-	-	-	N/A	N/A	
Net Consumption With Emissions				GHG Emissions				GHG Emissions		
Residential	159,741	545,037	56,868	N/A	162,468	554,340	44,516	-21.7%		-21.7%
Commercial	560,325	1,915,786	199,476	N/A	543,111	1,857,175	148,812	-25.4%		-25.4%
Industrial (Included in Commercial)	-	-	-	N/A	-	-	-	N/A		N/A
Streetlights	2,167	7,394	771	N/A	2,347	8,007	643	-16.7%		-16.7%
1 **Subtotals - Grid Purchased**	**737,612**	**2,516,733**	**257,115**	**N/A**	**707,925**	**2,466,737**	**193,972**	**-24.6%**	-2.0%	-24.6%
Blended emission factor (tonnes per MWh)	0.356				0.274			-23.0%		-23.0%
Electricity as a % of total citywide amounts		24.8%	33.2%			26.1%	29.1%			
Natural gas (Scope 1, therms):										
Notes: **Gross Consumption**				Consumption				Consumption		
Residential	10,510,662	1,050,815	55,693	N/A	9,559,171	955,689	50,651	-9.1%	-9.1%	-9.1%
Commercial and institutional	30,167,160	3,015,995	159,848	N/A	29,902,824	2,989,568	158,447	-0.9%	-0.9%	-0.9%
Industrial (Included in Commercial)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
Subtractions				Subtractions				Subtractions		
Residential - Renewable Natural Gas Sourced	-	-	-	N/A	-	-	-	N/A	N/A	
Commercial - Renewable Natural Gas Sourced	-	-	-	N/A	-	-	-	N/A	N/A	
Industrial - Renewable Natural Gas Sourced	-	-	-	N/A	-	-	-	N/A	N/A	
2 Airport, Waste, Water, Wastewater Process	(63,789)	(6,377)	-	N/A	(64,491)	(6,448)	-	1.1%	1.1%	
Net Consumption With Emissions				GHG Emissions				GHG Emissions		
Residential	10,510,662	1,050,815	55,693	N/A	9,559,171	955,689	50,651	-9.1%		-9.1%
Commercial	30,103,371	3,009,618	159,510	N/A	29,838,333	2,989,568	158,447	-0.7%		-0.7%
Industrial (Included in Commercial)	-	-	-	N/A	-	-	-	N/A		N/A
1 **Subtotals**	**40,614,033**	**4,060,433**	**215,203**	**N/A**	**39,397,504**	**3,945,256**	**209,099**	**-2.8%**	-2.8%	-2.8%
Emission factor (tonnes per MMBtu)	0.053				0.053					0.0%
Natural gas as a % of total citywide amounts		40.0%	27.8%			41.8%	31.3%			

Transportation (Scope 1):												
Notes:	Vehicle miles traveled (thousands of miles)	500,396			N/A	433,569			-13.4%		
3	Estimated number of vehicles in community	54,930				54,930			0.0%		
4	Registered electric vehicles in community (BEV)	63	0.11%			66	0.12%		4.8%		
	Estimated EV Share of VMT	574				521					
	Community VMT Total	**27,581,188**	**3,401,774**	**254,643**	N/A	23,740,891	2,927,855	220,020	-13.9%	-13.9%	-13.6%
	Municipal Airport										
	Electricity (MWh)	1,160	3,958	413	N/A	1,196	4,080	328	3.1%	3.1%	
	Natural gas (therms)	45,676	4,566	2,421	N/A	43,014	4,300	2,280	-5.8%	-5.8%	
	Airport Vehicle Diesel (gallons)	11,048	1,401	112		17,682	2,243	180	60.0%	60.0%	
	Airport Vehicle Gasoline (e10) (gallons)	4,201	505	34		3,658	439	29	-12.9%	-12.9%	
	Airport Vehicle Propane (gallons)	50,712	4,179	292		42,652	3,936	246	-15.9%	-5.8%	
	Aviation Gas	44,845	5,381	374		25,500	3,060	213	-43.1%	-43.1%	
5	Jet Fuel	1,124,870	151,857	11,006		639,631	86,350	6,258	-43.1%	-43.1%	
	Municipal Airport Total	**1,282,510**	**171,848**	**14,652**		**773,332**	**104,408**	**9,533**			-34.9%
	Subtotals		**3,573,622**	**269,295**	**N/A**		**3,032,263**	**229,553**	**-14.8%**	-15.1%	-14.8%
	VMT Emission factor based on vehicle MPG blend	0.509				0.508					-0.3%
	Transportation as a % of total citywide amounts		35.2%	34.7%			32.1%	34.4%			
Solid Waste (Scope 1):											
Notes:	Electricity (MWh)	4	14	1	N/A	3	12	1	-17.4%	-17.4%	-36.4%
	Natural gas (therms)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
1	Solid Waste Handled*	65,688			N/A	67,224			2.3%	N/A	N/A
	Recycled (tons)	3,579		-	N/A	8,590		-	140.0%	N/A	N/A
	Organics (tons)	53		6	N/A	65		8	22.2%	N/A	22.2%
	MSW managed as RDF (tons)	24,299		6,552	N/A	20,632		8,100	-15.1%	N/A	23.6%
	On-Site (tons)	-		-	N/A	-		-	N/A	N/A	N/A
	Landfill (tons)	37,757		22,943	N/A	37,937		23,131	0.5%	N/A	0.8%
	Subtotals		**14**	**29,503**	**N/A**		**12**	**31,239**	**5.9%**		5.9%
6	Emission factor - RDF (tonnes per ton)	0.27	CO2e MT/MSW ton	0.449		0.39	CO2e MT/MSW t	0.465			45.6%
7	Emission factor - Landfill (tonnes per ton)	0.61				0.61					0.3%
10	Emission factor - Organics Composted (tonnes per t	0.12				0.12					0.0%
	Solid waste as a % of total citywide amounts		0.0%	3.8%			0.0%	4.7%			
Water (Scope 1):											
Notes:	Water Use Within Community (gallons)	2,979,845,829		**1,613**	N/A	3,115,267,904		**1,215**	4.5%		-24.7%
	Subtotals		**0**	**1,613**	**N/A**		**0**	**1,215**	**-24.7%**	N/A	-24.7%
9	Emissions Factor: MT / MMGal	0.541				0.390					-28.0%
	Water as a % of total citywide amounts		0.0%	0.2%			0.0%	0.2%			
Wastewater (Scope 1):											
Notes:	Wastewater Flows Within Community (gallons)	3,614,252,000		2,499	N/A	3,614,252,000		2,024	0.0%	N/A	-19.0%
	Subtotals		**0**	**2,499**	**N/A**		**0**	**2,024**	**-19.0%**		-19.0%
9	Emission factor - Total MT / MMGal	0.691				0.560					-19.0%
	Wastewater as a % of total citywide amounts		0.0%	0.3%			0.0%	0.3%			
Citywide Totals (Scope 1 & 2):			**10,150,801**	**775,227**	**#REF!**		**9,444,268**	**667,102**	**-13.9%**	-7.0%	-13.9%

Notes:

1. Electricity in MWh, natural gas in therms. Carbon dioxide equivalents (GHG) are expressed in metric tonnes, which equal 1,000 kilograms, 2,204.6 pounds, or 1.102 US tons.
2. To avoid double-counting, energy consumption and emissions associated with process electricity and process natural gas for water and wastewater treatment, solid waste management, and Airport operations are subtracted Electricity and Natural Gas sectors
3. Total number of vehicles in community is based on US Census data ACS 5-year estimates.
4. Registered Electric Vehicles in Community do not inlcude HEV or PHEV categories and is based on registration data reported by EV Hub https://www.atlasevhub.com/materials/state-ev-registration-data/
5. Jet fuel was not included in 2019 ClearPath inventory reporting. For this summary 2019 jet fuel has been estimated based on the 2019 to 2020 Aviation Gas ratio.
6. Solid Waste RDF emissions emissions factors based on facility EPA GHG data reporting, total GHG emissions divided by total reported solid fuels burned https://ghgdata.epa.gov/ghgp/main.do
7. Solid Waste emissions factors based on facility EPA GHG data reporting https://ghgdata.epa.gov/ghgp/main.do
8. Emission Factor for organics based on 2020 EPA WARM model organics documentation https://www.epa.gov/warm/documentation-chapters-greenhouse-gas-emission-energy-and-economic-factors-used-waste
9. Water and Wastewater Citywide Emission factors per 1,000,000 gallons are based on data reported in City Operations Inventory

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City Operations Emissions Inventory Data Calculations

Emissions Sectors	2019 Consumption	2019 MMBtu	2019 GHG	Change from Prior Study Year	2020 Consumption	2020 MMBtu	2020 GHG	Change from Prior Study Year	MMBtu Change Since 2019	GHG Change Since 2019
Electricity (Scope 2, kWh)										
Notes: **Gross Consumption**				Consumption				Consumption		
1 Buildings, Grounds, Streetlights	22,102,889	75,415,058	7,869	N/A	19,968,764	68,133,423	5,471	-9.7%	-9.7%	-30.5%
Subtractions				Subtractions				Subtractions		
Buildings and Grounds - Solar/Wind Sourced	-	-	-	N/A	(114,670)	(391,254)	(31)	N/A	N/A	
2 Waste, Water, Wastewater Process (below)	(11,491)	-	(4)	N/A	(11,081)	-	(3)	-3.6%	N/A	
Net Consumption With Emissions				GHG Emissions				GHG Emissions		
Buildings, Grounds, Streetlights	22,091,398	75,415,058	7,865	N/A	19,843,013	68,133,423	5,437	-30.9%	-9.7%	-30.9%
Subtotals	**22,102,889**	**75,415,058**	**7,865**	**N/A**	**19,968,764**	**68,133,423**	**5,437**	**-30.9%**	-9.7%	-30.9%
Blended emission factor (tonnes per MWh)	0.356				0.274			-23.0%		-23.0%
Electricity as a % of total City Operations amounts		99.8%	40.3%			99.8%	34.1%	-15.3%		
Natural gas (Scope 1, therms):										
Notes: **Gross Consumption**				Consumption				Consumption		
1 Buildings and Grounds	534,932	53,480	2,834	N/A	578,124	57,799	3,063	8.1%	8.1%	8.1%
Subtractions				Subtractions				Subtractions		
Buildings - Renewable Natural Gas Sourced	-	-	-	N/A	-	-	-	N/A	N/A	
2 Waste, Water, Wastewater Process	(63,789)	(6,377)	(338)	N/A	(64,491)	(6,448)	(342)	1.1%	1.1%	
Net Consumption With Emissions				GHG Emissions				GHG Emissions		
Buildings and Grounds	471,143	47,103	2,496	N/A	513,633	51,351	2,722	9.0%	9.0%	9.0%
Subtotals	**471,143**	**47,103**	**2,496**	**N/A**	**513,633**	**51,351**	**2,722**	**9.0%**	9.0%	9.0%
Emission factor (tonnes per MMBtu)	0.053				0.053					0.0%
Natural gas as a % of total City Operations amounts		0.1%	12.8%			0.1%	17.1%	33.5%		
Fleet and Transportation										
Notes: Annual Municipal Fleet Fuel Use				Consumption				Consumption		
9 Gasoline (gallons)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
9 Gasoline (e10) Use (gallons)	90,249	10,840	724	N/A	84,307	10,126	676	-6.6%	-6.6%	-6.6%
E85 Use (gallons)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
Petroleum Diesel Fuel Use (gallons)	98,558	12,500	1,001	N/A	82,132	10,417	834	-16.7%	-16.7%	-16.7%
BioDiesel Fuel Use (gallons)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
Propane (gallons)	-	-	-		-	-	-		N/A	N/A
Total for Municipal Fleet		**23,340**	**1,725**			**20,543**	**1,511**		-12.0%	-12.4%
Notes: Annual MTU Fleet Fuel Use				Consumption				Consumption		
9 Gasoline (gallons)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
9 Gasoline (e10) Use (gallons)	2,130	256	17	N/A	1,949	234	16	-8.5%	-8.5%	-8.5%
E85 Use (gallons)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
Petroleum Diesel Fuel Use (gallons)	158,282	20,075	1,608	N/A	143,139	18,154	1,454	-9.6%	-9.6%	-9.6%
BioDiesel Fuel Use (gallons)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
Propane (gallons)	-	-	-		-	-	-		N/A	N/A
Total for MTU Fleet		**20,331**	**1,625**			**18,388**	**1,470**		-9.6%	-9.6%
Notes: Annual Airport Fleet Fuel Use				Consumption				Consumption		
9 Gasoline (gallons)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
9 Gasoline (e10) Use (gallons)	4,201	505	34	N/A	3,658	439	29	-12.9%	-12.9%	-12.9%
E85 Use (gallons)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
Petroleum Diesel Fuel Use (gallons)	11,048	1,401	112	N/A	17,682	2,243	180	60.0%	60.0%	60.0%
BioDiesel Fuel Use (gallons)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
Propane (gallons)	50,712	-	292		42,652	-	246		N/A	-15.9%
Total for MTU Fleet		**1,906**	**438**			**2,682**	**455**		40.7%	3.8%
Total Fleets		**45,576**	**3,789**	**N/A**		**41,613**	**3,435**	**-9.3%**	-8.7%	-9.3%
Staff Transportation										
Commercial Air Travel (miles)	7,458		**2**		3,515		**1**			-52.9%
Rental Car + Personal Vehicle Use (miles)	-	-	**0.0**		745	92	**0.4**			N/A
Total Staff Transportation		**0**	**17**	**N/A**		**92**	**16**	**-8.5%**	N/A	-8.5%
Subtotals		**45,576**	**3,806**	**N/A**		**41,705**	**3,451**	**-9.3%**	-8.5%	-9.3%
Air Travel Emission Factor (MT/Mile)	0.000274				0.000274					0.0%
VMT Emission Factor (MT/Mile)	0.000509				0.000508					-0.3%
Transportation as a % of total City Operations amounts		0.1%	19.5%			0.1%	21.6%	11.1%		

Solid Waste (Scope 1):											
Notes:	Electricity (MWh)	4	14	1	N/A	3	12	1	-17.4%	-17.4%	-36.4%
	Natural gas (therms)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
	Solid Waste Handled*	65,688			N/A	67,224			2.3%		
	Estimated Commercial Share of MSW	45.0%				45.0%					
3	Estimated City Share of Commercial Jobs	3.3%	City Ops Share			3.2%	City Ops Share				
	Recycled (tons)	3,579	52	-	N/A	8,590	125	-	140.0%	139.1%	N/A
	Organics (tons)	53	1	6	N/A	65	1	8	22.2%	21.8%	22.2%
	MSW managed as RDF (tons)	24,299	356	96	N/A	20,632	301	118	-15.1%	-15.4%	23.1%
	On-Site (tons)	-	-	-	N/A	-	-	-	N/A	N/A	N/A
	Landfill (tons)	37,757	553	336	N/A	37,937	553	337	0.5%	0.1%	0.4%
	Subtotals		**961**	**439**	**N/A**		**980**	**464**	**5.6%**	1.9%	5.6%
6	Emission factor - RDF (tonnes per ton)	0.27				0.39					45.6%
7	Emission factor - Landfill (tonnes per ton)	0.61				0.61					0.3%
8	Emission factor - Organics Composted (tonnes pe	0.12				0.12					0.0%
	Solid waste as a % of total City Operations amounts	Est Solid Waste per Employee (lbs/day):	5.7	2.3%		Est Solid Waste per Employee (lbs/day):	5.8	2.9%	29.3%		
Water (Scope 1):											
Notes:	Water Use Within Community (gallons)	2,979,845,829	85.7% Share of pumpage		N/A	3,115,267,904	86.2% Share of pumpage		4.5%		
	Water Use Outside Community (gallons)	5,003,171	0.1% Share of pumpage			5,200,096	0.1% Share of pumpage				
	Reported Water Loss	493,631,000	14.2% Share of pumpage			494,925,000	13.7% Share of pumpage				
	Total Water Pumpage by City Facilities (gallons)	3,478,480,000				3,615,393,000					
	Electricity (MWh)	5,157	17,597	1,836	N/A	4,947	16,880	1,356	-4.1%	-4.1%	-26.2%
	Natural gas (therms)	8,847	885	47	N/A	10,294	1,029	55	16.4%	16.4%	16.4%
	Diesel (gal.)	0	0	0	N/A	0	0	0	N/A	N/A	N/A
	Subtotals		**18,482**	**1,883**	**N/A**		**17,909**	**1,410**	**-25.1%**	-3.1%	-25.1%
4	Emissions Factor: MT / MMGal	0.541				0.390					-28.0%
	Water as a % of total City Operations amounts		0.0%	9.6%			0.0%	8.8%	-8.3%		
Wastewater (Scope 1):											
Notes:	Wastewater Flows Within Community (gallons)	3,614,252,000	82.2% Share of pumpage		N/A	3,614,252,000	82.2% Share of pumpage		0.0%		N/A
	Wastewater Flows From Outside Community (gal	782,125,685	17.8% Share of pumpage			782,125,685	17.8% Share of pumpage		0.0%		
	Total Wastewater Treated by City Facilities (gallo	4,396,377,685				4,396,377,685			0.0%		
4	Wastewater Treatment Process Emissions										
	City Facility Electricity (MWh)	6,330	21,597	2,253	N/A	6,131	20,918	1,680	-3.1%	-3.1%	-25.5%
	City Facility Natural gas (therms)	54,942	5,493	291	N/A	54,197	5,418	287	-1.4%	-1.4%	-1.4%
	City Facility Diesel (gal.)	0	0	0	N/A	0	0	0	N/A	N/A	N/A
	Biogenic emissions	4,396		495	N/A	4,396		495	0.0%	N/A	0.0%
	Subtotals		**27,091**	**3,039**	**N/A**		**26,337**	**2,462**	**-19.0%**	-2.8%	19.0%
4	Emission factor - Process Emissions MT / MMGal	0.691				0.560					
5	Biogenic Emission factor - Total MT / MMGal	0.11257				0.11257					
	Wastewater as a % of total City Operations amounts		0.0%	15.6%			0.0%	15.4%	-0.8%		
City Operations Totals (Scope 1 & 2):			**75,554,271**	**19,528**	**N/A**		**68,271,705**	**15,945**	**-18.3%**	**-9.6%**	**-18.3%**
			Per-FTE:	15.09	N/A		**Per-FTE:**	12.37			-18.0%
			Share of Citywide	2.5%			**Share of Citywide**	2.3%			

Notes:

1. Electricity in MWh, natural gas in therms. Carbon dioxide equivalents (GHG) are expressed in metric tonnes, which equal 1,000 kilograms, 2,204.6 pounds, or 1.102 US tons.
2. To avoid double-counting, energy consumption and emissions associated with process electricity and process natural gas for water and wastewater treatment and solid waste management are subtracted Electricity and Natural Gas sectors
3. Municipal Operations share of Solid Waste is estimated ProRata share of commercial portion of MSW based on FTE share of community-wide employment.
4. Emission Factors are based on City reporting for total energy expenditures and total volumes
5. Based on City of La Crosse 2019 ClearPath calculations for Combustion of Digester Gas, N2O from Treatment, and N20 from Effluent Discharge
6. Solid Waste RDF emissions emissions factors based on facility EPA GHG data reporting, total GHG emissions divided by total reported solid fuels burned https://ghgdata.epa.gov/ghgp/main.do
7. Solid Waste emissions factors based on facility EPA GHG data reporting https://ghgdata.epa.gov/ghgp/main.do
8. Emission Factor for organics based on 2020 EPA WARM model organics documentation https://www.epa.gov/warm/documentation-chapters-greenhouse-gas-emission-energy-and-economic-factors-used-waste
9. All "standard" gasoline sold in Wisconsin is e10.

Section A2

GHG Forecast Assumptions

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GHG Emissions Forecast

City of La Crosse GHG Forecast Assumptions:

Demographics:

Population: Total Population projections through 2050 are projected based on City's average growth rate since 2010.

Households: Total household counts through 2050 are projected based on City's projected population growth, holding average household size constant.

Jobs: Total commercial and industrial jobs through 2050 are projected based on City's average jobs growth rate since 2010.

Climate Data

Cooling Degree Days (CDD): Projected climate changes for the region will include increased summer temperatures. The increase in temperatures will result in an increase, or variability, in air conditioning demand. The forecast calculates annual changes in air conditioning demand based on projections provided by the "Climate Explorer" tool developed by US NOAA in support of the National Climate Assessment work. https://crt-climate-explorer.nemac.org/

Heating Degree Days (HDD): Projected climate changes for the region will include increased winter temperatures. The increase in temperatures will result in a decrease, or variability, in building heating demand. The forecast calculates annual changes in heating demand based on projections provided by the "Climate Explorer" tool developed by US NOAA in support of the National Climate Assessment work. https://crt-climate-explorer.nemac.org/

GHG Emissions Forecast

City of La Crosse GHG Forecast Assumptions:

Electricity:

Residential: Demand is based on a per household basis and modified based on the projected Cooling Degree Days for each year, assuming 15% of electricity is used for cooling (RCP 8.5 model). 50% of projected increased electrical vehicle usage is attributed to residential EV charging.

Commercial and Industrial: Demand is based on a per job basis and modified based on projected cooling degree days for each year, assuming that 15% of commercial and 7.5% of industrial electricity is used for cooling. (RCP 8.5 model). 50% of projected increased electrical vehicle usage is attributed to commercial EV charging

All electricity emission factors are calculated using estimated emissions factors for 2030, 2040, and 2050 based on current, known, supplier commitments. For electrical suppliers with unknown or unestablished emission commitments, and for electricity purchased from the SERC grid, electricity emission factors are calculated based on EPA forecasts (https://fas.org/sgp/crs/misc/R45453.pdf). Estimated emissions factors are reduced 5% by 2030, 10% by 2040, and 15% by 2050.

Natural Gas:

Residential: Demand is based on a per household basis and modified based on the projected Heating Degree Days for each year, assuming 75% of natural gas is used for heating (RCP 8.5 model).

Commercial and Industrial: Demand is based on a per job basis and modified based on projected heating degree days for each year, assuming that 40% of commercial and 20% of industrial natural gas is used for heating (RCP 8.5 model).

Natural Gas emissions factors are projected to be unchanged.

Transportation:

Vehicle Miles Traveled is based on US Department of Transportation VMT per capita projections through 2050 (1.1% annual growth rate through 2037 and 0.8% annual growth rate from 2038 through 2050. **NOTE**: due to COVID impacts, projections begin using 2019 VMT data in lieu of 2020. https://www.fhwa.dot.gov/policyinformation/tables/vmt/vmt_forecast_sum.cfm

Vehicle fuel use is calculated based on US Energy Information Agency projected rolling stock average fuel efficiency projections, modified to 85% projected MPG to account for heavy duty vehicle MPG share (based on US Department of Transportation data on current light duty to average all vehicle MPG ratios) https://www.eia.gov/todayinenergy/detail.php?id=31332

Total vehicle stock is based on per household projections maintaining existing average number of vehicles per household through 2030 (2.59) and then reducing the average vehicle per household 10% through 2050 (2.3).

Electric Vehicle Adoption: National projections expect an increased uptake of electric vehicles in coming years. The Edison Electric Institute has estimated that electric vehicle will be 7% of all vehicles on the road in the country by 2030. (http://www.ehcar.net/library/rapport/rapport233.pdf, https://berla.co/average-us-vehicle-lifespan/).

Solid Waste:

Total Solid Waste handled is based on total number of households and maintaining existing volume per household and emissions factors per ton handled.

Wastewater:

Total Wastewater handled is based on total number of households and maintaining existing volume per household and emissions factors per household.

Note:

GHG emissions forecasts are not predictions of what will happen, but rather modeled projections of what may happen given certain assumptions and methodologies. GHG forecasts in this report should be interpreted with a clear understanding of the assumptions that inform them and the limitations inherent in any modeling effort.

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